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CITY OF SANTA CLARA 2002 WATER MASTER PLAN

CITY OF SANTA CLARA WATER DEPARTMENT

CITY OF SANTA CLARA 2002 WATER MASTER PLAN

ENSURING A HIGH QUALITY SUPPLY OF WATER FOR THE COMMUNITY

Prepared by:

City of Santa Clara Water Department

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CITY OF SANTA CLARA

WATER MASTER PLAN

ENSURING A HIGH QUALITY SUPPLY OF WATER FOR THE COMMUNITY

EXECUTIVE SUMMARY

The City of Santa Clara has a long history of providing clean and abundant supplies of water for the residents and businesses in Santa Clara, beginning in 1895. Growing needs for water over the years have been met by finding new supplies: primarily by adding new wells to tap our groundwater resources and, since the 1960's, by delivery from the two imported supplies provided by San Francisco Water Department (SFWD) and the Santa Clara Valley Water District (District).

Several areas of concern and challenge must be successfully managed to continue meeting the needs of the community. These areas of concern primarily fall under the broad categories of water supply (quantity), health and safety (quality) and system reliability (infrastructure replacement).

WATER SUPPLY

With projections for 1½ % average annual growth of water demand used in this study, the City of Santa Clara will continue to enjoy sufficient capacity of water available from our three sources to maintain the ability to deliver water to our community. This capacity is assured for the next ten to twenty years. Supplies are projected to be sufficient for all but the more severe drought years. However, District projections indicate as much as a 20% shortfall in the event of a multiple year drought similar to the 1986-1991 drought. The San Francisco Water Department projections are similar. The recently adopted *Interim Water Supply Allocation Plan* (a multi-party agreement between the City, San Francisco and 28 other agency members of Bay Area Water Users Association) provides the City of Santa Clara with an assured share of the City's usual supply from SFWD. Although the City of Santa Clara could increase pumping from the underground aquifers to offset any short-term reduction in imported supplies, there are limits to the firm yield from groundwater pumping and the City would need to participate in any regional effort towards water rationing.

While water supplies will be available through all but the driest years, the cost for new supplies for our region will be ever increasing as water becomes progressively more scarce throughout the State of California. In addition, both SFWD and the District are expected to be replacing or improving aging infrastructure and water treatment facilities. In particular, SFWD has identified projects for system replacement and improvements that could cost more than $2.9 billion over the next ten years. These expenditures are needed to improve both reliability and capacity in the system for all suburban water customers of San Francisco Water Department. The costs for these improvements must be repaid by increases in the wholesale water rates. If all of the improvements are completed and added to the rate base, the wholesale cost of water from San Francisco will become more than three times the current rate. While this supply is currently only 16% of the City of Santa Clara's water supply, the future high costs for this portion of the City's water supply raises issues to be met by future policy decisions about whether to continue to take as much, or any, of SFWD supply and, if taken, how to incorporate the expected high wholesale cost into the City's retail water rate structure. All current contracts with San Francisco for wholesale water supplies will expire in 2009. Negotiations for new contracts will begin by 2004 or 2005.

Any decision to reduce or eliminate SFWD supplies will pose new problems in obtaining added supplies from the City's only other sources: groundwater and District treated water. Several improvements to the City's water system will need to be designed and constructed over the next few years to allow an increase in the capacity to receive and convey added water supplies from District treated water. Two new wells are now planned for the area north of Bayshore to help mitigate any potential loss of SFWD water.

By the end of 2002, the District expects to complete an update of their *Integrated Water Resource Plan*. This document will help define the future water supply for Santa Clara County including quantities to be available to the City of Santa Clara. The District's sources of supply will be particularly important in the event of the loss of SFWD water.

Recycled water offers one important new supply, a fourth source of water supply, for the City and the region. The City is part owner of the South Bay Water Recycling Project (SBWRP), funded primarily by sewer utilities tributary to the Water Pollution Control Plant. While recycled water is not intended to replace potable in all cases it does provide a reliable drought-proof supply. It is approved by the State for "unrestricted use" and, as such, it does replace potable supplies for landscape irrigation and certain industrial uses. With the current distribution system, five to eight percent of the City's total water demand can be met with recycled water.

WATER QUALITY

All water provided by the City from the three potable sources, and the recycled water, continue to meet or better all State and Federal water quality standards. These standards have historically been growing ever more stringent. Future regulations and standards may require extensive and expensive water treatment. While the City's groundwater continues to provide excellent quality water without any treatment, future State or Federal regulations could be imposed that would mandate some treatment, such as chlorination and/or fluoridation. Any costs for such "well-head treatment" have not been included in current water cost projections. The District is currently constructing improvements to the county's three water treatment plants. These improvements are intended to meet new State and Federal standards and regulations for treated surface water supplies and to improve the taste and odor of the treated water. Where the costs of these water quality improvements have been identified for either SFWD or District supplies, they have been included in the future water cost projections.

INFRASTRUCTURE REPLACEMENT

The majority of the City's growth has occurred over the past 40 to 50 years. During this time there has been little need to repair or replace aging portions of the water system. Several factors are now forcing a new awareness of, and need to plan for, replacement of the existing system. Increasing maintenance costs are a clear indication that portions of the system are reaching the end of their useful life. This is true for some of the oldest pipes, which were installed in the 1920s and 1930s, and for some of the water mains installed in the 1950s. At the current level of Capital Improvement Projects (CIP) funding for replacement, it would take over 300 years to replace the existing water distribution system. In order to maintain the required reliability of the City's water system the replacement rate must be improved to provide for complete system replacement in less than 100 years. To accomplish this there must be a steady annual increase in the number and cost of Capital Projects for replacement proposed for future budget years. The water department has started this process with Capital Projects included in the 2001-02 and the proposed 2003-03. During the next ten years the expected increase in Capital Project cost will only match the annual need for replacement; that is, projects will be funded only as required for replacement of those portions of the water distribution system with the highest maintenance costs.

On all three counts, water supply, water quality and system reliability, the City has the ability to meet the needs of the community for the foreseeable future. The community must in turn be prepared to meet the fiscal requirement to support and fund the utility with water retail rates sufficient for these requirements.

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INTRODUCTION

The City of Santa Clara water system has grown and changed from humble beginnings in 1895 when the City started the water utility with $56,000 of bond money. The water system in 1895 consisted of 4 wells, 45 hydrants and 400 service connections. Today the City is in the center of a fast paced highly industrial area known as Silicon Valley. The potable water distribution system today has grown to 27 production wells, over 295 miles of potable water mains, 3,135 hydrants and 25,131 service connections. In addition, the City now has a recycled water distribution system with 17 miles of recycled water mains, and 125 service connections.

The City of Santa Clara water system underwent significant changes in the 1960s and 1970s as the population grew rapidly. Water use grew at an even faster rate than the population as silicon and electronic technology industries began to flourish in the City. The water distribution system grew substantially during this time period with most of the construction provided by developers. Storage tanks, booster pumps, additional wells and imported water connections were added to the system, paid for by City rate payers, to keep pace with the growing demand and to ensure that the water supply was reliable and could meet the needs of a growing community. Many of these improvements were based on past Water Master Plans from 1959 and 1972. The most recent Water Master Plan was developed in 1985[1].

The previous Water Master Plan made projections to help guide the City in its efforts to continue to meet the water needs of Santa Clara. However, the significant numbers of changes that have occurred in supply projections and demand projections since the previous Water Master Plan was developed have resulted in the need for this 2002 Water Master Plan.

- Since the previous plans were written the City weathered an extended drought which began in 1986 shortly after the last Water Master Plan was written, and lasted until 1992. As a result of conservation measures instituted in response to the drought but still in effect, per capita water use has decreased from the levels seen in 1985.

- Water recycling was "under consideration" in the 1985 Water Master Plan. Today, water recycling is a reality. Santa Clara, as a part of South Bay Water Recycling funded by the San Jose – Santa Clara Water Pollution Control Plant (WPCP), has installed over 17 miles of recycled water distribution system within the City with an additional 8 miles currently proposed or under design. This system currently supplies more than 5% of the City's overall water supply and as much as 10% of the peak summer demand.

- Many industries have been instituting water and sewer discharge conservation measures. This is in part response to "flow audits" required for all large industrial dischargers permitted by the WPCP.

- The State of California has experienced intermittent power shortages. Rolling blackouts and power conservation measures have a potential effect on water supply in that interruptions of power could limit pumping to bring imported supplies for the District.

- The San Francisco Public Utilities Commission (SFPUC) has released information regarding the potential future wholesale cost of water from the Hetch-Hetchy system (operated by the San Francisco Water Department) as a result of necessary infrastructure repairs and upgrades. In

[1] City of Santa Clara Water Department, Water - A Master Plan, August 1985.

addition the City must take into account the limited reliability of the Hetch-Hetchy water system until these repairs and upgrades are completed and consider City system improvements to compensate for a possible loss of San Francisco Water Department (SFWD) water supply.

- The water distribution system within the City is continuing to age and has some current need for rehabilitation and replacement with increasing needs in the future. Past Water Master Plans addressed capital projects but did not include strategic long range planning for infrastructure replacement.

PURPOSE AND SCOPE OF THE WATER MASTER PLAN

This Water Master Plan (Plan) serves a number of purposes. The Plan documents the conditions under which the City of Santa Clara Water Department is operating as of the current year 2002. The Plan also looks to the future to project and estimate the water supply needs of the community in 2010 and 2020. This Plan contains analysis of usage and demand patterns to insure that, using the projections for future demands, the water distribution system is capable of meeting the future peak day and peak hour demands. The future needs are to be met by supplies from the four sources (three potable and one recycled water); two scenarios are projected that will meet the expected demands. Lastly, and most importantly, this Plan serves as a guide for long range planning for improvements and changes which the City must undertake to ensure that the community has a reliable, high quality water supply into the future.

To accomplish these goals the Plan documents, evaluates, and analyzes all aspects of the water supply system. The Plan also analyzes the conditions related to the two wholesale suppliers of water to the City and in the customer base that may effect future supply to or demand on the City's water supply system.

CHARACTERISTICS OF THE STUDY AREA

PHYSICAL GEOGRAPHY

Santa Clara is located on the southern end of the San Francisco Bay, bounded on the north, east and south by San Jose, on the west by Sunnyvale, and on the southwest by Cupertino. Santa Clara occupies part of an alluvial plain, which stretches across the width of the south bay region. The City is approximately three miles wide by seven miles long. Ground elevations vary rather uniformly from near sea level at the north end of the City to 175 feet above sea level at the south end. The south San Francisco Bay area is a rapidly growing area of high technology industry, known as the "Silicon Valley." Santa Clara's geographic location is shown in Figure 1.

LAND USE

The present area of the City is 12,352 acres or 19.30 square miles. About 37.5% of the land area is residential development including single-family homes, multi-family dwellings and apartments. While most of the residential area is in the southern part of the City, there are high-density home developments existing or under construction north of Highway 101.

Other major land use categories are commercial (6.8 %), industrial (22.5%), and public lands (including roads and highways 31.4 %). Approximately 3.5% of the land area within Santa Clara is currently vacant. Several large tracts of land in the northern portion of the City have been zoned exclusively for light industrial use.

Geographical Area

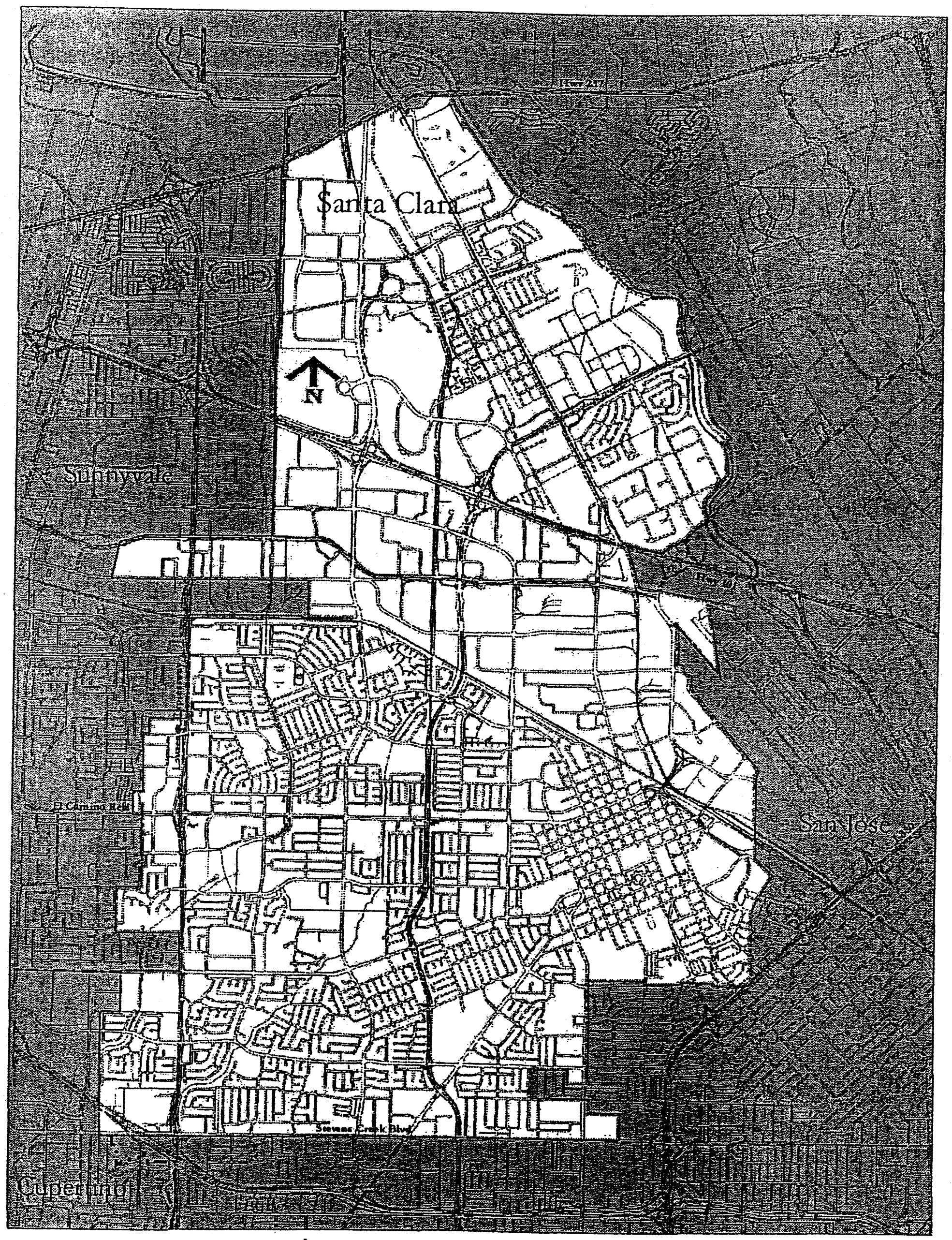

Figure 1

Although the City is essentially built out, a significant potential for redevelopment and on-site expansion remains. Some industrial facilities in the City have reserved land for future expansion on their current sites, and single story development has potential for conversion to higher density, multi-story development. Residential areas are currently approaching build out and further growth in this sector will most likely be high-density housing.

Land Use

Table 1

LAND USE	1990 ACREAGE[2]	% OF TOTAL
Residential:		
Single Family Detached	3516	28.4%
Single Family Attached	136	1.1%
Moderate Density (19-25 du/acre)	854	6.9%
Medium Density (26-36 du/acre)	137	1.1%
High Density (>37 du/acre)	0	0.0%
subtotal	**4,643**	**37.5%**
Commercial:		
Convenience	54	0.4%
Thoroughfare	138	1.1%
Community & Regional	143	1.2%
Office	64	0.5%
Tourist	448	3.6%
subtotal	**847**	**6.8%**
Industrial:		
Office / R&D	422	3.4%
Industrial Transition	24	0.2%
Light	1748	14.2%
Heavy	583	4.7%
subtotal	**2,777**	**22.5%**
Public:		
Institutional	538	4.4%
Education	503	4.1%
Parks & Recreation	342	2.8%
Open Space	184	1.5%
Urban Reserve	125	1.0%
Right-of-Ways	2173	17.6%
subtotal	**3,865**	**31.4%**
Mixed Use:	**220**	**1.8%**
Vacant:	**0**	**0.0%**
Total	**12,352**	**100%**

Land use zoning is based on the 1990-2005 General Plan. Very little change in distribution of acreages for these land uses is anticipated in the next 20 years.

POPULATION GROWTH

In the past 22 years since 1980, the population of Santa Clara has grown from 87,746 to 103,200, an increase of 18%. Despite some of the highest rents and home prices in the nation, the Silicon Valley continues to attract new residents and is experiencing continuing increases in population[3]. Population growth

[2] City of Santa Clara General Plan, Amendment No. 32, City of Santa Clara, 1992

[3] Silicon Valley Projections 2000, Association of Bay Area Governments, 2001

is expected to continue during the next 20 years. In the next two years Santa Clara will see an immediate increase in population as several large residential developments are completed.

The end of 2003 will see the completion of the Rivermark Development on the old State Hospital property. This development represents a significant increase in the number of residential units within the City. The Rivermark development consists of 1850 single-family dwellings and 1170 apartment units. In addition, the development includes a 150-room hotel and an emergency housing shelter. This single development area has the potential to raise the City's residential population by 8% over the 2000/01 population. The historic and projected population for Santa Clara is shown in Figure 2.

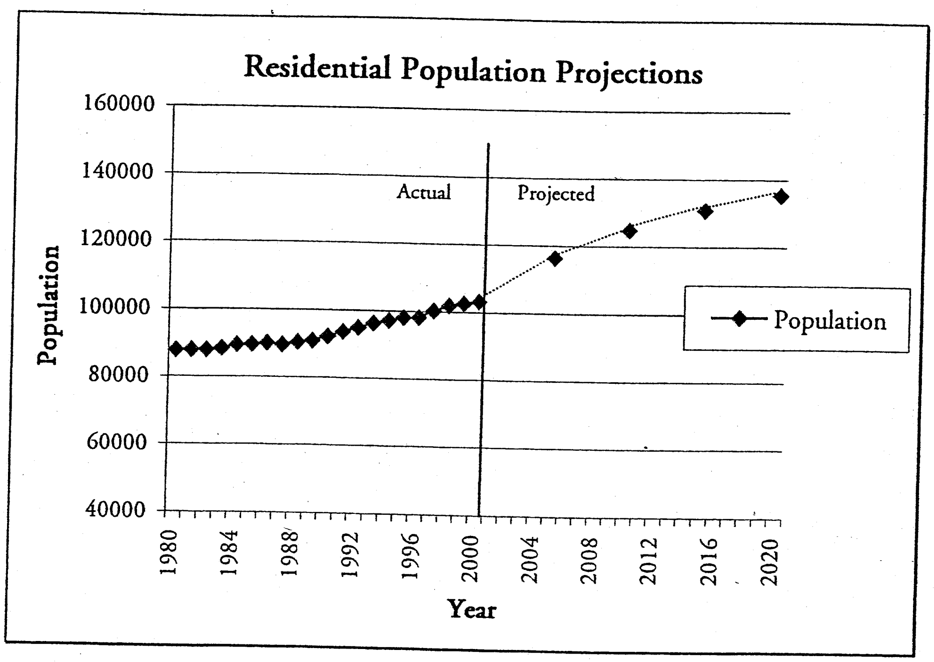

Figure 2

Water use is inherently variable. Water usage is dependent on a number of factors including weather, season, day, hour, customer category and for certain industries, business climate and the economy. Some general patterns are obvious such as irrigation usage increases during summer months. Long-term general trends in overall usage are valuable in projecting future supply requirements for categories of users.

Determining the patterns of usage and peak demands is critical for long term water supply planning. Peak demand factors are also critical in calculating the distribution system's capability of meeting the peak hour, peak day, and peak month demands.

WATER DEMAND BY USER CATEGORY

For purposes of water use tracking and long range planning, the City's water accounts are categorized into six broad categories of users: single-family, multi-family, industrial, commercial, institutional, and municipal. Figure 3 shows the total sales by user classification for the 2000/01 fiscal year. Water sales are evenly divided between residential and industrial/commercial sales with Municipal and Institutional sales accounting for a minor portion of the water sold. The City has a diverse industrial base with many customers that are dependent on water as a part of their manufacturing processes.

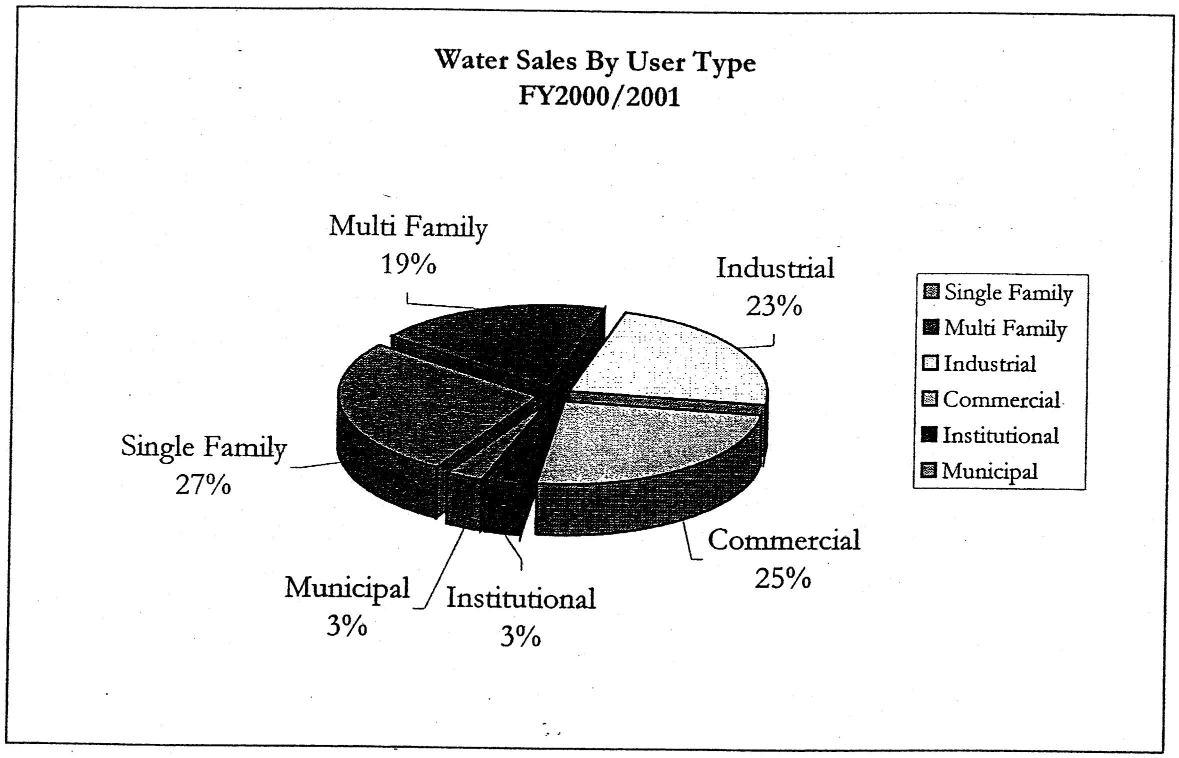

Figure 3

The amount of water used by each category of user varies over time. Figure 4 shows the variations over the past 14 fiscal years in the amount of water purchased by each category of water user.

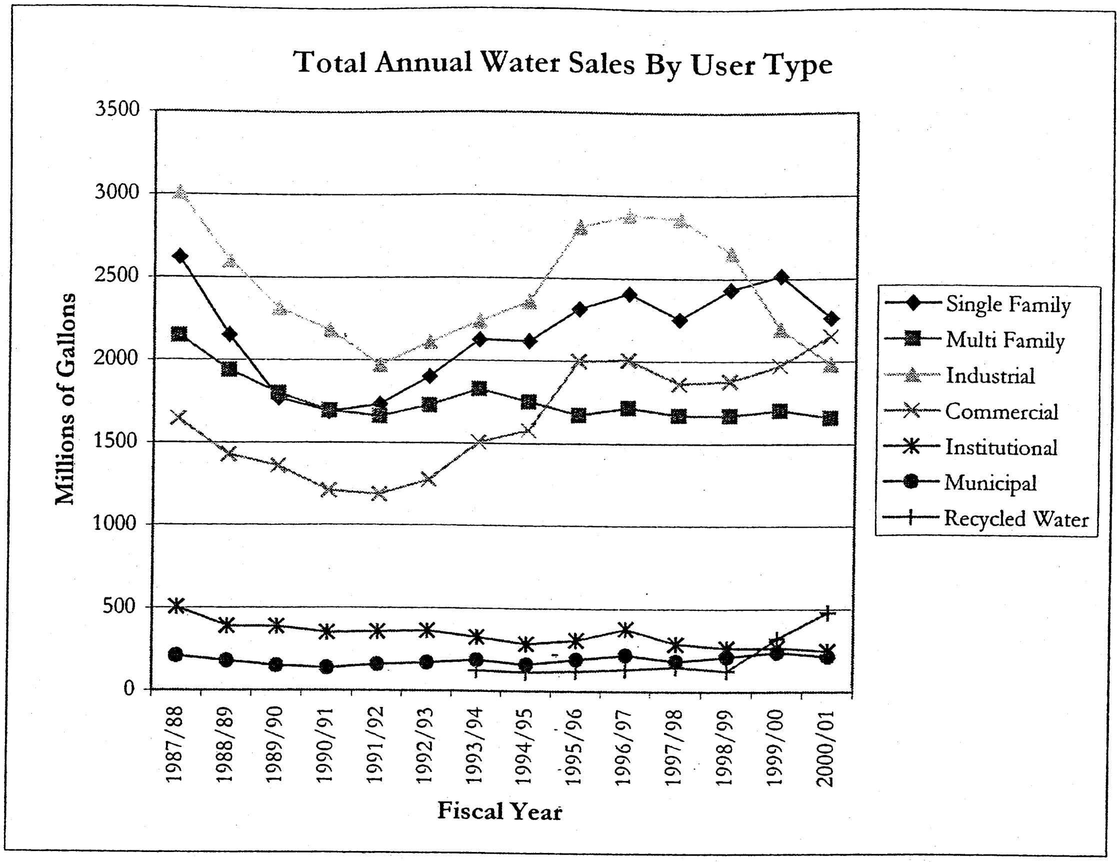

Figure 4

One of the goals of this Plan is to forecast the future water demand in order to determine the capability of the distribution system and water supply to meet projected future needs. In order to project future water demand a model or methodology must be selected. In the previous Water Master Plan, a model based on the present and projected acreage of various land uses was used to project future water demand. Due to the effects of conservation on all categories and fluctuations in use by the industrial category, this model was not selected for the current Plan. Instead, water demand projections were prepared for each user category. Several different forecasting methods were used. The method selected for each user category is based on the following: 1) the type and quality of the data available, 2) whether a dependent variable could be identified on which a projection could be based, and 3) the statistical significance of identifiable trends. An explanation of the particular method used for a user category is contained in the corresponding section of the Plan.

RESIDENTIAL

The water usage data for single and multi-family dwellings can be reduced to a per capita value by dividing the total residential water sales by the population of the City for that year. The per capita residential water usage has decreased over the past 15 years due to water conservation and water efficiency standards for devices such as ultra-low flush toilets and low-flow showerheads. During the last 11 years the per capita residential water use appears to have stabilized at 108 gallons/person/day with a standard deviation of 5 gallons/person/day (Figure 5). This per capita water use is comparable to the findings of the AWWA study "Residential End Uses of Water" (AWWA, 1999) which found that the median per capita water usage for single-family dwellings was 144 gallons/person/day. The Santa Clara figure is slightly lower than the AWWA study because the Santa Clara per capita estimate is a combination of both single-family and multi-family dwellings. Multi-family dwellings will typically have a lower per capita water usage due to a lower amount of outdoor water usage.

The per capita average of 108 gallons/day was used in conjunction with population projections from the Association of Bay Area Government's projections of future population in Santa Clara (ABAG, 2001) to project future residential water demands. The resulting water demand projection is shown in Figure 6.

INDUSTRIAL

The number of jobs in the Silicon Valley has increased at a rate of 4% per year over the past five years[4]. The number of jobs is projected to continue to increase over the next 10 years. The Association of Bay Area Governments (ABAG) estimates an increase of approximately 5% between 2000 and 2005 with another 5% increase between 2005 and 2010. An increase in the number of jobs in Santa Clara does not necessarily equate to a specific increase in water usage as it does with residential water usage. As can be seen in the graph in Figure 4, industrial water usage has decreased over the past three years. However the number of jobs in the area has not decreased proportionally during this time period. This decrease in usage may be attributable to both increased water conservation and relocation of water intensive processes to manufacturing facilities away from this area.

Preparing projections of future water demand for the industrial category is problematic because a small number of large volume water users have a significant effect on the overall usage data. Therefore it is difficult to accurately project future water demand through the statistical treatment of past data. Use of techniques such as linear regressions will result in a projected water demand, however the accuracy and statistical significance of such a projection would be highly questionable. Similarly, a correlation cannot be found between land use area and water demand for this category.

The water usage within this category is related most significantly to production levels within the electronics industry, which represents 84% of the water usage within the industrial category and 20% of the total water demand within the City, based on water sales for FY2000/01. Future production levels cannot be predicted with any relative level of certainty. For this Plan the water supply requirements were set based on a continuation of the current levels of industrial demand. The water demand for the industrial category is projected to be 2,580 MG/year in 2010 and 2,720 MG/year in 2020.

COMMERCIAL

The commercial base within Santa Clara is relatively stable. A decrease in water demand for this category was noted in the late 1980s, which corresponds to conservation measures in response to the 1986-92 drought period. Usage within this category has increased since 1992.

[4] Silicon Valley Projections 2000, Association Of Bay Area Governments, 2001

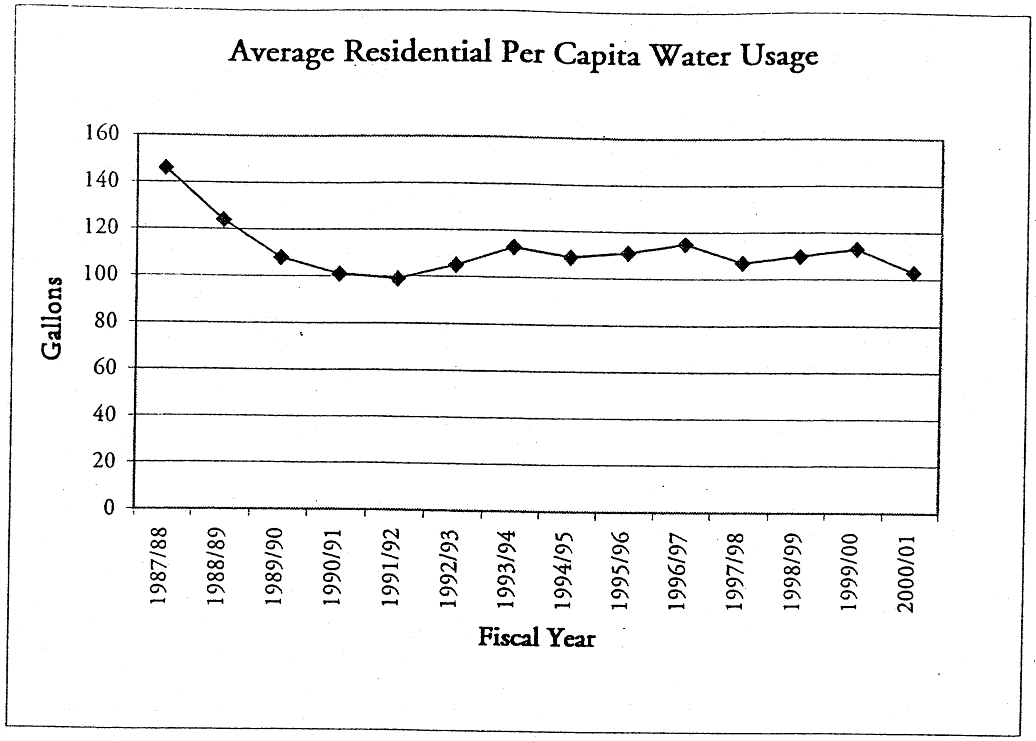

Figure 5

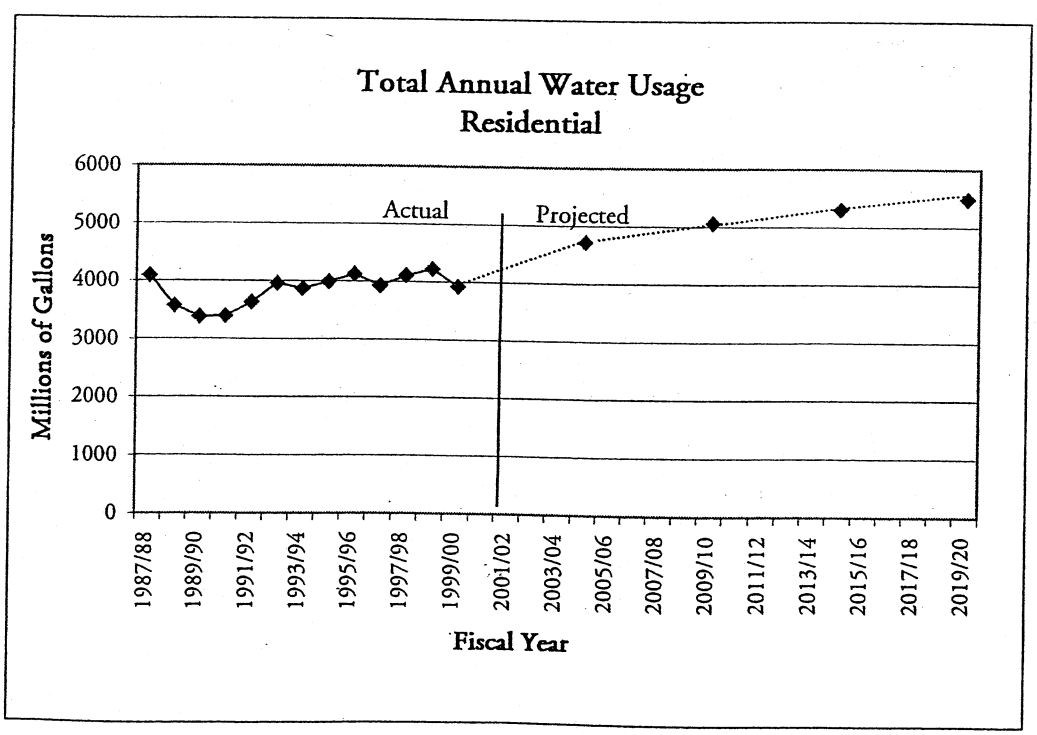

Figure 6

In order to forecast the future Commercial water demand, the historical data was adjusted for seasonal variation using the factors in Appendix B. The data was then adjusted to account for conservation measures and conservation pricing that was in effect during the 1986-92 drought. A 13-month moving average was then calculated using the resulting data. Finally, a least squared linear regression was performed on the data set to project the future demand. This statistical treatment of the data reduces the variation in the data set while preserving the general trend of the data. Using this statistical methodology results in a projected water demand of 2776 MG/year in 2010 and 3426 MG/year in 2020.

INSTITUTIONAL

Institutional use of water has decreased slightly over the past 14 years. Due to this downward trend, if a linear regression is used to project future water demand for this category the result indicates that all water use for the category will stop by approximately the year 2013. Obviously this is a statistical result that is not based in reality. It is not possible to identify a dependent variable such as with the residential component. Presently no expansion or reductions within this user category are foreseen. Therefore, for purposes of future water demand projection the usage will be assumed flat, at a demand level consistent with water sales to this user category in 2000 or 280 MG/year.

MUNICIPAL

This category includes county and state buildings that are located in the City of Santa Clara, as well as school district facilities. Municipal water use has remained relatively constant over the past 14 years.

The municipal water usage is expected to increase slightly over the next 20 years. However, the usage of potable water should decrease during the summer months as utilization of recycled water at City facilities increases and conservation measures are implemented.

The methodology used to project the future Municipal water demand was identical to the methodology used to project the future Commercial water demand. The weighted moving average method is described previously in detail in the Commercial section. Using this statistical methodology results in a projected water demand of 256 MG/year in 2010 and 304 MG/year in 2020.

SYSTEM LOSSES

Water loss within the distribution system can occur due to leaks, breaks, malfunctioning valves, fire suppression and the difference between the actual and measured quantities from water meter inaccuracies. A certain amount of loss is anticipated and considered normal. Some water losses are actually legitimate unmetered uses such as line flushing, fire system tests and street cleaning. Figure 7 shows the distribution system losses as a percentage of total sales over the last eight fiscal years.

The losses experienced by the Santa Clara water distribution system are substantially lower than the 10% losses normally experienced by systems in urban areas[5]. 95 percent of water distribution systems experience losses between 7 and 15%. During the past 8 years, losses within the Santa Clara water distribution system have been below 2.1 % and are expected to be less than 2% per year in the future. For purposes of projecting future demand, system losses will be calculated at 2% of the total of the projections for all other user categories.

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[5] AWWA, Water Resource Planning; Manual of Water Supply Practices M50, 2001, p33

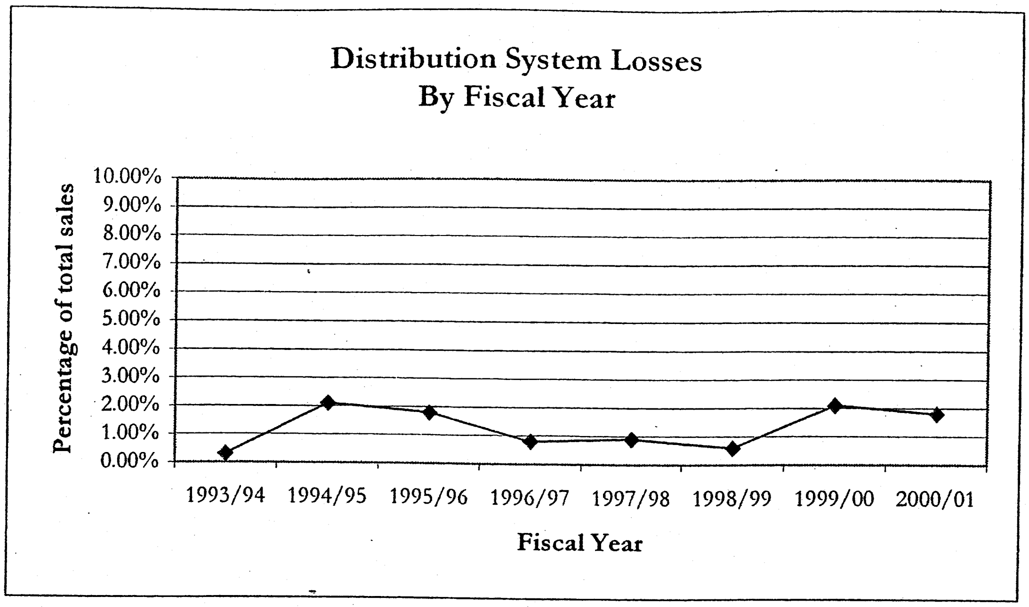


Figure 7

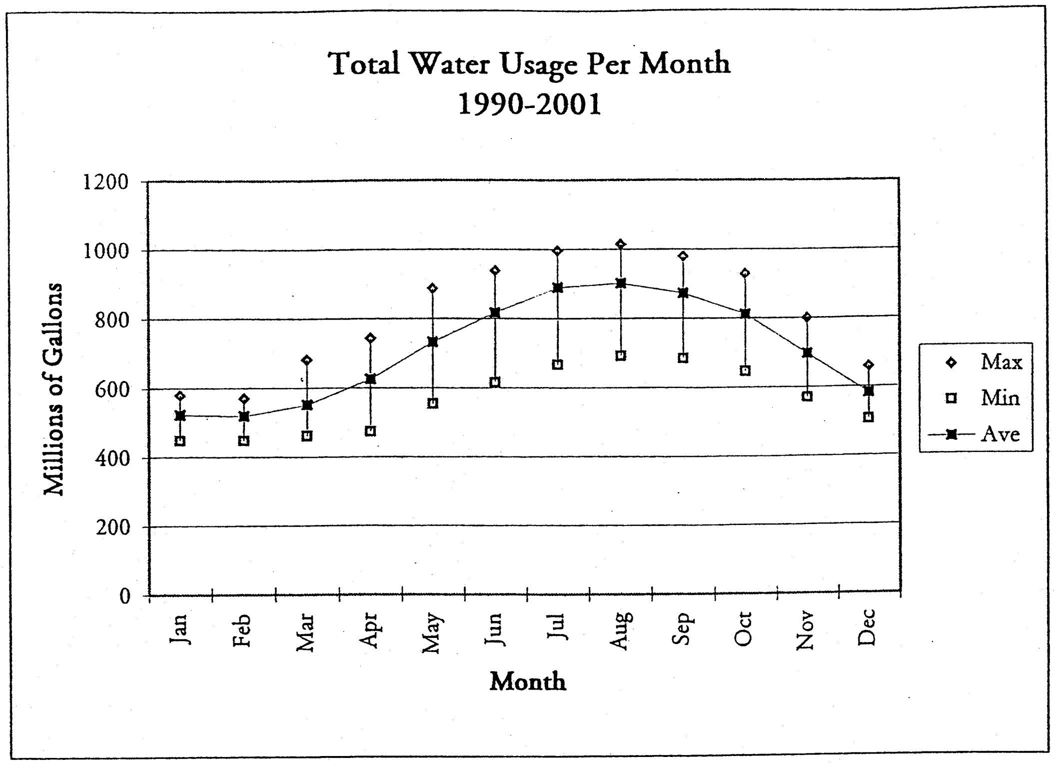
SEASONAL VARIATION

Water demand is typically higher during the summer months to primarily supply irrigation demand, with some increase due to cooling tower water use. By plotting the total water usage for each month, a demand curve can be generated that indicates both the general usage pattern and a seasonal peak demand factor. Figure 8 shows the seasonal demand variation for the entire water distribution system for the previous 11 years. Appendix A has a compilation of similar graphs for each category of water customer. Overall the system exhibits a seasonal peaking factor of 1.7 between the months of February and August, that is, the average water use in August is 1.7 times the base demand of an average February.

FIRE FLOW REQUIREMENTS

Water distribution systems provide water for residential, industrial and commercial purposes. However, the City also relies on the water distribution system to provide water of sufficient quantity and pressure for fire fighting efforts. The demand that fire fighting efforts place on the water system is unique. A high flow rate is necessary for fire suppression, however the demand is relatively short in duration compared to other uses. The maximum duration used in fire flow analysis is generally 3 hours. Typically peak day usage is used as a base to perform a fire flow analysis in order to insure that adequate flow and pressure are available to protect life and property[6].

[6] Cesario, Lee; Modeling, Analysis, and Design of Water Distribution Systems, American Water Works Association, 1995 p179



Total Water Usage Per Month
1990-2001
Millions of Gallons
1200
1000
800
600
400
200
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Max
Min
Ave

Figure 8

The sources of water supply in Santa Clara are: groundwater, imported water from the SFWD Hetch-Hetchy system, imported treated water from the District, and recycled water from South Bay Water Recycling. As seen in Figure 9, the predominant source of water within the City is groundwater from wells that are owned and operated by the City. Various areas within the City receive water from one or more sources depending on location. Figure 10 shows the approximate boundaries of the various sources. One section of the northwest portion of the City (designated Zone 1a) is designed to receive water solely from San Francisco Water's Hetch-Hetchy system. This area of the City has no well for groundwater supply; with the adjacent area north of Bayshore Freeway currently having only one well. The southern portion of the City receives a blend of water from City wells and treated water from the District. In FY 2000/2001 the blend of water in this area was 58% well water and 42% treated surface water. The boundaries indicated on Figure 10 are approximate. The zones of influence from the various water sources are dynamic and will change depending on changes in supply and the overall demands on the system.

Figure 11 shows the current recycled water distribution system as well as main extensions planned for the next four years.

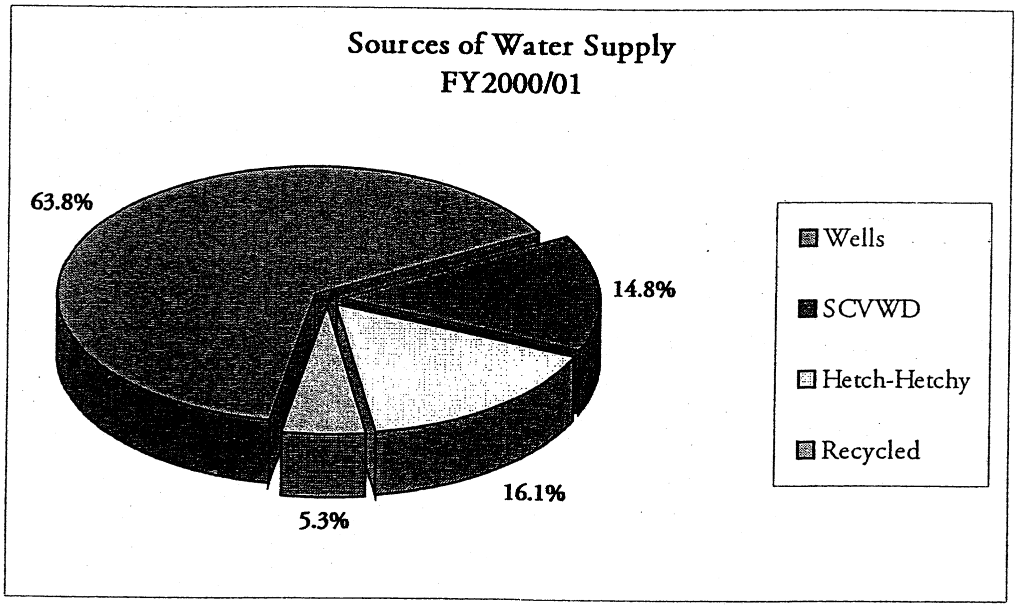
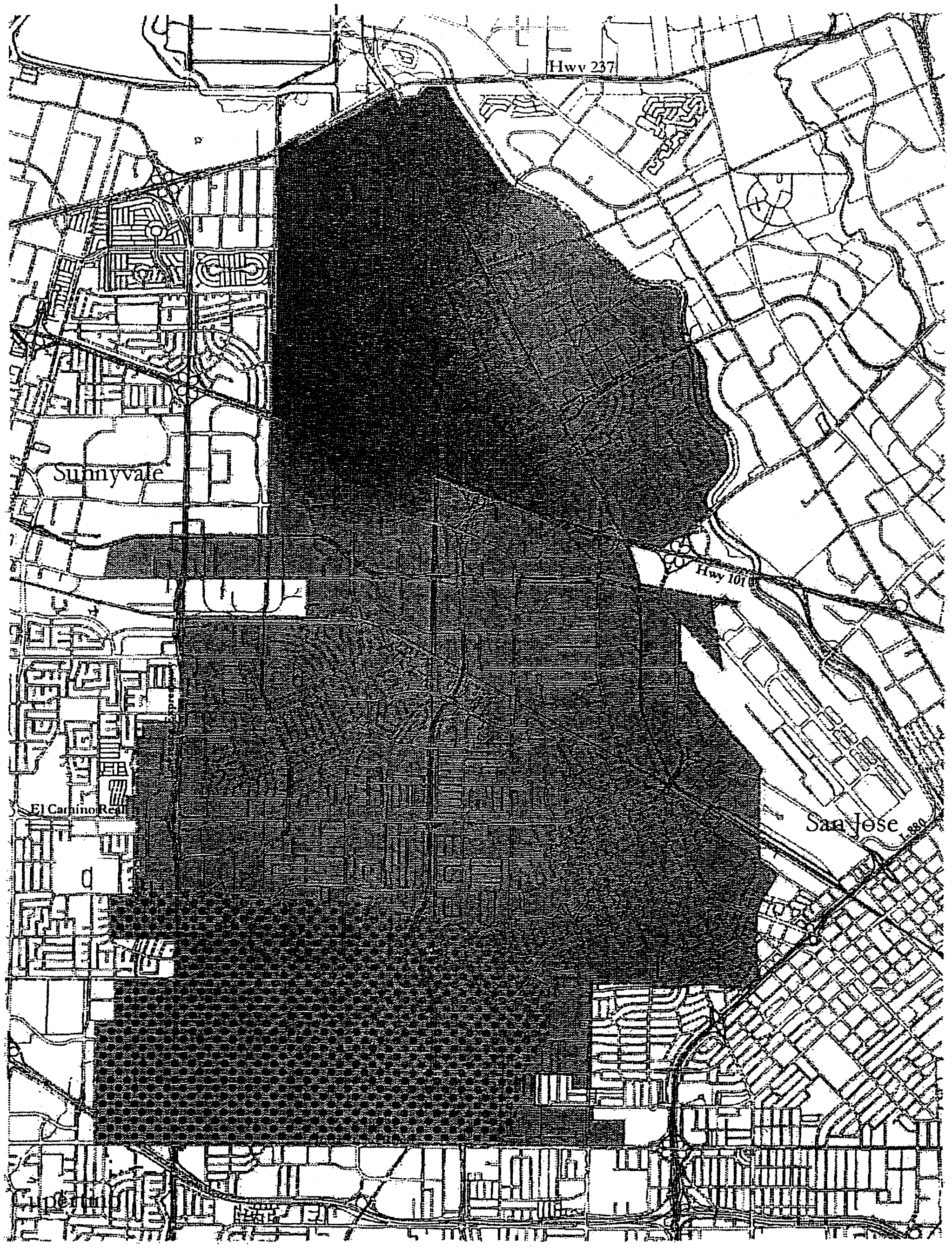


Figure 9

GROUNDWATER

The local groundwater basin has provided the primary source of water for domestic, industrial and agricultural use in the City since the area was first settled. The basin is comparable to a large underground reservoir. The groundwater basin is shown in Figure 12 and is the largest of three interconnected groundwater basins occupying 240,000 acres of the 849,000 acres in Santa Clara County.

Source of Water by Area



SFPUC Hetch-Hetchy

City of Santa Clara Well Water

A Blend of Well Water and SCVWD treated surface water

Figure 10

Recycled Water Distribution System

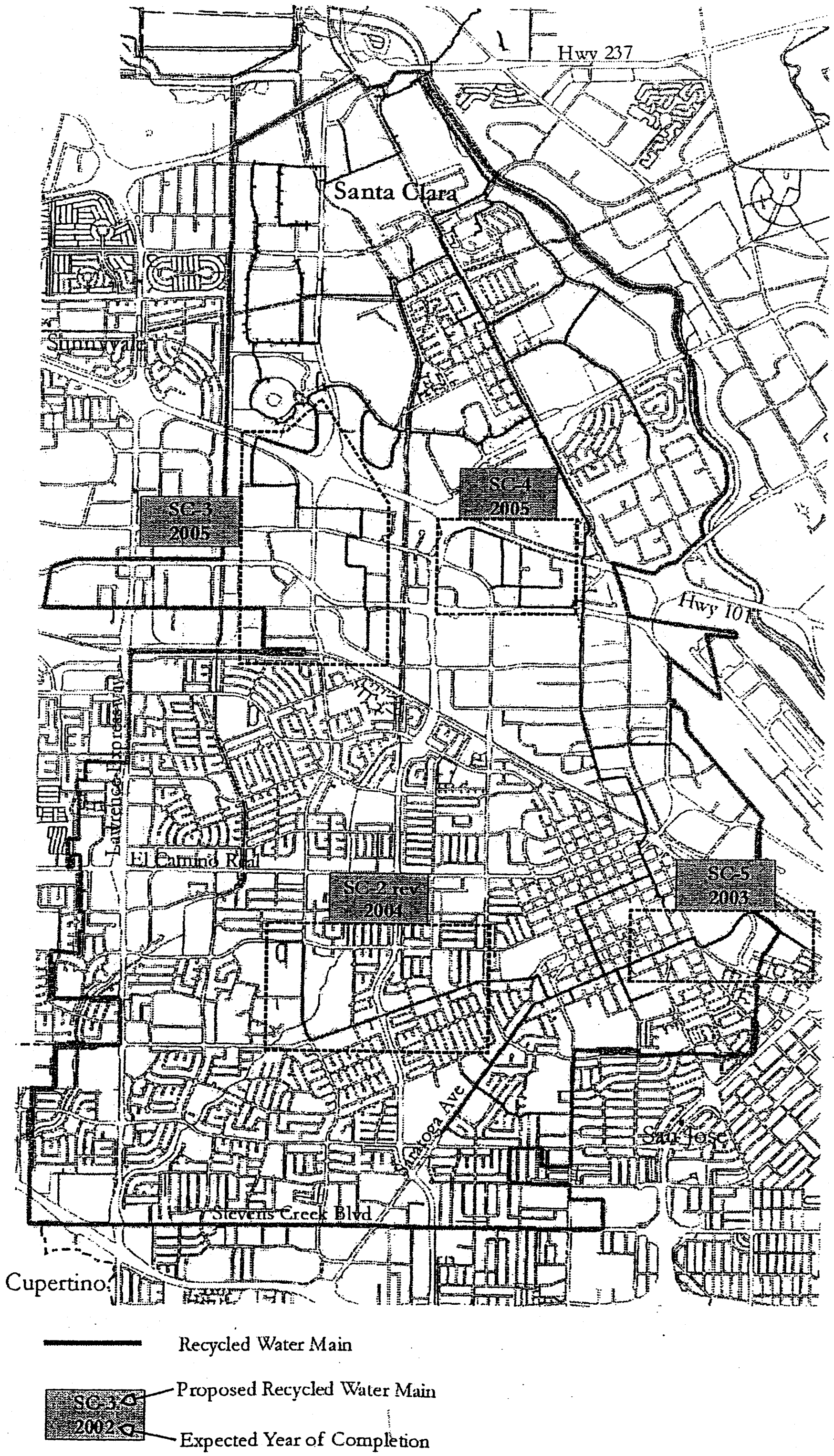


Figure 11

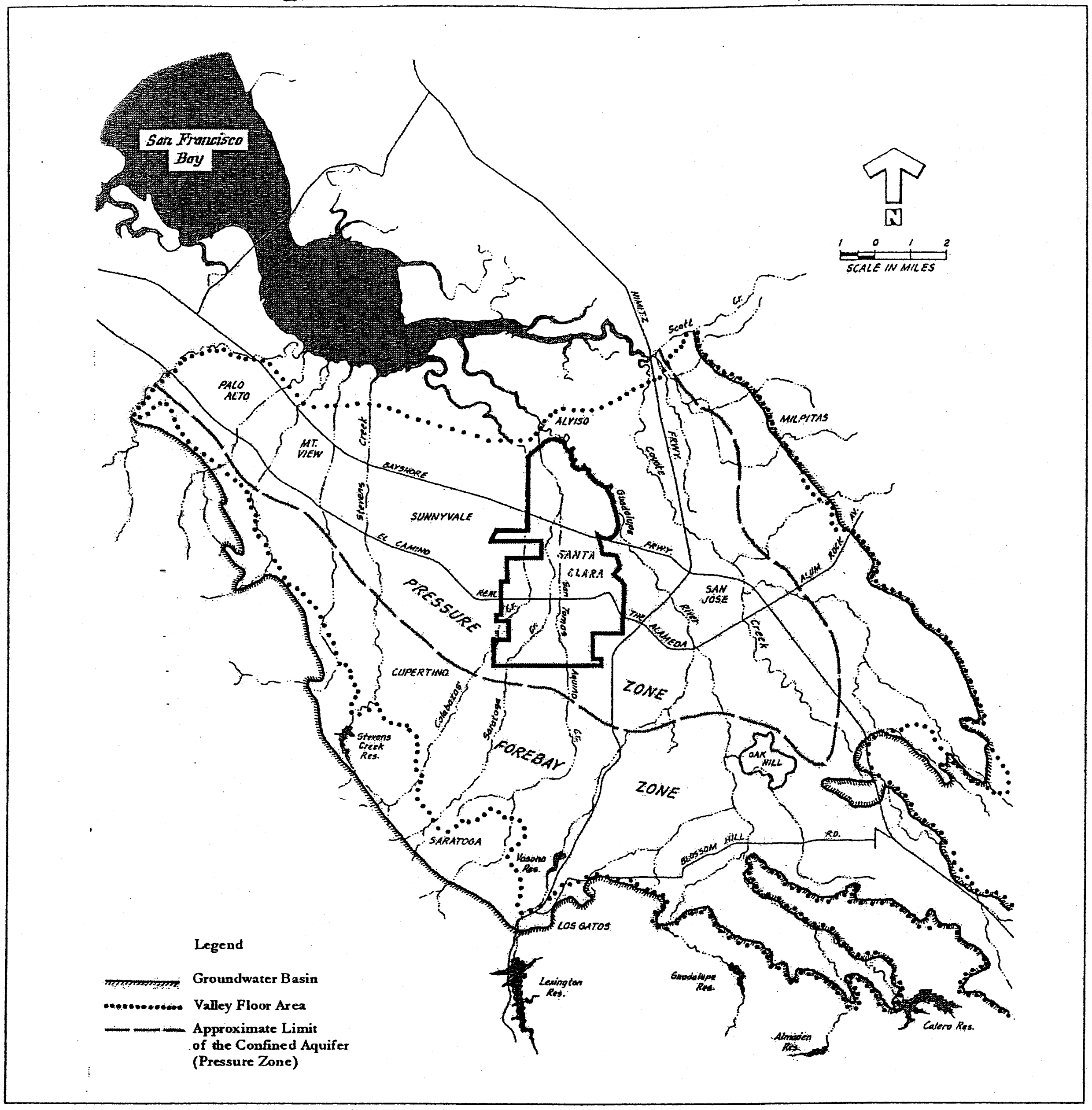


Figure 12

A surface map of the Santa Clara Valley groundwater basin is divided into two zones termed the "pressure" and "forebay" zones. The forebay zone lies in the upland portion of the valley floor and exists where the pervious gravels of the alluvial layers extend to the ground surface. Precipitation, stream flow, and water diverted into percolation ponds are able to enter the underlying aquifers (water bearing gravel layers) in the forebay zone. The pressure zone includes areas of the valley where impervious and generally continuous clay strata overlie the major aquifers within the groundwater basin. The City of Santa Clara sits entirely within the pressure zone of the Santa Clara Valley groundwater basin. The groundwater aquifers in this pressure zone are the most highly productive in the valley and the source of the majority of the groundwater extractions for both Santa Clara and the neighboring communities.

GROUNDWATER USAGE AND SUPPLY

The allowable withdrawal or safe yield of groundwater by the City of Santa Clara is dependent upon a number of factors including: withdrawals by other water agencies, quantity of water recharged and the carry over storage from the previous year. Development and agricultural needs in the 1920s increased the demand on the water systems within the Santa Clara Valley. The increased extraction of groundwater led to subsidence in several of the aquifers. The Santa Clara Valley Water Conservation District was originally formed in 1929 to alleviate land surface subsidence in and around San Jose. The rapid development of Santa Clara County occurred again in the 1960s and the corresponding increased demand on the existing water supply again resulted in the over-drafting of the groundwater basin. The continued over-drafting of the basin resulted in a significant lowering of the groundwater table, significant subsidence of the land in the northern portion of the valley and compaction of several aquifers. When an aquifer is compacted the storage capacity of the aquifer can be substantially reduced. Once lost, the capacity cannot be regained.

In order to avoid any further subsidence and loss of aquifer capacity the District has attempted to operate the basin at equilibrium through water importation and groundwater recharge. The District is currently using projected supply, carryover capacity and anticipated demand to predict potential water shortages. The District in their draft Urban Water Management Plan (UWMP) indicates an estimated basin capacity of 500,000 acre-feet and identifies responses for demands of 450,000 acre-feet and 500,000 acre-feet. In April of each year, when the quantity of imported water available to the District by contract and the local water yield can be estimated fairly accurately, the District will estimate the carryover storage. Based on the calculated carryover capacity and the anticipated customer demands, the District reviews and modifies its groundwater management strategy in order to maintain adequate water in the basin to avoid subsidence[7]. Future supply projections use an assumed (approximate) limit of 8,000 MG (24,553 acre-feet) per year as a "firm yield" from the groundwater supply for the City of Santa Clara.

In FY 2000/01 a total of 17,932 acre-feet (5,842.8 MG) were pumped from the 27 production wells within Santa Clara. Groundwater from wells accounted for 63.8% of the water used in Santa Clara.

GROUNDWATER COSTS

The cost of groundwater used by the City is composed of fixed and variable costs. These costs include pump taxes, power costs, amortization of equipment, operation and maintenance costs.

Pump taxes

The Santa Clara Valley Water District imposes a groundwater extraction charge on all water pumped from underground to finance its groundwater recharge and water importation programs as well as to assist its treated water program. The pump tax was $85 per acre-foot in 1985 when the last Master Plan was written. In FY 2001-02 the pump tax is $330 per acre-foot. With anticipated increases of approximately 4% per year, the projected pump tax will be greater than $500 per acre-foot by 2010.

[7] Santa Clara Valley Water District, Draft Urban Water Management Plan, January 2001

Power costs

All of the groundwater must be pumped from wells into the water distribution system. Over the last several years this cost has amounted to $32 per acre-foot. This cost is expected to rise at a rate of 3% per year in the near term and result in a cost of $42 per acre-foot by 2010.

Amortization costs

The approximate cost for the 29 current water production wells is $7 million or just over an average cost of $240,000/well. Assuming an average 40-year life of a well, straight-line depreciation is $175,000 per year. The average interest at 5% per year on approximately $3,500,000 remaining principal would add another $175,000 per year. Therefore the approximate amortized cost for all wells is $350,000. Divided by the current production of 18,149 acre-feet per year, yields a current amortized cost of $19 per acre-ft.

Operation and Maintenance costs

Operations and maintenance (O&M) costs are dependent on the amount of pump repair, and other maintenance work that is required. In 1985, when the last Master Plan was written, O&M costs were approximately $4 per acre-foot of water pumped. That amount did not include the water quality monitoring costs that are directly attributable to the operation of our own groundwater pumping capacity. By FY 2000-01 this figure has increased to $16 per acre-foot of water pumped. O&M costs are anticipated to increase by 4% per year for the next 10 years.

Water Quality costs

The operation of City owned wells also imposes certain water quality testing that would not be required if the City only retailed water purchased from the two wholesale water agencies. This marginal cost for water testing that is directly related to the operation of wells should be included in the operational cost of water produced by wells. For FY 2000-01 this cost was $145,000 or $8 per acre-foot.

For all costs combined, the City of Santa Clara's groundwater currently costs $400 per acre-foot.

SANTA CLARA VALLEY WATER DISTRICT, IMPORTED WATER

The Santa Clara Valley Water District was formed in 1929 as the Santa Clara Valley Water Conservation District by public vote under provisions of the Water Conservation Act of 1929. In 1951 the Santa Clara County Flood Control District was created and placed under the direction of the County Board of Supervisors. In 1968 the two districts merged to become the current organization under an independent elected Board of Directors. Today the Santa Clara Valley Water District is responsible for flood control within the County of Santa Clara, storage and use of water supplies from within the county, importation of water into the area from the State and Federal water projects for local storage and groundwater recharge programs and production of treated water that is sold to water retailers in the county.

The District has eight local reservoirs with a combined storage capacity of 155,000 acre-feet. These reservoirs collect the local runoff during the winter storms for later release to percolation ponds or to water treatment plants. By the use of the percolation ponds, water is allowed to recharge the groundwater basin. In addition to local runoff, a portion of the water imported from the State Water Project is also directed to the percolation ponds for groundwater recharge.

CITY USE OF SANTA CLARA VALLEY WATER DISTRICT TREATED WATER

The City of Santa Clara receives treated surface water via the Santa Clara "distributary" (pipeline) at the Serra Tank site at the southwest corner of the City. This pipeline was designed for a flow of approximately 15,000 gpm. However, if the City were to utilize more than 4,000 gpm, or 5.76 MGD, the pressure loss from this flow along with that of other users from the pipeline would require some or all of the following:

1. re-pumping of the water,
2. modification of the City storage and transmission system,
3. expansion of the District's Rinconada Treatment Plant, and/or
4. the other users also re-pump District water at their connection sites.

A modification of the current District connection, or a separate connection would allow for greater flows than the current 4000 GPM. One possible modification would allow for the District's treated water to enter the City's system at a new location for increased capacity and greater flexibility of operations.

In FY 2000/01 Santa Clara Valley Water District was the source of 4157 acre-feet (1354.5 MG) or 14.8% of the water supplied to Santa Clara.

SANTA CLARA VALLEY WATER DISTRICT TREATED WATER COSTS

The cost for treated water supplied from the District is $410 per acre-foot in FY 2001/02 (proposed to be $420/AF for 2002-03). This cost is anticipated to rise at a rate of 3% to 5% per year for at least ten years. Additional increases in energy costs, new water quality regulations and/or infrastructure replacement costs may result in higher rates of increase for the cost of treated water in the next several years. With these assumptions for current projections it is expected that by 2010 the wholesale cost for treated water will be more than $600 per acre-foot.

SAN FRANCISCO HETCH-HETCHY TREATED WATER

The San Francisco Water Department water supply system was planned during the late 1800s and constructed in the early 1900s. The first water was delivered to the Bay area from the Hetch-Hetchy system in 1934. Currently this system serves 2.3 million people in San Francisco and 29 other communities and water agencies in the bay area, including Santa Clara. The 29 agencies have organized as the Bay Area Water Users Association (BAWUA) for representation on issues of mutual concern with the City of San Francisco.

The San Francisco Water Department obtains its water from the Tuolumne River watershed in the Sierra Nevada Mountains, Calaveras and San Antonio Reservoirs in Alameda and Santa Clara Counties, and from Crystal Springs Reservoir on the San Francisco Peninsula. The water direct from the Sierras along with water from Calaveras and San Antonio Reservoirs is delivered to San Francisco through the Hetch-Hetchy Aqueduct. A branch of the aqueduct traverses the northern portion of the City of Santa Clara. This branch of the Hetch-Hetchy system is called the Bay Division Pipelines and consists of 96" and 72" lines under high pressure. Within Santa Clara County, the Cities of Milpitas, San Jose, Sunnyvale, Palo Alto, Mountain View, Los Altos and Los Altos Hills obtain some or all of their water from the Hetch-Hetchy system.

During the drought that occurred from 1986 to 1992, the reservoirs within the Hetch-Hetchy system became seriously depleted, indicating the system is less reliable during dry periods than previously thought. The San

Francisco Public Utilities Commission (SFPUC) has also identified serious concerns about portions of the Hetch-Hetchy system that are aging and in need of repair or replacement. In addition, due to the age of the system, most facilities are not designed to current seismic standards and the system is vulnerable to earthquakes. An earthquake or similar catastrophic event could result in a prolonged disruption of the Hetch-Hetchy system with loss of service for 3 to 4 months. The SFPUC recently completed an evaluation of the Hetch-Hetchy water system that indicates approximately $2.9 billion in infrastructure replacement and upgrades are necessary to insure the capacity and reliability of the water system for the suburban users[8].

CITY USE OF SAN FRANCISCO HETCH-HETCHY TREATED WATER

The City of Santa Clara has two connections to the Hetch-Hetchy system to receive water from SFWD. The combined capacity of these two turnouts is 7500 gpm or 10.8 MGD, although current contractual arrangements limit the City's use to less than 4.5 MGD. This capacity can be obtained without additional pumping costs. Water can also be taken into the Northside Storage tanks for re-pumping into the water distribution system. The area served by Hetch-Hetchy is primarily industrial, with several key industries in Santa Clara being supplied water that is predominately from the Hetch-Hetchy system.

Currently the City of Santa Clara does not have a permanent supply contract with San Francisco. San Francisco has been unwilling to grant Santa Clara a permanent contract because the firm delivery capability of the Hetch Hetchy system is fully committed, and in some cases over-committed through San Francisco's current wholesale contracts. Instead of amending the existing contractual agreements with San Francisco, the 29 agencies of BAWUA have adopted a multi-lateral agreement titled the Interim Water Shortage Allocation Plan. The Interim Water Shortage Allocation Plan has the effect of providing a formula for an assured supply of SFPUC water in times of a water shortage. This, in effect, makes the Santa Clara supply of SFPUC water non-interruptible with a formula for allocation in times of shortage. In FY 2000/01 SFPUC Hetch-Hetchy system was the source of 4531 acre-feet (1476.3 MG) or 16.1% of the water supplied to Santa Clara.

SAN FRANCISCO HETCH-HETCHY WATER COSTS AND PROJECTIONS

The cost for water supplied from Hetch-Hetchy is $405 per acre-foot in FY 2001/02. As detailed above, the Hetch-Hetchy system is currently in need of significant capital expenditures. Once these system improvements are placed into service, the cost of the improvements can be rate based, that is, passed on to the various communities that purchase water from the San Francisco Hetch-Hetchy system. Therefore, by 2010 the cost may be expected to double or probably triple to a cost of $800 to $1,200 per acre-foot respectively.

With respect to the future supply of SFWD water, the City's view is clouded. All contracts between the suburban water agencies and San Francisco will expire in 2009. The re-negotiation of these contracts will be a necessary step to assure a long-term supply of SFWD water. Much will depend on the ability of San Francisco to obtain sufficient water supply for the growing needs of San Francisco and all BAWUA agencies. These uncertainties of supply added to those of cost may force the City of Santa Clara to replace some, or all of SFWD water with supplies from the Santa Clara Valley Water District. However, if other cities in Santa Clara County also elect to turn to the District to augment or replace SFWD water, the District's supplies (as now projected) would also be inadequate. Two scenarios are included in the section Planning for the Future,

[8] San Francisco Public Utilities Commission, Bay Area Water Users Association: Water Supply Master Plan - A Water Resource Strategy for the SFPUC, April 2000

one includes SFWD as a supply after 2009, and one assumes the loss of SFWD supply to be replaced by a combination of District treated water, ground water and recycled water.

RECYCLED WATER

At the time the last Master Plan was written in 1986 the use of recycled water as an adjunct to the City's water supply was under consideration. As a result of the 1986 to 1992 drought, and new restrictions placed on the San Jose/Santa Clara Water Pollution Control Plant (WPCP), recycled water use has become a reality. In the 1989, the City of Santa Clara completed the first significant recycled water transmission and delivery system from the WPCP to irrigate the Santa Clara Golf & Tennis Club and for other non-potable applications. The San Francisco Bay Regional Water Quality Control Board granted Santa Clara permission to use recycled water for landscape irrigation, street median landscaping, dust control for construction projects, sewer cleaning and street cleaning. The project was nationally recognized as the 1989 winner of the American City & County Award of Merit in the water supply category.

Recycled water within the City of Santa Clara is supplied from the WPCP. The recycled water meets California Administrative Code (CAC) Title 22 Division 4 requirements for "unrestricted use." The users of recycled water must insure that a number of regulatory requirements specified in CAC Title 22 are met. CAC Title 22 specifies the types of use and the conditions under which the use of recycled water is allowed.

The South Bay Water Recycling Program was initiated to reduce the discharge of treated water flowing from the WPCP into the San Francisco Bay. The WPCP discharge permit places a discharge limit of 120 million gallons each day during the summer to help maintain the salt marsh habitat of the south Bay. It is believed that the salt marsh habitat of two endangered species may be threatened by converting the saltwater marsh to fresh and brackish water marsh due to the discharge of the WPCP's highly treated water. As a result, the WPCP formed South Bay Water Recycling (SBWR) which purchased the City of Santa Clara's recycled water system and now is the regional recycled water wholesaler within the WPCP service area. SBWR provides oversight, promotes recycled water, operates the recycled water distribution system, and assists recycled water customers both technically and financially. The second driving force behind the water recycling efforts was changes in the State of California Water Code. In 1991, the state passed the Water Recycling Act of 1991 which is contained in Sections 13575-13583 of the California Water Code. The Water Recycling Act instructs water retailers to "identify potential uses for recycled water within their service areas, potential customers for recycled water service within their service area, and, within a reasonable time, potential sources of recycled water."[9] Within certain technical and financial considerations, water retailers are instructed by the Water Recycling Act to provide recycled water to customers that request it. To further encourage the use of recycled water, the Water Code was also changed to prohibit the use of potable water for certain uses, if recycled water is available.[10]

CITY USE OF RECYCLED WATER

Recycled water is primarily used for irrigation of large turf areas within the City such as golf courses, parks and schools. Several industries use recycled water in industrial processes, cooling towers or for toilet flushing in dual plumbed buildings, however the predominant use remains irrigation.

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[9] California Water Code Section 13579(a)

[10] California Water Code Section 13550-13551

SBWR provided funding for 9 miles of recycled water distribution mains as the first phase of construction. Four additional projects are currently scheduled in the City for a second phase of construction as funded by SBWR. The recycled water system is owned by the WPCP under the SBWR program. The City maintains the system under contract by agreement with the City of San Jose. Additional in-fill projects of smaller distribution lines should continue over the next 10 years once the several Phase 2 extensions are completed. It is anticipated that even with the completion of the Phase 2 extensions and construction of minor distribution mains, recycled water will remain a minor source of water within the City of Santa Clara. In FY 2000/01 recycled water was the source of 1477 acre-feet (481.1 MG) of the water supplied to Santa Clara. In FY2000/01 the combined volumes of potable water from Santa Clara Wells, Hetch-Hetchy, and the District was 26,619 acre-feet. If the 1477 acre-feet of recycled water is included in this figure, recycled water represents 5.3% of the water used within the City. The total annual production for recycled water could reach 2000 acre-feet (652 MG) by 2010 after the projected future customers are connected to the recycled water distribution system.

RECYCLED WATER COSTS

The wholesale costs are set by South Bay Water Recycling[11], currently wholesale costs for recycled water are $180 per acre-foot for irrigation and $20 per acre-foot for irrigation or industrial uses where a private well was the previous source of water. Future wholesale rates for recycled water are expected to increase as much as 40% within the next five years.

THE ROLE OF CONSERVATION

Conservation plays a critical role in reducing current and future water demand within the City. This fact is dramatically demonstrated by the reduction in residential per capita water usage noted in previously in Figure 5. The observed reduction in per capita water usage equates to a significant reduction in the total water demand within the City. The recent average residential per capita usage is 108 gallons per person per day. In FY1987/88 the residential per capita demand was 148 gal/person/day. At the City's current population of 102,361 this reduction in per capita water use equates to 1,420 MG annually. At the projected populations for 2010 and 2020 the reduction in demand is 1,550 MG/year and 1,879 MG/year respectively.

The reduction in the per capita water usage within the residential user category is the result of a number of factors including conservation programs, new water efficiency standards for toilets and increased public awareness. The City of Santa Clara participates in a number of water conservation programs through the District and the WPCP. The programs include:

- *Ultra Low Flush Toilet programs.* The Ultra Low Flush Toilet Programs have taken a number of different forms over the years. Initially rebates were offered as an incentive to consumers to purchase Ultra Low Flush Toilets. Later a full service program offered the opportunity for residents to have an Ultra Low Flush Toilet installed for a nominal fee of $50. The current program consists of distribution events where free low flow toilets are distributed to residents. In addition, a full service installation program exists for elderly, low income, and disabled individuals to provide qualifying individuals the opportunity to have an Ultra Low Flow Toilet installed at no cost to the resident.
- Distribution of free low flow devices such as showerheads and aerators.

[11] The City of Santa Clara is part owner of SBWR through its ownership of the Water Pollution Control Plant

- *High Efficiency Washer Rebate Program* - The District offers rebates for the purchase of high efficiency washers by residents or commercial facilities. According to District literature, the average household reduces water usage by 5,100 gallons per year by switching to a high efficiency washer.
- *Residential leak detection*- According to the AWWA report Residential Ends Uses of Water (AWWA, 1999) leaks account for 13.7% of the water used inside an average home. The primary source of leaks is toilets. The City offers free leak checks to residents in an effort to reduce the amount of water lost through leaks.
- *WaterWise House Calls* - According to the District's literature, the average program participant reduced their water usage by 30 gallons per day as a result of the audit.
- *Water Efficient Technologies (WET)*- The WET program was originally created by the WPCP as an incentive to industrial facilities to reduce the volume of wastewater discharged to the sanitary sewer. WET offers rebates of up to $50,000 per project to businesses that make changes to their facilities or operations that result in a reduction in wastewater discharge to the sewer. Such projects also typically result in a reduction of water usage.
- *Irrigation Technical Assistance Program (ITAP)*- The program was created by the District in 1994 to assist landscape managers improve efficiency of their irrigation systems. According to the District literature, the average commercial/multi family residential site reduces water usage by 600 to 800 hundred cubic feet per acre per year after participating in the program.
- *Public Education Program*- Water conservation and the programs referenced above are promoted within the City by means of newspaper articles, educational displays, and public events.

The conservation programs fall into two distinct types of programs: behavior based and technology based. Behavior based programs rely on a change in the public's behavior such as taking shorter showers or changing the time of day when lawns are watered. Behavior based conservation requires periodic reinforcement, typically through public education and outreach, in order to sustain reductions.

Technology based conservation relies on physical changes to water using devices in order to decrease water usage, such as replacing older high-flow toilets with ULFTs. The primary means of accomplishing technology-based changes has been through promotion of an incentive program. The primary purpose of incentive programs such as the free showerhead and aerator distribution, ULFT programs and high efficiency washer rebate program is to is to motivate the consumer to install water saving technologies or accelerate the conversion to water efficient technologies. The water savings from such replacements are generally long term and not dependant on a change in behavior. Such replacement programs can achieve a finite reduction in water usage. For example once the majority of households have installed ULFTs further reductions in the per capita water usage will not occur by continuing the incentive program. At some point in the future, saturation will be reached and ULFT incentive programs will be unnecessary.

The continuation of maintenance type programs such as public education, leak check, and irrigation assistance programs are necessary to insure that the progress made in water conservation is maintained. However, further dramatic reductions, such as the reduction in per capita water usage, will likely only be gained by advancement of the state of the art for technology or initiation of new programs.

EMERGENCY WATER SUPPLY

Water agencies are charged with the responsibility of providing sufficient water at an adequate pressure to meet the domestic demands on the system while maintaining a reserve supply for fire suppression purposes. A failure in a portion of the distribution system may cause a localized area to be without water, which could result in serious consequences in the event of a fire or emergency. In the early 1980s the City of Santa Clara installed three automatically controlled interconnections with two neighboring cities to reduce the likelihood of a water outage. In 1990, the City added another emergency water interconnection with a third neighboring water system to further improve the emergency water supply reliability.

The interconnections each have a preset pressure control device that will allow water to flow from one system to the other if there is a loss of pressure. If both water distributions systems loose pressure simultaneously, the automatic valve will not open and no water will be exchanged.

The interconnections are located at Kifer Road and Mead Avenue (City of Sunnyvale), Kifer Road west of Semiconductor Drive (City of Sunnyvale), Trimble Road at De La Cruz Boulevard (City of San Jose) and Steven Creek Boulevard at Bret Avenue (Cal Water Service).

WATER SUPPLY

CITY WELLS

City wells are located throughout the City and supply water directly to the distribution system. A list of the 29 current wells and their production capacities are listed in Table 2. The wells were installed at various dates between 1949 and 1995.

Table 2

ZONE I

Well No.	Location	Capacity (gpm)
1-02	Franklin & Railroad	Inactive
2-02	Between Lincoln & Jefferson	1832
3-02*	Benton & Railroad	1868
4	Scott & Benton	1072
5-02	De La Cruz overpass at D.T.T.	1658
7	Between ECR & Warburton	1192
12	San Juan & Calabazas	1410
13-02	Main & Santa Clara	1646
14	Townsend & Briarwood School	1087
16-02	De La Cruz & Brokaw	1106
18-02	Cabrillo & Saratoga Creek	1323
19	Nelson & Burke	Inactive
20-02	Semiconductor & Tahoe	737
21*	Agate & Calabazas Creek	1461
22-02	Pomeroy & El Sobrante	1230
25	Benton & Saratoga Creek	946
26	Laurie & Aberdeen	1121
28*	San Tomas south of Benton	1956
30	City Hall parking lot	1409

ZONE II

Well No.	Location	
6	Saratoga & Pruneridge	1943
8	Forbes & Saratoga Creek	1144
9-02	Rodonovan & Saratoga Creek	1164
10	Forest @ Parkway Park	1647
11**	San Tomas Exp @ Mary Gomez Park	1821
17-02*	Brookdale@ Curtis School	2104
23	Magnolia & Forbes	1771
24	Swallow & Waterbird	1410
29	Aspen & Barto	1914

ZONE IIa

Well No.	Location	
15	Hubbard north of Melody	788

* = Diesel Generator ** = Stationary Engine (propane)

Wells 1-02 and 19 are not currently in use as production wells.

IMPORTED WATER

Imported water sources within the City include SFWD Hetch-Hetchy and District treated surface water. Water from these imported sources enter the City distribution system from turn outs. These interconnections are shown in Table 3.

Imported Water Connections

Table 3

Source	Location	Capacity (gpm)
Hetch Hetchy #1	Great America Pkwy	5,000
Hetch Hetchy #2 at Northside Tank	Gianera St.	3,200
SCVWD Import at Serra Tanks	Lawrence Expwy.	4,000

WATER DISTRIBUTION STORAGE

The function of storage within the water distribution system is to provide operational flow equalization, water for fire-suppression and emergency need. The present distribution system storage facilities are shown in Table 4. The present total system storage capacity is 27.3 million gallons (MG).

OPERATIONAL STORAGE

Operational storage serves two specific purposes: to stabilize system pressures and to provide operation flexibility. System pressure is stabilized by the use of storage to make up short-term differences between the customer's peak demand and the available production water supply into the distribution system. Operational storage also allows operational flexibility. The City can selectively draw down storage during peak demand and fill storage tanks during periods of low demand. This helps to prolong service life of the well pumps. This ability is also used to conserve electrical energy during power shortages and/or to help the City's electric utility "shave the peak" for lower power supply costs.

The three tanks at Serra and the elevated tank at Walsh directly connected to Zone 1 and are used so that 33% of the total storage capacity (33% of 13.7 MG, or 4.5 MG) is routinely utilized for operational daily peak demand. The remaining tank capacity (Downtown Tank and Northside Tanks) is available for emergency water supply. The three Serra storage tanks and Walsh elevated tank provide water by gravity via a 27" transmission main and 12" distribution main, respectively, to pressure Zone 1.

EMERGENCY STORAGE

Emergency storage is the volume of water reserved to meet demands during emergency situations such as supply failures, loss of electrical power, natural disaster, or other emergency. No set criteria exists for the amount of emergency storage that should be available to a distribution system, although the generally accepted capacity used in the water industry is in the range of 33% to 50% of the maximum day[12]. Wells with back up power supplies are assumed to be able to continue to supply water to the distribution system for a

[12] Walker, Roger; Water Supply, Treatment and Distribution; Prentice Hall; New Jersey; 1978, p314

period of time. Therefore, wells with back-up generators are considered as an emergency storage with a capacity equal to the well capacity multiplied by the hours of operation.

Existing Storage Tanks

Table 4

Storage Tank	Location	Type	Capacity (MG)	Emergency Capacity (MG)	Year Constructed	Zone
Serra 1	Lawrence Expwy & Stevens Creek Blvd	Steel GST	4.6	3.1	1964	IIA
Serra 2		Steel GST	4.4	3.0	1967	IIA
Serra 3		Steel GST	4.2	2.8	1981	IIA
Downtown	De La Cruz & S.P.R.R.	Steel GST	4.2	4.2	1975	I
Walsh	Walsh Ave	Steel EST	0.5	0.33	1965	I
Northside 1	Lakeshore & Gianera	Steel GST	4.7	4.7	1978	I
Northside 2		Steel GST	4.7	4.7	1984	I
		Total	27.3	22.8		

FIRE FLOW STORAGE

Fire flow storage is the amount of water required to provide a specified fire flow for a specified duration. The fire flow storage is generally calculated as a separate and distinct value from other storage requirements[13]. Several methods exist for calculating fire flow requirements for specific points within a distribution system including the Iowa State University, Illinois Institute of Technology Research Institute and Insurance Services Offices (ISO) methods. However, these criteria do not address overall system design. The ISO method does allow for the calculation of a fire flow for a particular type of structure. This method was selected to develop a general guideline of 3,500 gpm for 3 hours per fire event. This equates to a fire flow storage requirement of 630,000 gallons per fire event. These figures are also used in the hydraulic network analysis described later in this Plan.

Because the amount of water in storage will fluctuate during the day, the normal minimum that is maintained during routine operations will be used for the fire flow analysis. Only that portion of the normal minimum amount in storage that can be delivered at a minimum residual pressure of 20 psi will be considered available for the fire flow analysis[14].

[13] Walker, Roger; Water Supply, Treatment and Distribution; Prentice Hall; New Jersey; 1978, p314

[14] Distribution System Requirements for Fire Protection, AWWA Manual M31, First Ed., 1989

Storage Tank Booster Pump Capacity

Booster pumps are used to pump water from ground-elevation storage into the distribution system to help maintain system pressures. Pumping is also needed to move water to maintain water quality within the tanks. As part of the hydraulic network analysis, the pumping capacity was analyzed to insure that the pump capacity was sufficient, in conjunction with storage, to supply the maximum daily demand rate, and the maximum fire flow demand rate at the required pressure and duration, with the single largest pump at each tank site out of service.[15]

Booster Pumps

Table 5

	Name	Location	Horsepower (hp)	Capacity (gpm)
Zone 1				
	Downtown #1	De La Cruz over-crossing & U.P.R.R.	60	1450
	Downtown #2	De La Cruz over-crossing & U.P.R.R.	60	1450
	Downtown #3	De La Cruz over-crossing & U.P.R.R.	60	1450
	Downtown #4	De La Cruz over-crossing & U.P.R.R,	60	1450
	Northside #1	Lakeshore & Gianera Street	100	1700
	Northside #2	Lakeshore & Gianera Street	100	1700
	Northside #3	Lakeshore & Gianera Street	100	1450
	Northside #4	Lakeshore & Gianera Street	100	1200
Zone Iia				
	Serra #1	Stevens Creek Blvd & Lawrence Expwy.	60	1000
	Serra #2	Stevens Creek Blvd & Lawrence Expwy.	60	1000
	Serra #3	Stevens Creek Blvd & Lawrence Expwy.	60	1000

STORAGE CALCULATIONS

Calculations of the total amount of storage necessary for the distribution system were made based on operational storage of 4.5 MG, emergency storage of 50% of a maximum day, and fire flow storage equivalent to two fire events at 3,500 gpm for 3 hours each. This analysis indicates that the storage capacity within currently meets the criteria established in this plan. A similar analysis using the projected max day demands in 2010 and 2020 indicates that the existing storage is sufficient to meet the operational, emergency and fire flow storage requirements of the distribution system.

POTABLE WATER DISTRIBUTION SYSTEM

The water distribution system is composed of transmission mains, distribution mains, and minor distribution mains. In 1985 the distribution system consisted of 287 miles of water mains varying in size from 2" to 27". By the year 2002 the system had grown to 295 miles of mains.

TRANSMISSION MAINS

Transmission mains are those portions of the distribution system that convey water from storage facilities or major supply sources to the distribution mains. Transmission mains are sized to provide adequate service during peak consumption, provide required quantities for fire fighting purposes and provide sufficient

[15] Distribution System Requirements for Fire Protection, AWWA Manual M31, First Ed., 1989

capacity for future expansion. The existing transmission network consists of 14.3 miles of 20 inch, 24 inch and 27 inch mains connecting the Serra storage facilities with the distribution mains in the central and northern sections of the City (pressure Zone 1).

DISTRIBUTION MAINS

Distribution mains are the smaller secondary piping that conveys water to the users from the transmission mains or from production wells. This portion of the distribution system consists of 8 inch to 12 inch mains that are interconnected so that there are few, if any, areas of the City that are dependent on a single distribution main for service. The distribution system currently contains 185 miles of 8 inch to 12-inch distribution mains.

MINOR DISTRIBUTION MAINS

The remainder of the water distribution system consists of smaller mains serving small areas and individual fire hydrants. There are approximately 96 miles of 6 inch or smaller mains in this category.

MULTIPLE PRESSURE ZONES

The Santa Clara water system is separated into four interconnected zones in order to provide optimum pressures throughout the City. In this manner the normal pressure ranges within the system are maintained between 50 psi and 92 psi: in any one area the pressures do not normally fluctuate more than 15 psi. A schematic diagram of the system is shown in Figure 13. A map of the zones within the City is shown in Figure 14.

Zone I

Zone I extends over the northern section of the City from an approximate ground elevation of 100 feet to nearly sea level. This area contains 80% of the City land area. The water supply in this zone consists of 18 wells located in the area, imported water from two Hetch-Hetchy connections and the excess water from Zone II. In FY1999/00, 63.6% of the water production occurred within this zone. The Walsh elevated tank and Serra ground storage tank function as gravity storage for this zone. Because of the difference in ground elevations the water surface elevation in Serra Tanks is the same as the water surface elevation in the Walsh Tank, which is also the approximate hydraulic grade line for Zone I.

Zone IA

Zone IA was created as a subsection of Zone I in 1997 to insure a constant supply of SFPUC (Hetch-Hetchy) water to certain industrial customers north of Bayshore freeway.

Zone II

Zone II extends over the southern section of the City. Zone II and Zone IIA comprises 20% of the area of the City. In FY1999/00, 19.3% of the water production occurred within this zone. The source of supply in this zone is nine wells located within the area and the excess water from Zone IIA. The pressure in this area is maintained by a slight overproduction in the zone with the excess water being released to Zone I.

Zone IIA

Zone IIA is located in the extreme southwest section of the City. This zone was created in 1968 to provide increased pressure in a portion of Zone II. Zone IIA is supplied water from one well, the Serra booster pumps and a connection to the Santa Clara Valley Water District. The source of water supply to this zone usually exceeds demand and the excess water is released to Zone II through regulating valves. In FY1999/00 17.1% of the water production occurred within this zone. In the event of an emergency, water can flow from Zone II to Zone IIA through these same relief valves.

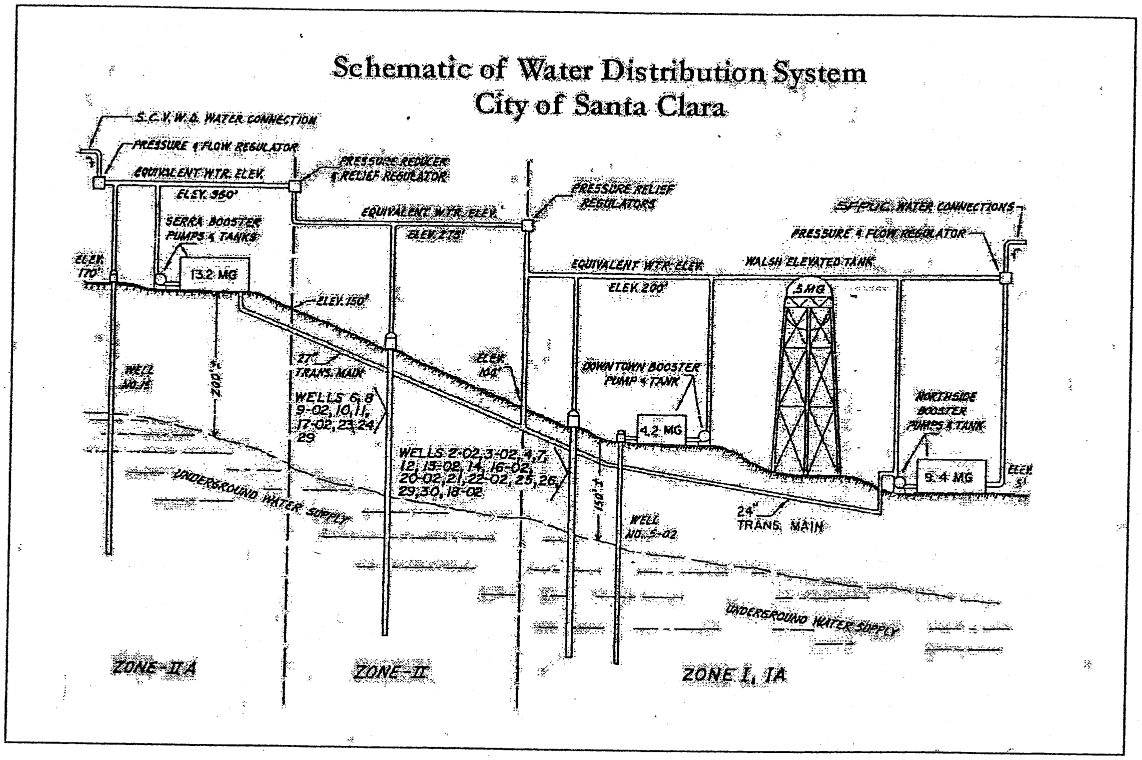

Figure 13

METERS AND SERVICES

The Santa Clara system is completely metered, including all fire service connections. The meters vary in size from 5/8-inch domestic meters to 12-inch industrial meters and are sized in accordance with plumbing code requirements. The meters are maintained according to a preventative maintenance schedule that specifies that meters under 1½ inches are calibrated every 16 years, 1½ and 2 inch meters are calibrated every 8 years, and meters larger than 2 inches are calibrated annually. Meters are replaced or repaired as necessary to insure accurate measurements.

Services sized for 3 inches and smaller are primarily copper with some plastic services. Services larger than three inches are installed with Ductile Iron Pipe (DIP) or Polyvinyl-Chloride (PVC) pipe.

Pressure Zones

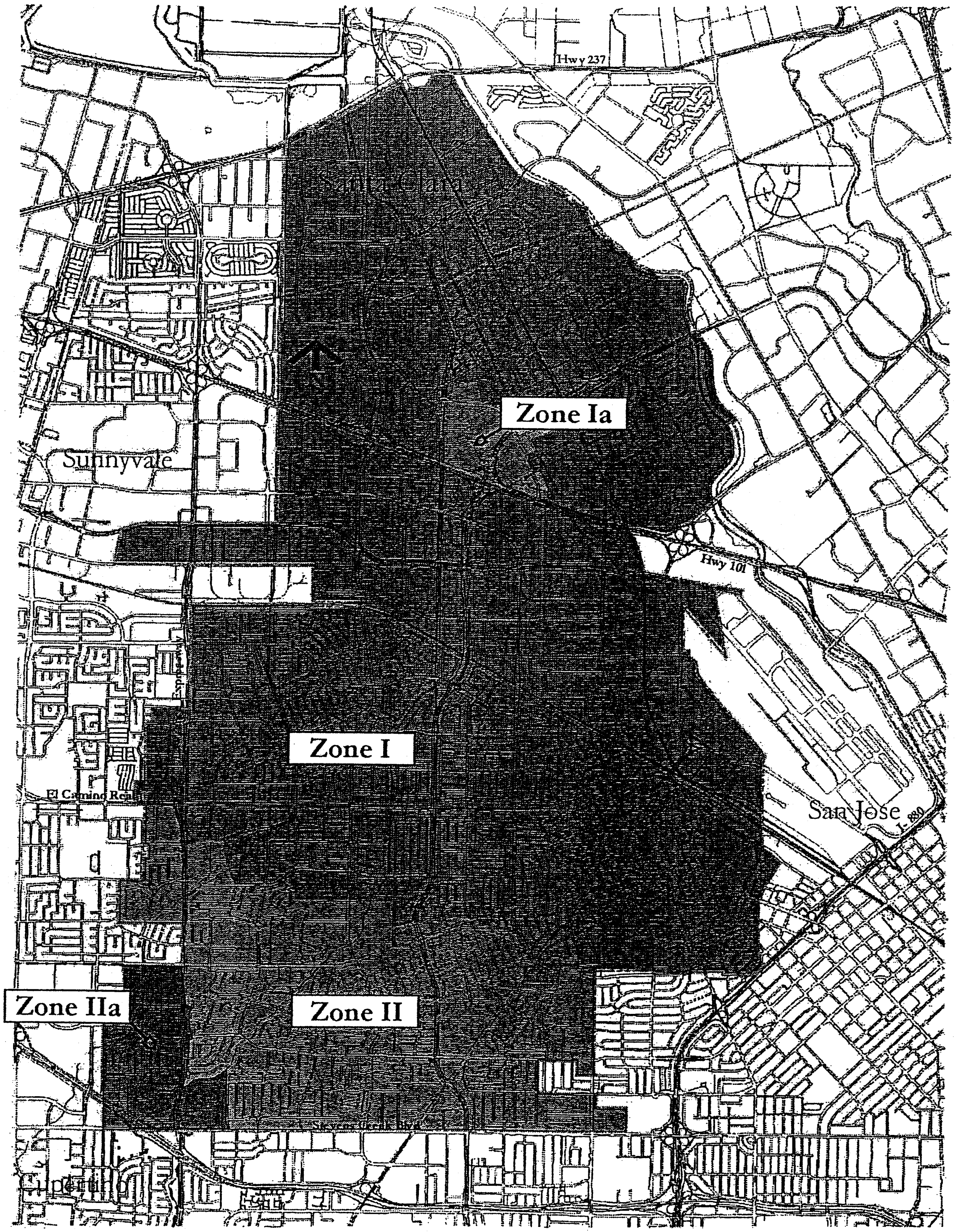

Figure 14

FIRE HYDRANTS

The City uses wet barrel type fire hydrants. The standard fire hydrant has one 2½ inch and a 4 inch pumper connections which have separate valves. In industrial and high-value commercial areas, fire hydrants have an additional 2½ inch outlet. Fire hydrant laterals are 6 inch and each hydrant lateral has its own gate valve.

PIPELINE MATERIALS

All pipeline materials are selected in accordance with American Water Works Association specifications for 150 psi services[16]. Mains within the City are primarily cast or ductile iron, asbestos cement, and plastic pipe with an estimated service life of 60 years or more. The ductile iron pipe installed since 1950 is cement lined to insure against internal corrosion and loss of flow capacity. The large transmission mains are cement lined and coated steel mains or ductile iron pipe.

The soil north of Central Expressway is potentially corrosive to metallic pipe. In this area, non-metallic pipes such as asbestos cement and PVC pipe are typically used to avoid failures due to excessive corrosion.

VALVES

Distribution valves are located throughout the system so that small sections of the system can be isolated for repairs. Valves are generally located at street intersections. The distance between valves is approximately 500 feet in high value areas and 800 feet in other areas. In addition, the valves are spaced so that no more than two hydrants are affected by the shut down of any particular pipe section.

RECYCLED WATER SYSTEM

At the time this report is being written the recycled water system is still a work in progress. Although portions of the system are in excess of 10 years old, construction of major transmission mains is still under way and new customers are connected to the system on a regular basis.

The recycled water distribution is similar in construction to the potable water distribution system. Several notable differences exist between the potable and recycled water systems. The recycled water system operates at an operating pressure up to 120 psi, has fewer inline valves for isolating portions of the system, and does not serve fire protection. Only portions of the recycled water system are looped to provide the capability of isolating small sections of the system while maintaining service to other customers.

PRESSURE ZONES/EXTENSIONS

Extensions and routes of the recycled distribution system were designed around potential large users of recycled water. These large users generally have large irrigated turf areas or industrial processes that are not water quality sensitive and require a large volume of water. Golf course and public parks are typical candidates for recycled water. Examples of typical industrial uses include paperboard manufacturing, cooling towers and toilet flushing.

[16] American Water Works Association Standards

PIPELINE MATERIALS

The distribution system pipes vary in diameter from 4-inch to 30-inch. The pipeline material includes PVC, ductile iron, and steel. Distribution mains between 16-inch and 30-inch in diameter are mortar lined and coated steel or ductile iron pipe. Distribution pipelines of 12-inch diameter and smaller are generally PVC with ductile iron fittings. All pipeline materials are specified to meet the AWWA standards for Class 150 or Class 200 pressure pipe. The recycled water pipelines are identified with warning tape and by their purple color, in the case of PVC, or with purple polyethylene vinyl wrap.

METERS AND SERVICES

The water meters on the recycled water system are similar to the meters used on the potable system. The primary difference is that recycled water meters have an identifying tag or purple meter cap to differentiate the recycled from the potable meters. The recycled water meters are calibrated on the same schedule as the meters for the potable water system. While SBWR owns the recycled water distribution system, the City owns and maintains all recycled water meters.

The typical service lateral for the recycled water system is 2 inch copper or 4 inch ductile iron pipe.

EXISTING SUPERVISORY CONTROL AND DATA ACQUISITION SYSTEM (SCADA)

The City's water system has utilized a SCADA system since 1964. The present third generation system was installed in 1988. This system was upgraded with new versions of Windows based software and PC hardware in 2001. The system currently consists of the following:

1. Two base stations with radios,
2. Remote Telemetry Units (RTUs) at each well, tank or booster pump site,
3. Radio transmitters/receivers at each RTU,
4. Four base-station host PC computers.

In addition to the 27 active wells, four storage tanks (three with booster-pump stations) and three imported water turn-outs, the SCADA system also monitors six sewer pump stations and 15 storm pump stations. Communication uses paired 900 meg-Hz radio frequencies, one for host to RTUs and one for RTUs to host.

CONTROL CENTER

The City of Santa Clara water and electric systems share a control center located at City's Utility Center. This control center is staffed 24 hours a day by operators who monitor the operations of the City's electric system, water and sewer systems, and the status of storm pump stations.

A second emergency base station with base radio and antenna is located in the building associated with one of the City wells. This site has an emergency generator and insulated "control room" and can act as the base to operate and monitor the City's SCADA system if there should be a problem with the Control Center. A separate monitor is located at the Water Department engineering office in City Hall. This is connected to the SCADA system and allows monitoring and possible operation of the water system from that location.

REMOTE STATIONS

Each remote station has an RTU and a 900 meg-Hz radio capable of monitoring and transmitting discreet inputs (DI), analog inputs (AI) and issuing discreet outputs (DO). The RTUs are also programmable to automatically retain data and operate the remote site as necessary in case of loss of radio communication with the base stations. All RTUs have battery back-up power to allow at least 8 hours of operation without external power supply.

SYSTEM CONTROLS

The water system is monitored and controlled either by the Water and Electric System Control Operators or by authorized water department personnel. The system also has multiple redundant automatic controls programmed to maintain water system pressures within set limits. Operation of the water system typically occurs in the following order of priority:

1. Pumps are controlled manually by means of the SCADA system from the control center.

2. Well pumps are controlled automatically by the "master" base station computer to start at minimum and stop at maximum pressures according to control logic programmed into the SCADA software. Five wells in pressure zone 1 are set to operate automatically according to the water surface levels at Serra Tanks (site for three 4 million-gallon tanks). Booster pumps that can provide water from storage tanks to the system as required, also have such automatic pressure settings.

3. Each RTU is programmed to start and stop each pump according to similar pressure settings for minimum and maximum pressures.

4. For added emergency backup in case of RTU failure, each site has electro-mechanical relays that can start and stop each well or booster pump within set pressure ranges.

5. Each well and booster pump also has an electro-mechanical relay for emergency high maximum pressure shut-off.

In addition to the operation of the pumps, the three imported water turnouts (two from Hetch-Hetchy and one from the District) all have valve operators, which allow for remote control of each valve's position. The water turbidity from San Francisco is monitored continuously and the base computer is programmed to immediately shut the valves from the two Hetch-Hetchy turnouts if the water the City receives does not meet water quality standards for turbidity.

SYSTEM DATA AND REPORTS

The base station computers maintain the history of certain data points such as production flows and system pressures. A daily report is generated and printed that indicates the production from each well and booster pump station, both for the day and cumulative for the month. Once each month the historical data is archived to tape and stored.

The federal Safe Drinking Water Act of 1974 (SDWA) and its subsequent amendments in 1986 and 1996 establish water quality standards for drinking water. The State of California has been delegated authority by the United States Environmental Protection Agency (USEPA) to implement and enforce the provisions of the SDWA. The California Department of Health Services, a division of the California Environmental Protection Agency, is the primary state agency for the dissemination and enforcement of drinking water regulations in the State of California.

The City conducts all water quality monitoring for the City's production wells and distribution system in compliance with a state-approved Water Quality Monitoring Plan. The Water Quality Monitoring Plan specifies the monitoring that is necessary to meet the requirements of federal and state law. This monitoring plan is reviewed annually and updated as needed. City staff performs sample collection activities specified in the monitoring plan and analysis for pH, chlorine residual, temperature, Phosphate and turbidity. All other sample analyses are performed by state-certified laboratories.

The City does not perform specific monitoring on the water purchased from the District or SFPUC Hetch-Hetchy. The District and SFPUC perform the required monitoring and provide the analytical results to the City.

An annual Water Quality Report, also known as the Consumer Confidence Report, is published and sent to all City water customers in June of each year. Information is included in the report about the range of water quality test results from all sources and how those results compare with State and Federal water quality requirements. Added information is provided about the significance of the reported test results and risks that may be associated consumption of the water for some people with compromised immune systems.

BACTERIOLOGICAL MONITORING

THE TOTAL COLIFORM RULE (TCR)

The TCR was promulgated by EPA on June 29, 1989. These regulations require public water systems to monitor for total coliform. Coliforms are a group of closely related bacteria that are generally found in water contaminated with pathogens associated with warm-blooded animals. Total coliform testing is used as a screening test for fecal coliform contamination.

The monitoring frequency required by the regulations is dependant on the number of people served by the water system. If positive results are found in the testing, the regulations contain requirements for re-testing. The regulations also set a maximum contaminant level (MCL) based on a percentage of positive coliform results. Acute violations of the MCL for coliform require immediate public notification.

The City has 33 established sample points within the water distribution system for coliform monitoring. Samples are collected at a minimum of once each week from each of the sample points.

CHLORINE RESIDUAL MONITORING

The presence or absence of chlorine residual is monitored weekly at each of the City's 33 sample points. City staff performs this analysis. Chlorine residual is expected to be present at certain stations (those with imported water) and absent at others (those with groundwater). Chlorine residuals are not expected in areas supplied by groundwater from City wells because the City does not typically chlorinate the well water. If the water should have a chlorine residual but does not, another sample is collected for a heterotrophic plate count of organisms in the water for additional water quality assureance.

GENERAL PHYSICAL STANDARDS AND MONITORING

The City is required to collect and analyze water samples for physical characteristics of the water. These include temperature, hardness, alkalinity, turbidity, pH color, odor and background radioactivity.

TURBIDITY

Turbidity is a measure of water clarity. The primary MCL for turbidity is 5 Nephelometric Turbidity Units (NTU) within the distribution system. Typical NTU values within the Santa Clara distribution system range from 0.06 NTU to 0.9 NTU depending on the prevailing water source at that time and location in the system.

TEMPERATURE

Water temperature within the distribution system ranges from 10^{o} C (SFPUC) to 22^{o} C for water from well 16-02, the warmest source.

COLOR AND ODOR

Color and odor are tested as indicators of possible problems within the distribution system. Taste and odor problems are rare and generally reported by the customers. In nearly all cases taste and odor problems are related to aging piping or other plumbing related problems within the customer's site.

ORGANIC CHEMICAL STANDARDS AND MONITORING

VOLATILE ORGANIC CHEMICALS (VOC)

The City monitors the groundwater supply for Volatile Organic Chemical (VOC) contamination once each year in the fourth quarter. The City is required to monitor for VOCs only once every three years, however the City has voluntarily maintained that an increased monitoring frequency due to the City's location in the Silicon Valley. Annual VOC monitoring has been performed since the early 1980s.

SYNTHETIC ORGANIC CHEMICALS (SOC)

The City is required to monitor the City wells for the presence of non-volatile Synthetic Organic Chemicals (SOCs) every three years. These chemicals are most commonly herbicides and pesticides that are or were readily available to consumers for residential, agricultural and industrial use. Chemicals such as dioxin, polychlorinated biphenyls (PCBs) and several widely used plasticizers are also included in the analysis. The list of SOCs for testing currently includes 33 regulated chemicals.

TRIHALOMETHANES (THMS)

Trihalomethanes are a family of organic chemicals that form when chlorine is added to water for disinfection during treatment. Chlorine combines with naturally occurring organic matter in the water to form bromoform, chloroform, dibromo-chloromethane and bromo-dichloromethane. The City monitors 14 sample points once each quarter for THMs.

INORGANIC CHEMICAL MONITORING

LEAD AND COPPER RULE

The Lead and Copper Rule was promulgated by USEPA on June 7, 1991. Under the Lead and Copper Rule, water systems are required to demonstrate that optimum corrosion control has been achieved and maintained. The monitoring required by this rule is different from all other sampling performed by the City. Samples must be collected from taps inside a number of customers' residences. At the request of the City, a number of customers have volunteered to collect the necessary samples. The monitoring consists of first flush samples, which are collected only after the households' water systems have each been unused for a minimum of 6 hours. The rule requires a program of sample collection every three years for water systems that have demonstrated optimum corrosion control.

NITRATE MONITORING

The City monitors the municipal wells for the presence of Nitrate and Nitrite. Trace amounts of both chemicals are expected to be present in well water since these materials occur in nature. However, nitrate contamination can also result from man-made sources such as nitrate based fertilizers, nitrate containing chemicals, and the breakdown of organic wastes.

The 1996 amendments to the Safe Drinking Water Act require annual monitoring of water sources for nitrate and nitrite concentrations. This monitoring is conducted at the same time as the annual monitoring of the municipal wells for VOCs. The current limits for nitrate and nitrite is 45 mg/L and 10 mg/L respectively.

RADIOLOGICAL MONITORING

The City also monitors the City wells for evidence of naturally occurring radioactivity, sometimes called background radioactivity. Samples are tested for the presence of gross alpha emitters and in some cases Radium 226. Radon is a naturally occurring slightly radioactive gas that can be present in soil and groundwater. Monitoring for Radon is not currently required, however water samples from several of the City's wells have been analyzed for Radon as regulations governing Radon are anticipated to be proposed in the next few years.

Radioactivity monitoring of the wells is required every four years. The monitoring consists of samples collected in four consecutive quarters. Compliance with current regulations is demonstrated by averaging the results for each groundwater source and comparing the average to the MCL. The MCL is 15 picocuries per liter (pCi/L). If a sample is over 5 pCi/L, a second analysis is performed for Radium 226.

SPECIAL SAMPLING AND MONITORING

Certain construction, repair, and maintenance activities require the collection of samples to ensure that the water quality has not been compromised as a result of the work being performed. Special sampling is an integral part of the state-approved Water Quality Monitoring Plan. The analytical results from this sampling are not required to be submitted to DHS. However, if the analysis indicates a potential or serious problem the DHS would be notified and kept informed of the City's progress in resolving the problem.

POTENTIAL FUTURE IMPACTS OF PROPOSED AND EXISTING REGULATIONS

GROUND WATER RULES (GWR)

The Ground Water Rules were proposed in the Federal Register on May 10, 2000. Originally referred to as the Ground Water Disinfection Rule, EPA changed the name of this regulation to more accurately reflect the regulation's emphasis on control measures other than disinfection. The regulation contains requirements for periodic sanitary surveys, hydrogeologic sensitivity assessments, and additional monitoring for viral and bacterial indicators. If other control measures are not effective in reducing or eliminating the risk of viral or bacterial contamination, disinfection may be required. The implementation of this regulation would, at a minimum, require that the City perform additional monitoring and studies. If disinfection is required the City would need to install chemical treatment and monitoring systems at each well site. The disinfection process would need to be designed to allow for sufficient contact time prior to delivering water the nearest customer on the system. This need for reaction time between the water and disinfectant may necessitate the installation of holding tanks at each well site. The chemical addition systems would require maintenance and chemical replenishment. In addition the level of disinfectant, either chlorine or chloramines, would require daily monitoring in order to insure appropriate process control. At present it is expected that the City will be able to continue to operate without disinfection of the City's groundwater supply.

DISINFECTION BYPRODUCTS RULE (DBPR)

The DBPR was originally proposed in the Federal Register on July 29, 1994. The DBPR is being implemented in stages. The first stage of the DBPR was promulgated in December of 1998.

When chlorine or chloramine comes into contact with trace amounts of organic material a reaction occurs forming trihalomethanes. The DBPR establishes a threshold for total organic carbons (TOC), establishes maximum contaminant level goals (MCLG) and maximum contaminant levels (MCLs) for disinfection by-products, and sets maximum residual disinfectant levels (MRDLs) for disinfectants. The systems subject to this rule must monitor and control the use of disinfectants and meet new requirements for total trihalomethanes (TTHMs) and the sum of 5 haloacetic acids (HAA5)

Compliance with this regulation would require increased monitoring and additional record keeping. The City currently is not currently subject to these regulations. However, the City will become subject to these regulations if the GWR is implemented and the City is required to disinfect the groundwater from the City wells. A groundwater system using chlorine or other chemical disinfectants must comply with Stage 1 DBPR by December 2003. In this instance, the City would be required to perform additional monitoring to demonstrate compliance. The sampling frequency appears to be once per quarter for TTHMs and HAA5 at each treatment point. Monitoring would have to be performed at the same time and place as monitoring for total coliform. Additional monitoring would be required if chlorine dioxide is selected as a disinfectant.[17]

PUBLIC HEALTH GOALS

Public Health Goals are the result of the California Safe Drinking Water Act Amendments of 1996, contained in the Calderon/Sher SB 1307, which became effective on January 1, 1997. The amendments were incorporated into the Health and Safety Code, Sections 116365 and 116470. The Office of Environmental Health Hazard Assessment (OEHHA) has adopted 27 Public Health Goals (PHGs) for drinking water. Public water systems serving more than 10,000 service connections must prepare a brief written report in plain language by July 1, 2001 and every three years thereafter to inform water consumers of anything detected in our water that exceeds the PHG. Furthermore, the regulation specifies that "a public hearing for the purpose of accepting and responding to public comment" shall be held. The regulation further requires that if a PHG has not been adopted for a currently regulated contaminant, the existing Maximum Contaminant Level Goal (MCLG) adopted by the U.S Environmental Protection Agency (USEPA) must be used.

PHGs, set by the OEHHA, which is part of Cal-EPA, are non-enforceable goals based solely on extremely small public health risk considerations. None of the practical risk assessment factors that are considered by the USEPA or the California Department of Health Services (DHS) in setting Maximum Contaminant Levels (MCLs), which are the enforceable drinking water standards, are considered in setting the PHGs. These other factors include the capabilities for analytical detection, available treatment technology, benefits and costs. The PHGs are not enforceable and are not required to be met by any public water system. MCLGs are the federal equivalent to PHGs.

All of the water quality data collected by the City in 1998 to 2000 for purposes of determining compliance with drinking water standards was considered. This data for each year is summarized in the City's annual Consumer Confidence Report (CCR) sent to all City utility customers in June. For the above time period, City of Santa Clara Water Utility has analytical evidence showing three constituents of the water supply that exceeded a PHG or MCLG. The regulations require a report to the public in the cases where PHGs and/or MCLGs are exceeded.

The City of Santa Clara complies with all health-based drinking water standards and MCLs required by the California Safe Drinking Water Act and Related Laws and as otherwise mandated by the USEPA. The City Council has voted to accept the staff recommendation to not provide treatment for the two constituents of the water supply for which treatment is available that do not meet the PHGs.

FLUORIDATION

In January 1997 regulations took effect that require that potable water systems with over 10,000 service connections install fluoride treatment with certain exceptions[18]. The exceptions require that sufficient funds be available for the capital, operations and maintenance costs from sources other than ratepayers, stockholders, bondholders, fees, or local taxpayers[19]. The funding must come from federal block grants or

[17] National Primary Drinking Water Regulations: Groundwater Rule, Proposed rules, Federal Register Vol. 65, No. 91, Wednesday May 10, 2000

[18] AB733 Speier (1996)

[19] California Health and Safety Code Sections 116410 and 116415

private foundations. The regulations required that by July 1, 1996 the City supply an estimate of the capital, operations and maintenance costs from which the State created a priority ranking based on lowest capital cost per connections. The State uses the priority ranking to decide which projects to fund, as funds are available. The City has met the requirements for the exception and therefore the City has no immediate plans to install facilities to add fluoride to the water systems.

The addition of fluoride to the City's potable water system would require the installation of chemical holding tanks, metering equipment, and monitoring equipment at each of the City's 27 production wells. In 1996 the City estimated the cost of these installations to be approximately $2 million dollars, or approximately $81 per service connection. These cost estimates resulted in the City being ranked 140th out of 167 effected utilities by DHS. Therefore, DHS must fund 139 fluoridation projects before funding modifications for fluoridation in Santa Clara. The equipment at each well would require maintenance and chemical replenishment on a regular basis.

The estimated costs for the City to install fluoride addition to the potable water system are:

1. Capital Cost: $2,300,000

2. Operation and Maintenance Costs: $250,000 per year.

The City may be required to install the necessary infrastructure to fluoridate the potable water within the City if the State acquires sufficient funds to install all the projects that rank higher than the City of Santa Clara. However, the City Council passed a resolution stating that the City will not seek to accelerate the implementation schedule for fluoridation. Hetch-Hetchy SFPUC and the District may add fluoride in the future. Fluoride addition is more cost effective (as a cost per unit of water) for the District and SFPUC, since fluoride can be added at a single point whereas the City would have to install and maintain 27 systems dispersed over a geographic area encompassing 19.3 square miles. If the SFPUC and District both elect to add fluoride, the water delivered to the northerly and southerly portions of the City would contain fluoride. Figure 9 shows the areas of the City that receive water from these sources.

INTRODUCTION AND BACKGROUND

The City of Santa Clara has developed a computer model to perform a hydraulic network analysis of the water distribution system. The primary purpose of this task is to evaluate the distribution system's ability to convey water to the customers within the City at the projected increased future demands. The year 2010 was defined as the planning horizon for evaluating mid-term improvements based on customer water use projections. The second purpose of this task is to evaluate the potential distribution system impacts of the projected increases in demand and potential impacts of either short or long term loss of the City's imported water sources (SFWD Hetch-Hetchy, District's West Valley Pipeline).

HYDRAULIC MODEL DEVELOPMENT

The year 2002 City water distribution computer model represents a fourth significant revision in hydraulic modeling since 1981. The H2ONET modeling software was selected for its compatibility with GIS and AutoCAD software; it utilizes the latest modified hybrid method which is an improved algorithm based on the Environmental Protection Agency's EPANET hydraulic modeling application.

The hydraulic model imported significant data from the City's existing Hansen database and AutoCAD files including; pipes, pump stations, groundwater wells, import connections (SFWD and District), pressure reducing valves, and system isolation valves. City water demands were developed and refined using historic water use data from 1987 to 2002. In addition, billing records from the City's top ten users, which constitute greater than 10% of the City's total water demand, were imported individually into the model.

Once the computer model of the physical system was developed, the model was calibrated using the real-life operational information from the City's SCADA telemetry. The water system's operators reviewed the model and provided the refined SCADA control logic to emulate actual system control parameters. Calibration included detailed extended periods of simulation data. During the calibrations, the water system demand curves, Hazen Williams friction coefficients for pipelines, pump stations and well productions were adjusted to further fine tune the model. Calibration is achieved once the pressures in the system, as well as the pump flow rates, reasonably approximate the SCADA data. The hydraulic model was used to perform over two hundred fire-flow simulations. These were compared to actual historical field test fire-flow results.

HYDRAULIC ANALYSIS

After calibration, the hydraulic model was used to assess the current operation of the distribution system, and the impact of future water usage in the year 2010. The hydraulic model was run to provide a comprehensive understanding of the existing system and to determine any operational limitations. This allows a general overview of the water system with which to compare future demand projections. Projected water demands were distributed in the model throughout the system based on land use and analyzed under different operating scenarios: average day demand, maximum day demand plus fire flow requirements and a peak hour demand. Table 6 summarizes the water system demands under current and future projected 2010 demands.

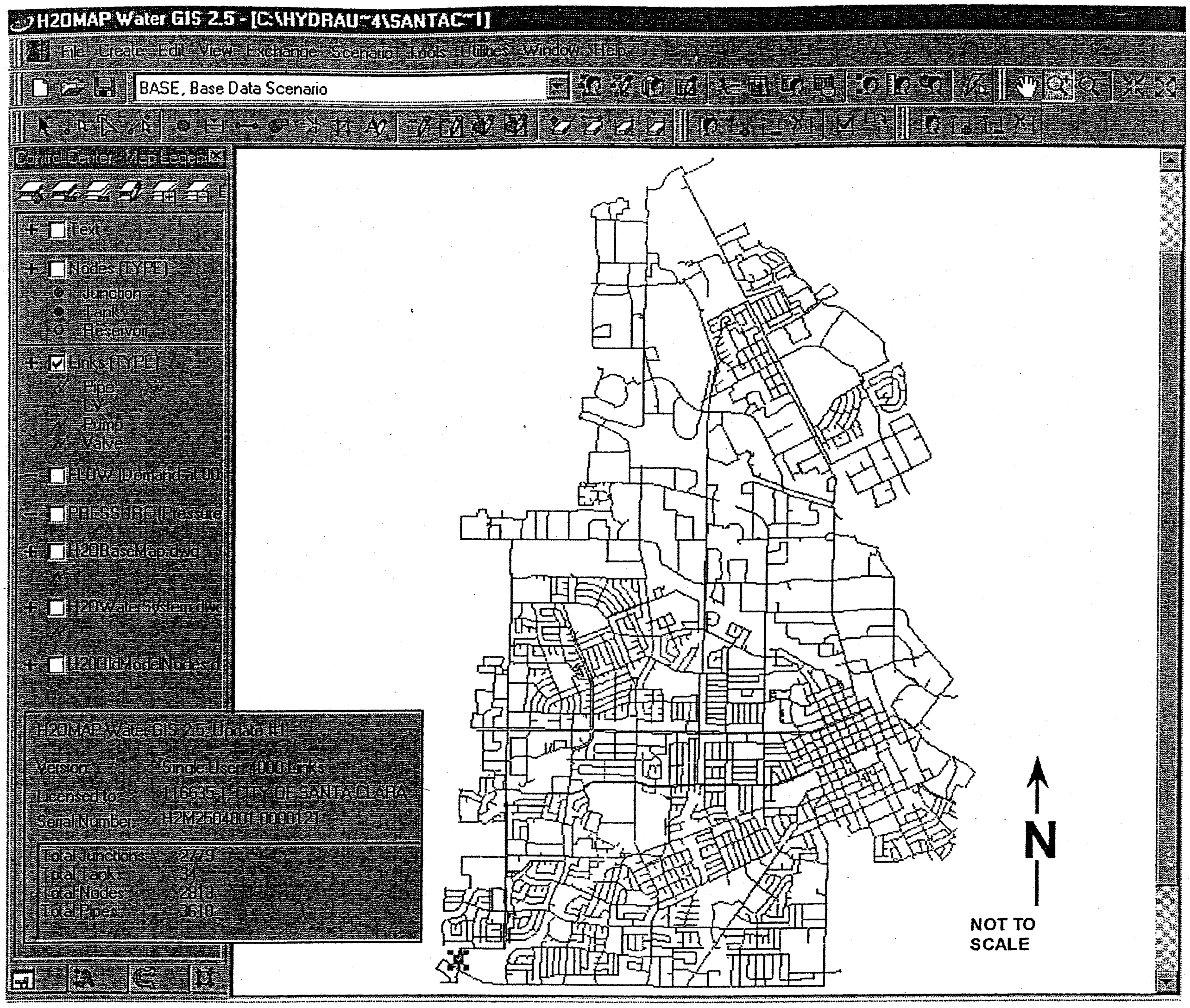

Figure 15

Hydraulic Model Demand Parameters

Table 6

Model Time Period	Key Infrastructure	Average Day Demand	Maximum Day Demand	Maximum Day Demand with Fire Flow	Peak Hour Demand
2002	New Crossing of Hwy 101	23.7	35.5	40.5	42.6
2010	Two New Wells	28.7	43.0	48.0	51.6

Under both the average day and maximum day demand projections for 2010, the water system pressures remain stable in all pressure zones because the imported water sources are typically used to provide a base-load supply throughout the year (see Figure 16). Groundwater wells are controlled to automatically supply the additional pressures and flow to meet the City demand and to mitigate any short-term reduction or loss of any of the imported supplies.

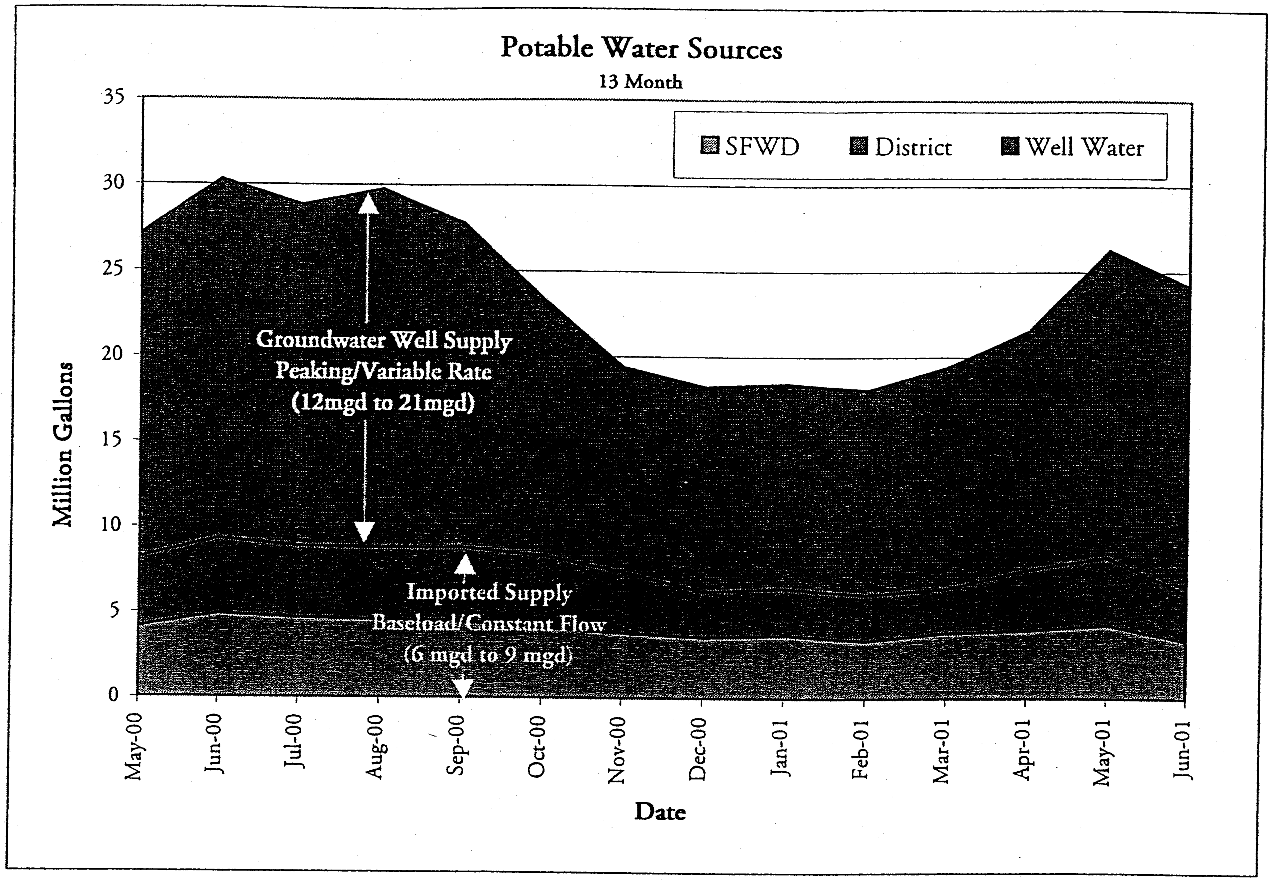

Figure 16

In general, the hydraulic network analysis confirms the City's water system operational flexibility based on widely distributed water supply sources, and water system transmission and distribution system redundancy. The architecture of the water system (production, transmission and storage capacity) is robust and can meet projected 2010 demands. While the 2010 demands are similar to the historic peak demand from 1985, the future demands are projected to be more geographically uniformly distributed (i.e., less intensive with respect to certain major industrial users).

The existing system has large diameter transmission pipelines connected to the storage facilities. This provides the City with the flexibility to supply water from either groundwater or imported water. The zone valves between pressure zones also allow for water supply and pressure to be maintained fairly evenly throughout the City during peak demands or during any emergency. Significant effort was allocated to reviewing impacts to the water system during emergency conditions and atypical water situations such as those experienced during the 1989 Loma Prieta earthquake and the statewide energy crisis in the summer of 2001.

WATER USE PROJECTIONS

Combining the projected water use for each user category (Figure 17) results in a total projected water demand of 11,125 MG by 2010 and 12,414 MG/year by 2020 (Figure 18). These figures equate to an average daily demand 31 MG/day in 2010 and 34 MG/day in 2020.

IMPACT DUE TO LOSS OF SFWD OR DISTRICT IMPORTED WATER SUPPLY

The water system control architecture will also allow for the temporary loss of an imported water supply by the expedient of pumping groundwater. The long-term loss of either imported supply would, however, probably result in over-draft of the groundwater basin. The water system can accommodate the increase use of groundwater through the increased operation of storage tanks and their associated booster pumps during periods of high water demand. This mode of operation would also place more demands on the pumping equipment while leaving the system more vulnerable to equipment failure.

The loss of SFWD Hetch-Hetchy supply would eliminate the single-source supply of water to Zone 1A industrial customers. This loss can be only temporarily replaced with well water; long-term replacement would require a new connection and a new agreement with the District. The District connections would need to be modified and automated to allow a direct supply of District water into the transmission main to serve Zone 1. The two new production wells (Wells 32 and 33) planned for the Agnews area would also be critical in replacing the potential loss of SFWD supply.

The temporary loss of District imported supply could be replace in the short term by a combination of increased well production of groundwater and an increase in SFWD supply (within contract limits). The areas of the City served by this District connection could be served via the existing booster pumps at Serra Tanks that have back-up power supplied by a diesel-powered generator. Some additional optimization of Zone 2 and Zone 2A zone valves would be required to mitigate an extended loss of District supply.

RECOMMENDATIONS

The City of Santa Clara water distribution system has been shown to be very robust in its ability to meet all demands for the peak day and peak hour, for now and for the future expected demands. Fire flow analysis for certain sections of the City indicate minor improvements in system piping would greatly improve pressures that would be available for fighting a major fire. The loss of SFWD (Hetch-Hetchy) water can be accommodated with the existing system for short-term loss including a potential 3 to 4 month outage that is expected from a major earthquake.

The long-term replacement of SFWD supply would require an additional connection to the District's distribution system and an agreement with the District to provide additional supplies of treated water to the City of Santa Clara.

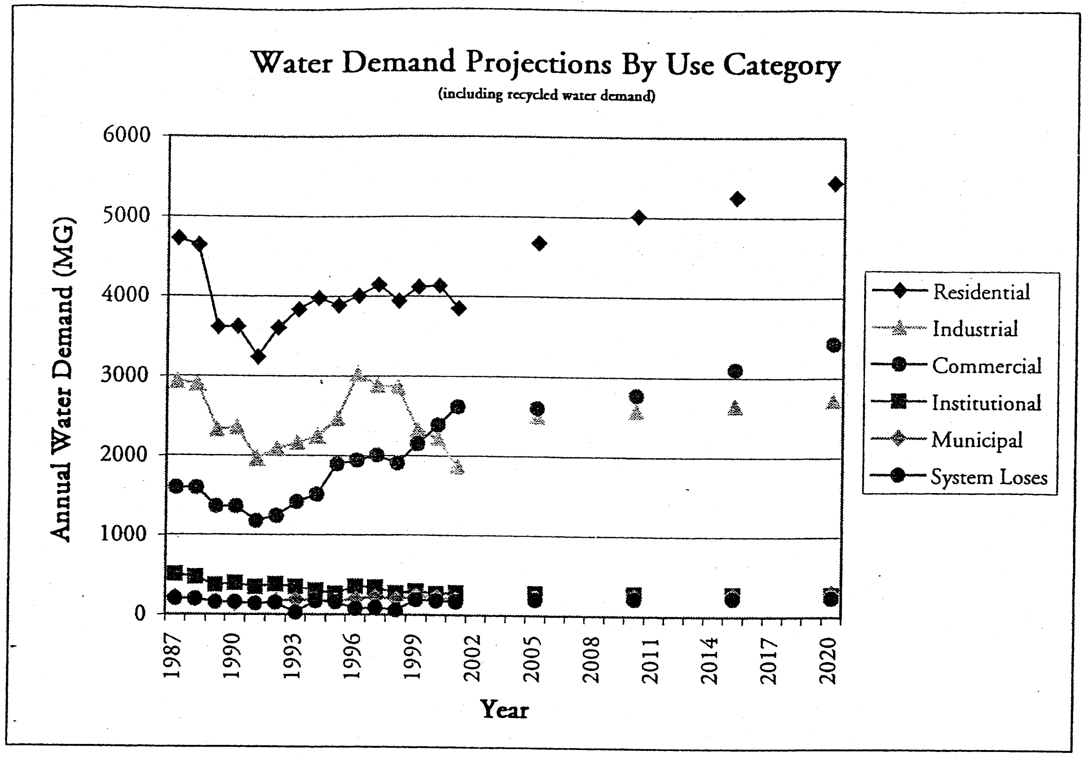

Figure 17

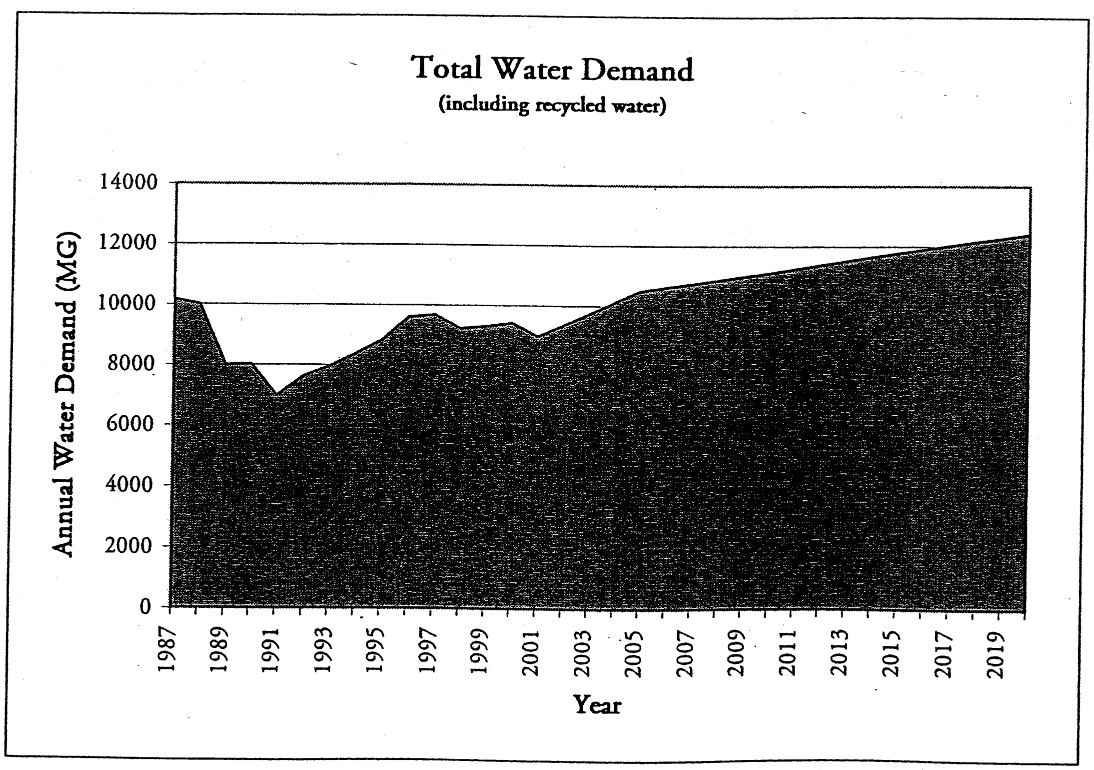

Figure 18

SOURCES OF SUPPLY

GROUNDWATER

Proposed wells

Two new wells are proposed to be constructed as a part of the development of the surplus State of California property at the old Agnews State Hospital site. Both wells are currently being planned with an expected completion date of the spring of 2003. These two wells will greatly enhance the system supply reliability for the northerly portions of the City; that is, those areas now served by SFWD.

No additional new wells are proposed at this time. The City of Santa Clara has sufficient well production capacity to meet all water demands of the City for peak day without utilization of imported supplies. However, long-term use of only groundwater cannot be sustained without over-draft of the groundwater basin. Still, some of the future expected demand will be supplied by groundwater. As is stated below in *Alternatives to San Francisco Water Department Water* the best quality water immediately available to the City of Santa Clara is the groundwater supply. The Santa Clara Valley groundwater basin is currently enjoying near record high water levels. The firm yield from this basin is not known exactly and is, in any case, dependent on the continued successful operation of the SCVWD's groundwater recharge program. While the firm yield is not known it is certain that there is a limit to how much of the City's long-term water demand that can be supplied from the basin. It is also apparent that the City's groundwater utilization can be increased above the current use. The projections of future demands include an assumption that the ground water supply for the City is limited to approximately 8,000 MG per year.

Well Rehabilitation

Well 19 is scheduled for a study on the possibility of a rehabilitation project to reduce or eliminate high manganese content in the water produced from this well. The proposed study will attempt to identify the particular aquifer as the source of the high manganese to be followed by a sealing-off of the aquifer. If the manganese can be successfully reduced to acceptable levels, this well would need to be re-certified as an approved public potable water supply. This is another groundwater supply that could potentially be utilized to help replace any loss of SFWD supplies.

IMPORTED WATER

Santa Clara Valley Water District (SCVWD)

The SCVWD operates three water treatment plants (WTP) within the county. The City of Santa Clara receives treated water from the Rinconada WTP by way of the West transmission pipeline. Each year some additional water has been made available from the SCVWD beyond the City's contractual obligation to take treated water, usually during the off-season (non-summer). Future increases in the imported SCVWD supply would require modification to or installation of an added connection the City's connection to the SCVWD supply pipeline and would require negotiation for added contract quantities.

San Francisco Water Department (SFWD)

The SFWD supply is limited by the capacity of the Hetch-Hetchy system for both conveyance and for availability of water. Any increase in the City of Santa Clara's "contract" amount will require SFWD to construct additional facilities and, in the future, obtain added water resources.[20] Further discussion of this issue is contained in the section below titled "Alternatives to San Francisco Water Department Water".

RECYCLED WATER

Current projections indicate that recycled water usage will increase to approximately 2000 acre-feet per year (652 MG) by 2010. If recycled water usage reaches this level it will still account for less than 8% of the total water usage within the City. However, recycled water usage occurs primarily during the summer months when demand is the highest. In this way the use of recycled water reduces the peaking factors for summer demand (mostly for irrigation) and thereby improves the emergency water storage reliability for the whole City.

ALTERNATIVES TO SAN FRANCISCO WATER DEPARTMENT WATER

As was discussed above, the San Francisco Water Department (SFWD) supply is subject to many uncertainties in both supply and costs. During the coming ten years the City of Santa Clara will likely be faced with decisions regarding the continued use of SFWD water supplies. The current contract with San Francisco must be renewed by 2009 (along with the contracts for 28 other suburban water agencies). Over the same time period SFWD plans to fund and construct more than $2 billion in improvements for system reliability and conveyance capacity. When completed, the cost of these projects will be added to the basis for SFWD wholesale water rates. These projects alone will require a 300% increase in wholesale rates. The resulting wholesale rate would be in excess of $1000 per AF. The need for additional supplies for growth in demand by all agencies and for added commitments to meet the needs of "interruptible" customers[21] could add other costs (the price of additional water from somewhere in the State) for an even higher wholesale rate. Since SFWD is about 15% of the City's total supply, a result of this scenario could be the City retailing SFWD supplies for less than what is paid for the water at the wholesale rate. The alternatives to this situation are as follows:

- Establishment of a separate rate for Hetch-Hetchy service: The City's distribution system now includes a partial containment of the SFWD supply. It is possible that the SFWD supply could be more fully contained to insure delivery to a limited segment of the water distribution system. These selected customers could then have a rate commensurate with the wholesale cost (a pass-through of the wholesale rate). Those industries within the SFWD area would be asked if they support such pricing to insure continued access to SFWD water.

- Increased groundwater utilization as partial or complete replacement: The best quality water immediately available to the City of Santa Clara is the groundwater supply. The Santa Clara Valley groundwater basin is currently enjoying near record high water levels. The firm yield from this basin is not known exactly and is in any case dependent on the continued successful operation of the District's groundwater recharge program. While the firm yield is not known it is certain that there is

[20] SFWD Water Supply Master Plan, January 2001.

[21] Currently Santa Clara and San Jose receive SFWD supply out of "extra" water available in the Hetch Hetchy as interruptible customers of SFWD.

a limit to how much of the City's long-term water demand that can be supplied from the basin. It is also apparent that the City's groundwater utilization can be increased above the current use. The scenario used in Figure 19 assumes a limit on the groundwater basin for the City at 8,000 MG per year (beyond which there is a potential over-draft) and the loss of SFWD would be supplied from District treated water.

- Increase District utilization: Any possibility of an increase in the contract supply of treated water will be subject to the District's ability to obtain additional supplies from sources outside of the Santa Clara Valley. Such supplies may be obtainable but that possibility will be better illuminated after the District completes its update of their Integrated Water Resource Plan (Figure 20).

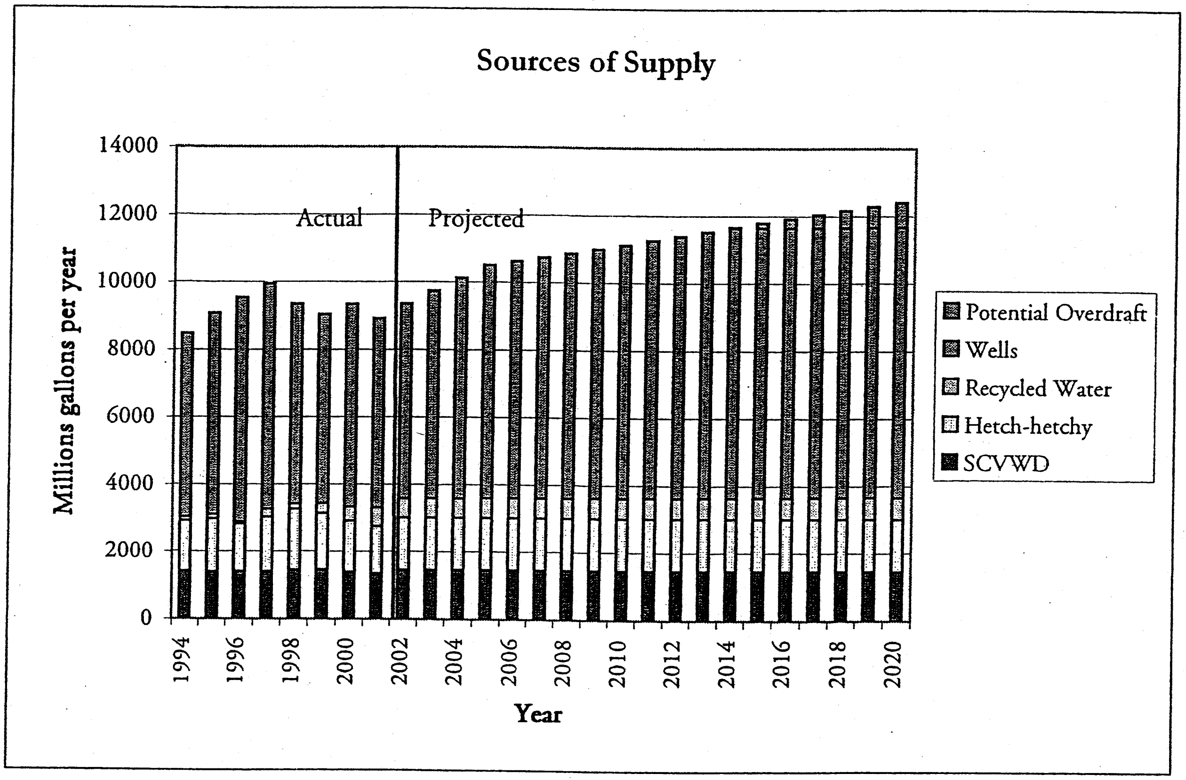

Figure 19

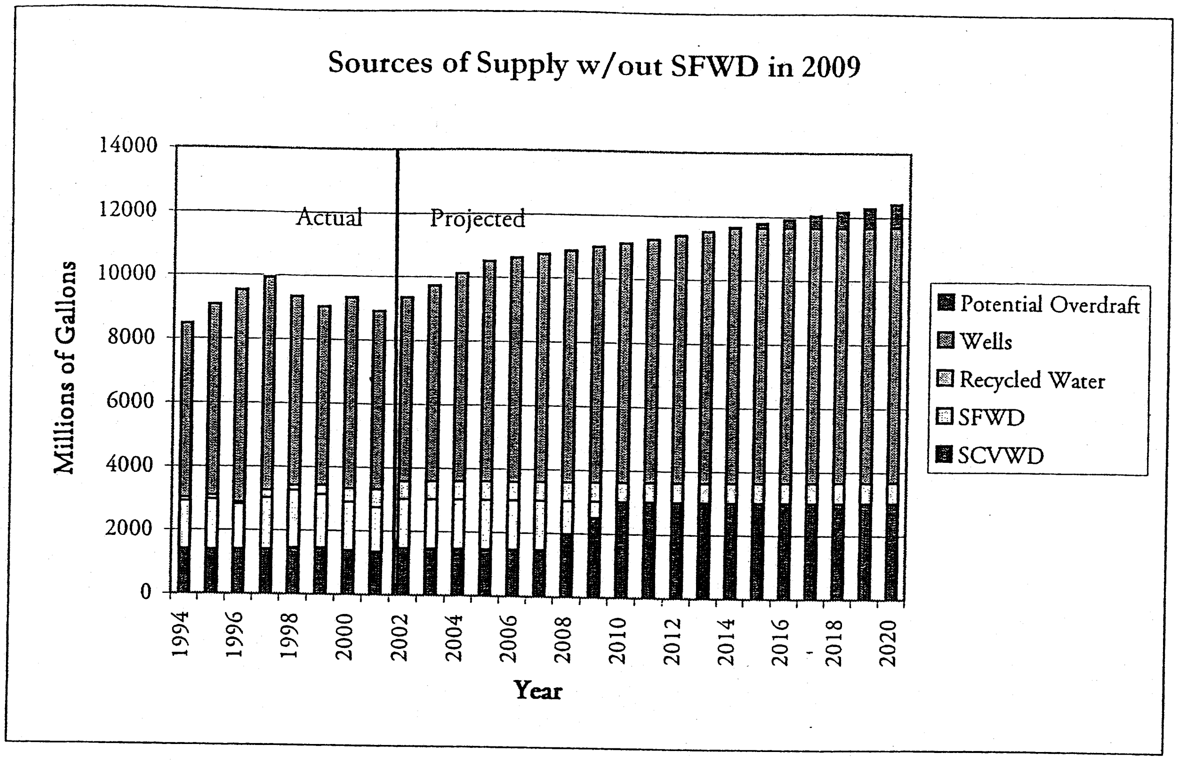

Figure 20

STORAGE

Walsh Avenue elevated tank replacement

The Walsh Avenue storage tank is the only elevated tank within the water distribution system. This tank was constructed in 1965 under less stringent seismic standards than are currently used. This storage tank will be removed from service in FY 2002-03 and replaced with a similar sized tank constructed to meet current seismic standards.

STRATEGIC INFRASTRUCTURE REPLACEMENT PLAN

A recent study completed by the American Water Works Association (AWWA) cites infrastructure replacement and repair as a critical issue for water utilities. The water distribution infrastructure across the nation is approaching the end of its expected service life. AWWA estimates that $250 billion will need to be spent nationally on replacing or repairing infrastructure in the next 30 years. According to the study, by 2030 the average water utility will have to spend three and one half times as much on pipe replacement and three times as much on repairs as it spends today. In the 20 utilities in the AWWA study the costs ranged from $550 to $2,300 per household in larger utilities and $1,100 to $6,900 per household in smaller systems over 30 years. This estimate does not include expenditures for future water quality related modifications to the water distribution system, future increases in wholesale rates or costs associated with obtaining additional new supplies. This increase in spending is attributable to portions of the water distribution system reaching the end of its service life.[22].

Water distribution infrastructure is hidden, buried and easily taken for granted. Water distribution systems have been in place for decades without the need for systematic replacement. Water utilities have become accustom to a level of expenditure that is commensurate with new infrastructure. This situation is analogous to owning a new car. A new car owner anticipates routine maintenance expenses but does not expect or budget for major repairs or complete replacement of the car. However as the car ages maintenance cost will increase and eventually it will become cost effective or a necessity to replace the car.

The range of life expectancies also contributes to the tendency to delay replacement. For example cast iron pipe manufactured in the 1880s has an average service life of 120 years but may fail in 90 years or last to 150 years in age. With such a broad range of anticipated service life, scheduling replacement for a particular year is difficult and the temptation to delay replacement is great. It is not cost effective or fiscally responsible to replace a par of the distribution system that may have 20 or 30 years of remaining useful life. The issue of infrastructure replacement is further complicated by the differing useful lives of the different materials and components within the distribution system. The study also found that the date that pipe was manufactured also effected the expected service life of the pipe. Cast iron pipes made in the 1920s and 1950s have shorter average service life, 100 and 75 years respectively, than the pipe manufactured earlier. The date of manufacture is only one factor that must be considered in estimating service life. Soil conditions and water quality also affect the service life of pipe.

The City of Santa Clara's water distribution system is also continuing to age. The majority of the water distribution system was installed in the 1950s and 1960s. An analysis of the water distribution system age is contained in Appendix C. All the components of the distribution have a finite anticipated service life. Although much of the system may exceed the anticipated service life, this is not a factor to be relied upon. Under current annual expenditure levels, the effective replacement of the entire system would occur within approximately 300 years. Since the typical life expectancy of a water distribution system's components varies from between 75 to 120 years and much of the infrastructure has been in place for more than 40 years, the current rate of replacement is not sufficient to maintain the high degree of reliability that the City's customers have come to expect. However, it is fiscally impractical to immediately increase infrastructure spending to a level where the 75 to 120 year replacement would be accomplished. A systematic approach is necessary given the broad range of service life that can be expected from the various components. A Strategic Infrastructure Replacement Plan will be developed in the near future to present a prudent means to prioritize and plan expenditures to effectively maintain the water distribution infrastructure. The intent is to develop a plan to replace only those portions of the water distribution system that highest and most immediate need.

The development of the Strategic Infrastructure Replacement Plan will include:

- an assessment of the current condition of the various components of the water distribution system,
- review of maintenance records,
- field surveys,
- record searches,
- development of a systematic method for prioritizing upgrades and replacements of system components,
- creation of an infrastructure database,

[22] Reinvesting in Drinking Water Infrastructure, Dawn of the Replacement Era, American Water Works Association, May 2001.

- establishment of a project ranking and rating system,
- development of cost projections for identified high priority projects.

Once the Strategic Infrastructure Replacement Plan is prepared and adopted, projects will be proposed for the capital budget, and with approval, designed and constructed. The funding of these projects will result in increased expenditures for main replacements and repairs. The fiscal impact on the City's water rates will be determined as a part of the Strategic Infrastructure Replacement Plan.

PROJECTED FUTURE EXPENDITURES

Based on analysis of expected wholesale costs of water, system operations and maintenance budgets, costs for overhead and expected infrastructure replacement, it is possible to estimate the projected annual expenditures for the water utility. A ten-year projection of expenditures is shown in Figure 21. Due to the level of uncertainty relating to projected industrial water demand, and other factors explained elsewhere in this report, extrapolating past the 10 year timeframe presented here would not yield reliable information. The information presented here is shown for informational and broad planning purposes and will necessarily be adjusted annually based on current information, as it becomes available. This information does not represent a formal budget nor does it commit the City to a particular level of expenditure.

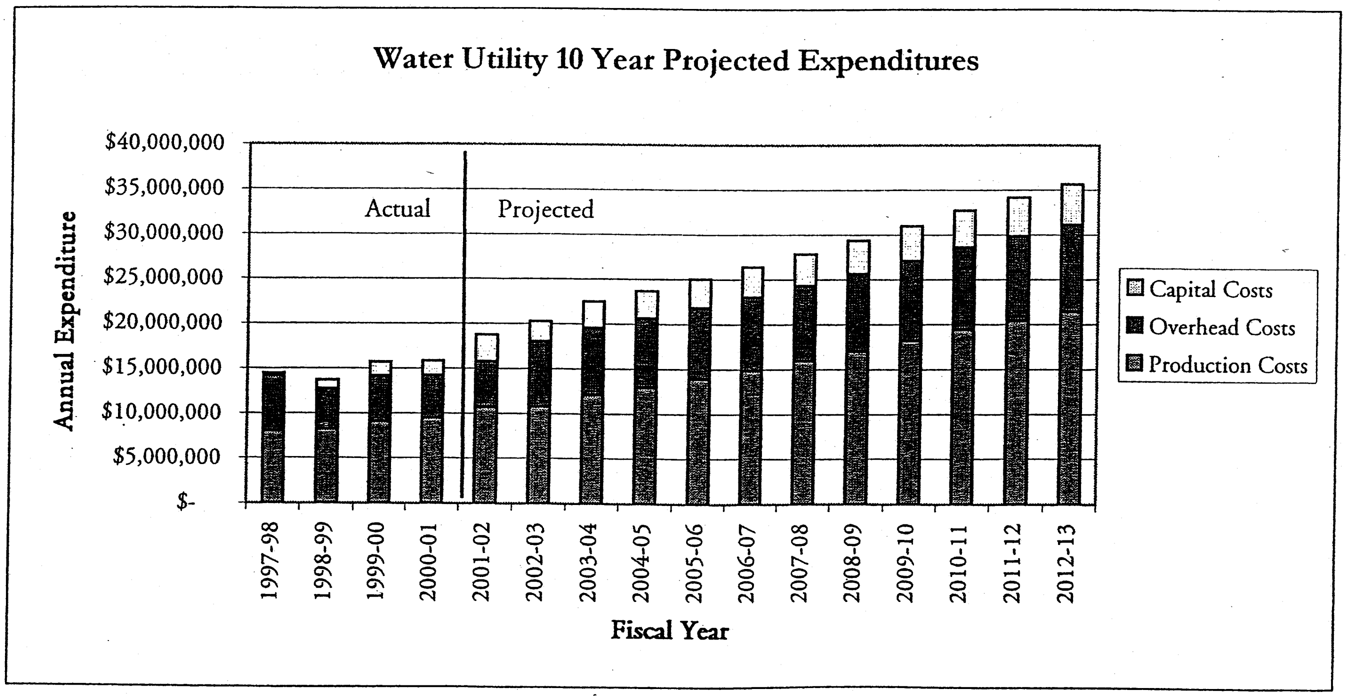

Figure 21

SUMMMARY

The City of Santa Clara water utility has access to sufficient resources from three sources of potable water, in addition to the recycled water supply, to insure adequate quantities for all foreseeable needs through 2020. The future growth is projected to require 1½ % average annual increase in supply. This rate of increase is based on likely projections of population growth, however, a large portion of the City's water needs are for industry and the projections for this sector are subject to variations in demand due to changes in economy and changes in manufacturing processes. With our conservative estimates of future demand, the City's water supply and water distribution system will be adequate for all needs except in times of drought or during a water supply emergency as might be caused by an earthquake.

The portion of the City's supply provided by San Francisco Water Department (SFWD) has its own uncertainties. A report on SFWD system reliability indicates that a major earthquake could severely curtail or cease delivery of SFWD water for 2 to 3 months. The City's current contract with San Francisco allows for cancellation of water delivery with a one-year notice. Although this "interruptible supply" provision is unlikely to be used, the negotiation and renewal of the City's contract by 2009 may be contingent on SFWD's ability to obtain additional water supplies (at a presumably higher cost). The costs for future reliability improvements by SFWD will also be added to the wholesale rate for water. Within ten to fifteen years the wholesale rates for SFWD water will likely be at least 3 times the current rate of $405 per acre-foot.

Uncertainties also exist in the future requirements for water treatment and future limits on water quality. Regulatory changes imposed for future water quality could greatly increase costs of water for all users. Specific cost projections cannot be made without knowledge of future regulatory requirements for water treatment.

One assured future cost is to fund the replacement of the water system's aging infrastructure. Costs for replacement of pipes, pumps, storage tanks and booster pumps will need to be paid by increasing retail water rates. The capital expenditures will need to be increased over the next ten years from the current $3 million to $5 million per year to an estimated $10 to $15 million per year in order to meet the expected replacement needs. A Strategic Infrastructure Replacement Plan will be developed in the near future to present a prudent means to prioritize and plan expenditures to effectively maintain the water distribution infrastructure

The combined needs for added water supply, higher wholesale rates, mandated water treatment improvements and infrastructure replacement would force a series of annual increases in the retail water rates for the City of Santa Clara. Current estimates are that these increases will need to be 8% to 10% each year for the next 3 to 4 years. Since other water utilities in California all face similar issues, it is expected that the City of Santa Clara will continue to enjoy lower water rates than other communities in the Bay area. With proper funding for these combined needs and investments the City of Santa Clara will continue to be able to provide an assured supply of high quality water for all residential and industrial customers.

APPENDIX A SEASONAL VARIATIONS FOR EACH USER CATEGORY

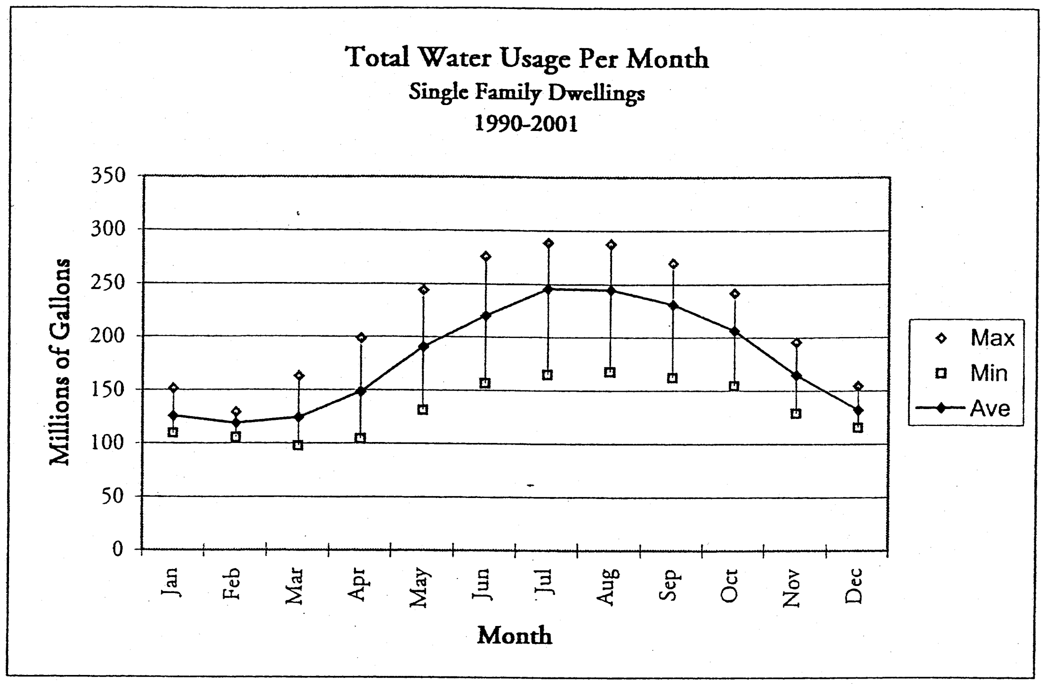

Figure 22

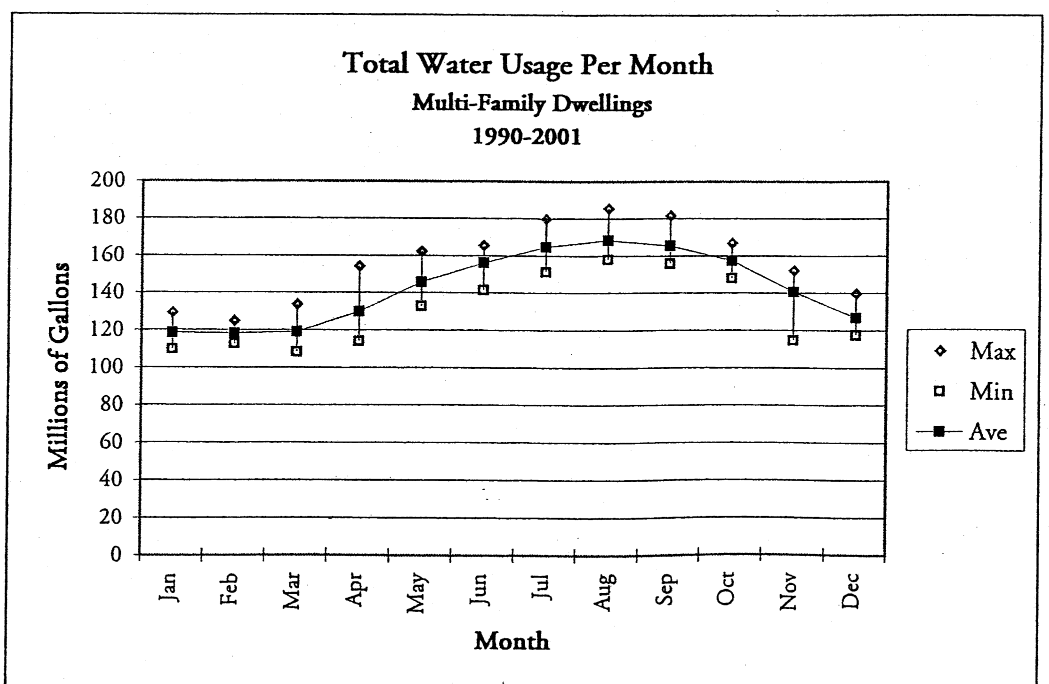

Figure 23

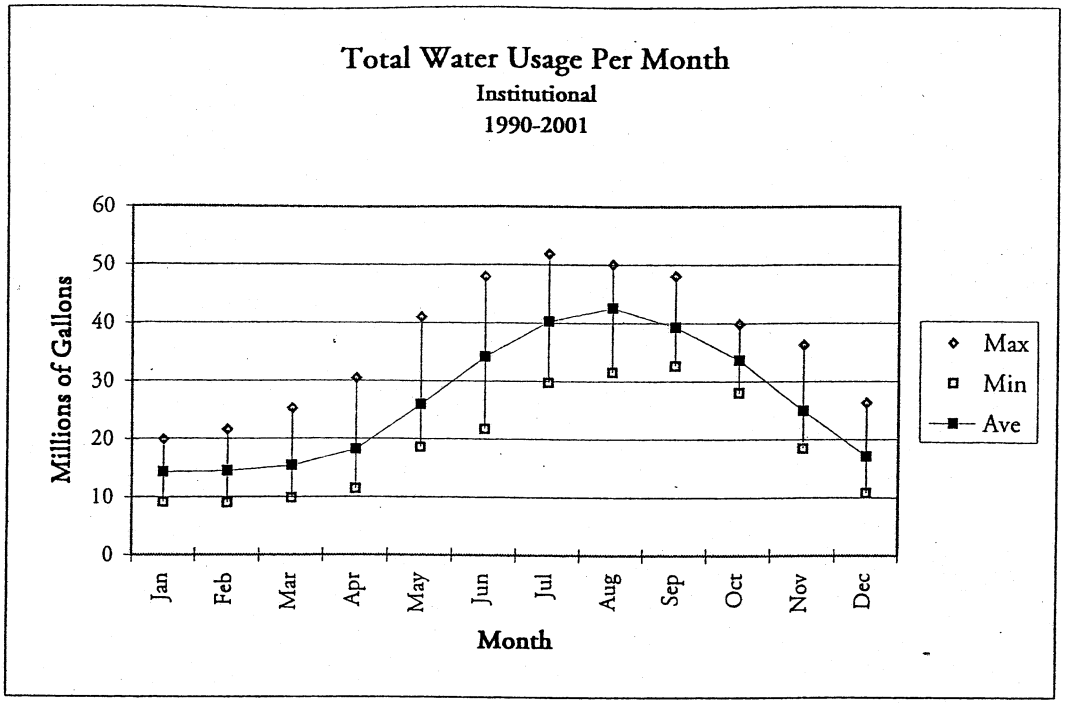

Figure 24

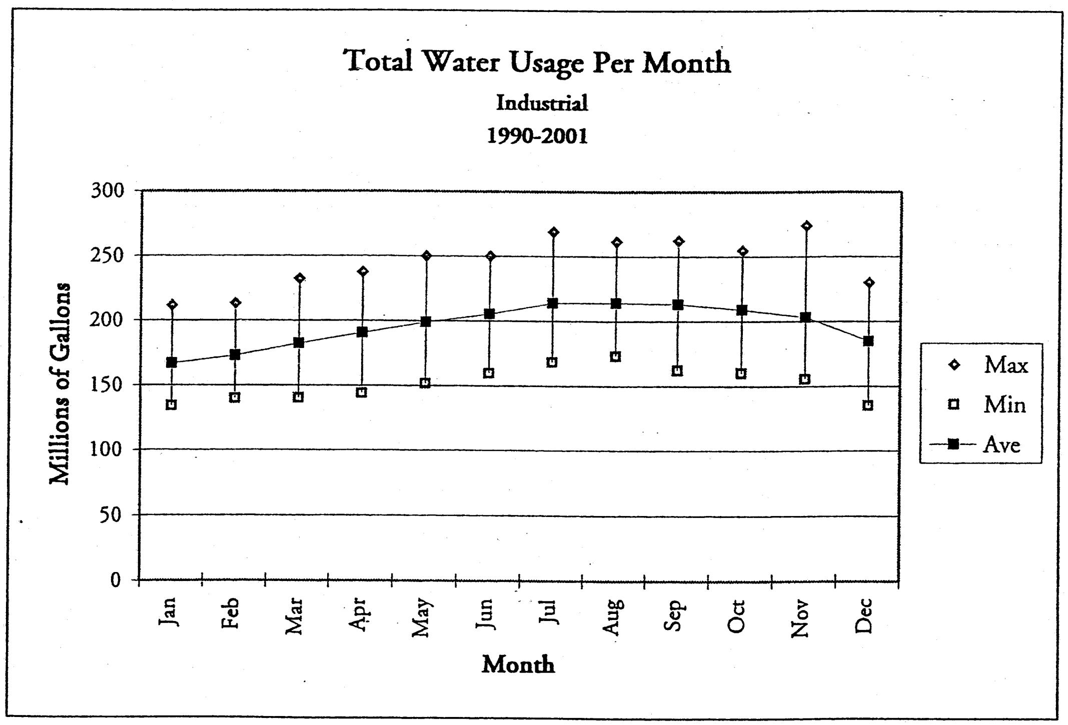

Figure 25

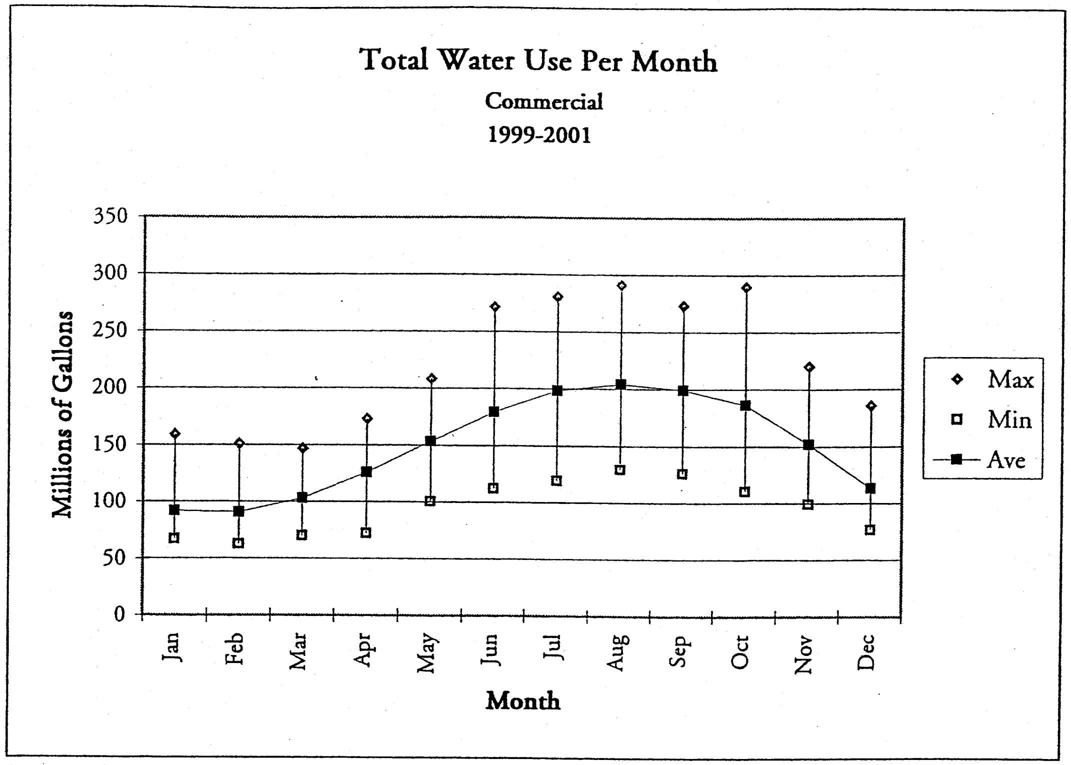

Figure 26

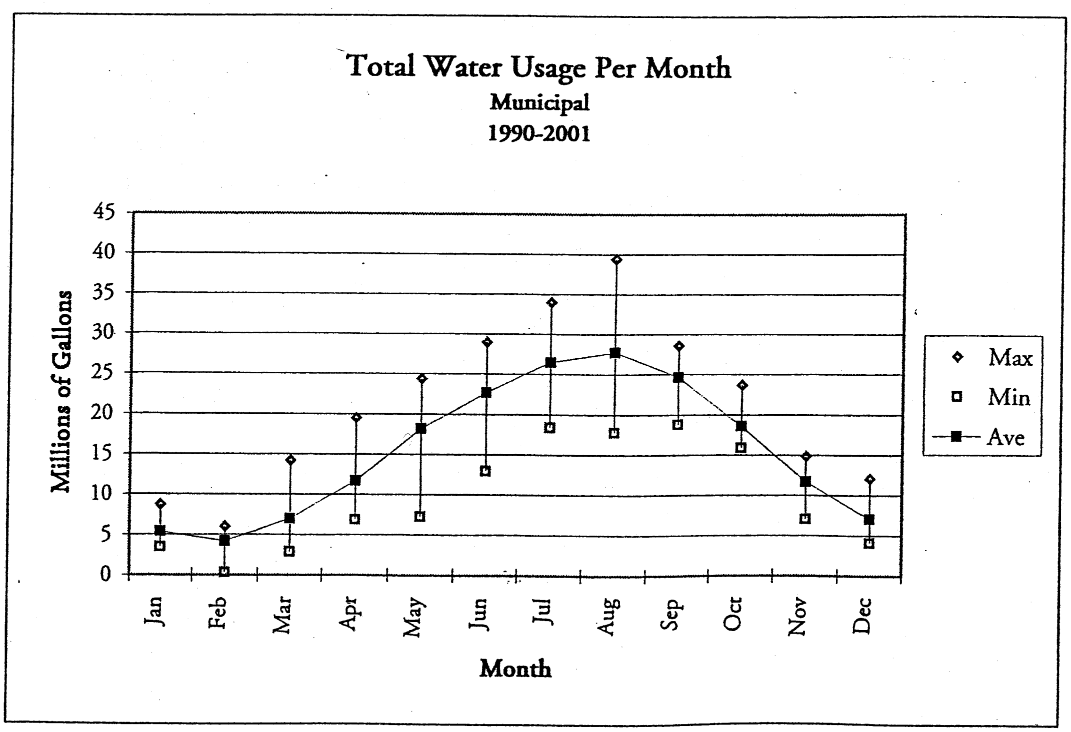

Figure 27

APPENDIX B SEASONAL INDICES FOR USER CATEGORIES

Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Residential	0.8	0.8	0.8	0.9	1.1	1.2	1.3	1.3	1.2	1.1	0.9	0.8
Institutional	0.6	0.6	0.6	0.7	1.0	1.3	1.5	1.5	1.4	1.2	0.9	0.6
Industrial	0.9	0.9	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.0	0.9
Commercial	0.7	0.7	0.7	0.9	1.1	1.2	1.3	1.3	1.3	1.2	1.0	0.8
Municipal	0.3	0.3	0.4	0.7	1.1.	1.5	1.8	1.9	1.6	1.2	0.7	0.5

APPENDIX C WATER DISTRIBUTION SYSTEM AGE

Table 8

Year	1910s & 1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	Unknown age	Total	% of Total
Age, years	71 to 90	61 to 70	51 to 60	41 to 50	31 to 40	21 to 30	11 to 20	1 to 10			
ACP			10,426	3,665	72,305	152,549	19,715	5	604	259,269	16.6
CIP	56,854	11,971	48,664	578,350	315,401	49,253	7,673	989	42,230	1,111,385	71.2
DIP					16,947	26,295	40,714	27,069	358	111,383	7.1
K					590		223	1,850	597	3,260	0.2
PEP						263	535			798	0.1
PVC					415	4,184	34,168	16,232	1570	56,569	3.6
RCP					10,489					10,489	0.7
WS				2,408	335	759				3,502	0.2
unspecified	314			390	2075	416				3,195	0.2
Total	57,168	11,971	59,090	584,813	418,557	233,719	103,028	46,145	45359	1,559,850	100.0
% of System	3.7	0.8	3.8	37.5	26.8	15.0	6.6	3.0	2.9		

The figures shown are linear feet unless otherwise specified.

Abbreviations

ACP - Asbestos Cement Pipe
CIP - Cast Iron Pipe
DIP - Ductile Iron Pipe
K - Copper
PEP - Polyethylene Pipe
PVC - Polyvinyl chloride
RCP - Reinforced Concrete Pipe
WS - Welded Steel

REFERENCES

(1) California Health and Safety Code Sections 116410 and 116415

(2) California Water Code Section 13550-13551

(3) California Water Code Section 13579(a)

(4) City of Santa Clara General Plan, Amendment No. 32, City of Santa Clara, 1992

(5) City of Santa Clara Water Department, Water - A Master Plan, August 1985

(6) Cesario, Lee; Modeling, Analysis, and Design of Water Distribution Systems, American Water Works Association, 1995

(7) Distribution System Requirements for Fire Protection, American Water Works Association Manual M31, First Ed., 1989

(8) National Primary Drinking Water Regulations: Groundwater Rule, Proposed Rules, Federal Register Vol. 65, No. 91, Wednesday

(9) Reinvesting in Drinking Water Infrastructure, Dawn of the Replacement Era, American Water Works Association, May 2001

(10) Residential End Uses of Water, American Water Works Association Research Foundation, 1999

(11) San Francisco Public Utilities Commission, Bay Area Water Users Association, Water Supply Master Plan- A Water Resource Strategy for the SFPUC System, April 2000.

(12) San Francisco Water Department, Water Supply Master Plan, January 2001.

(13) Santa Clara Valley Water District, Draft Urban Water Management Plan, January 2001

(14) Silicon Valley Projections 2000, Association Of Bay Area Governments, 2001

(15) Walker, Roger; Water Supply, Treatment and Distribution; Prentice Hall; New Jersey; 1978, p314

(16) Water Resource Planning Manual of Water Supply Practices, American Water Works Association Manual M50, 2001

Data Request 59

LETTER FROM CITY OF SANTA CLARA
STORM DRAIN BLOCK BOOK SHEETS
NPDES PERMIT NO CAS029718

Santa Clara
All-America City
2001
Engineering Department

December 18, 2002

Michael J. Fox, Consultant
Silicon Valley Power
1500 Warburton Avenue
Santa Clara, CA 95050

Re: Pico Power Project
California Energy Commission (CEC) Data Request

Dear Mr. Fox:

The following is the response to the CEC data request:

59.a) The peak operating capacity of the existing 27-inch sanitary sewer is 4.7 MGD. The current peak volume in the existing 27-inch sanitary sewer is 4.1 MGD, based on 1-week (July 12 to July 19, 2002) continuous monitoring of the 27-inch line.

59.b) See response to 59.a) above.

59.c) The existing 27-inch sanitary sewer line connects to an existing 48-inch line which in turn connects to two 33-inch parallel lines. The 33-inch lines connect to the City of San Jose trunk lines at the intersection of Trimble Road and Zanker Road (see attached plan sheet C-7). The City of San Jose trunk lines convey the flow to the treatment plant. Please contact the City of San Jose for information on their sewer system.

The two 33-inch lines govern the capacity of the City of Santa Clara sewer system. The peak operating capacity of the two 33-inch lines is estimated at 14 MGD. The following are recent historical sewer flow data for the two existing 33-inch lines:

	Total Flows
Maximum	13 MGD
Average	7.5 MGD
Minimum	3.5 MGD

59.d) The existing 27-inch sewer line was designed using the following minimum average design flows:

Residential:	70 gallons per capita per day
Commercial:	2,100 gallons per acre per day
Industrial:	2,450 gallons per acre per day
Hospital:	150 gallons per bed per day

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Santa Clara, CA 95050
(408) 615-3000
FAX (408) 985-7936
www.ci.santa-clara.ca.us

Past practice has been to allow development to occur as long as there is adequate capacity in the sanitary sewer system. If in the future the system is surcharged, the properties served by the system are asked to contribute towards supplementing (i.e., up-sizing the line or constructing a new parallel line) the sanitary sewer system, as determined by the City. The amount to be contributed towards supplementing the system is on a prorata share, based on site acreage, using the minimum average design flows (above).

61. The 54-inch storm drain system is designed to convey the 10-year storm event. It is expected that the existing storm drain system will be surcharged (pressure flow) and that the public street prism (curb to curb) will convey part of the flow during the 100-year storm event and not allow "public" storm water to enter private properties.

The reported net increase of 0.24 cfs (10-year storm) and 0.35 cfs (100-year storm) is an insignificant increase for this storm drain system.

65. The attached City of Santa Clara Storm Drain Block Book Sheets 66, 67, 77 and 78 show the location of the storm drain system from the Project Site to the Guadalupe River. The increased flow from pre and post-development are insignificant for this storm drain system (see response to 61, above).

In regards to "sediment controls in the system as well as clean-outs and monitoring plans", the Project shall implement the appropriate storm water pollution control plan and comply with the California Regional Water Quality Control Board, San Francisco Bay Region C.3. Provisions (copy attached).

If you have any questions or need more information regarding this matter, please call Gusatvo Gomez at (408) 615-3011.

For Rajeev Batra
City Engineer

RB:GG:rd

Cc: Rick Mauck, Director of Street and Automotive Services
Robin Saunders, Director of Water and Sewer Utilities
Gustavo Gomez, Principal Engineer – Design
Tom Supan, Principal Engineer – Land and Property Division

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 01-119
NPDES PERMIT NO. CAS029718

AMENDMENT REVISING PROVISION C.3. OF ORDER NO. 01-024 FOR:

SANTA CLARA VALLEY WATER DISTRICT, COUNTY OF SANTA CLARA, CITY OF CAMPBELL, CITY OF CUPERTINO, CITY OF LOS ALTOS, TOWN OF LOS ALTOS HILLS, TOWN OF LOS GATOS, CITY OF MILPITAS, CITY OF MONTE SERENO, CITY OF MOUNTAIN VIEW, CITY OF PALO ALTO, CITY OF SAN JOSE, CITY OF SANTA CLARA, CITY OF SARATOGA, AND CITY OF SUNNYVALE, which have joined together to form the SANTA CLARA VALLEY URBAN RUNOFF POLLUTION PREVENTION PROGRAM

The California Regional Water Quality Control Board, San Francisco Bay Region, hereinafter referred to as the Regional Board, finds that:

Existing Permit and Revision of Provision C.3.

1. The Regional Board adopted Order No. 01-024 on February 21, 2001, reissuing waste discharge requirements under the National Pollutant Discharge Elimination System (NPDES) permit for the Santa Clara Valley Urban Runoff Pollution Prevention Program (Program) for the discharge of stormwater to South San Francisco Bay and its tributaries. The Program's NPDES permit is jointly issued to the thirteen Cities of Santa Clara County named above, Santa Clara County and the Santa Clara Valley Water District, all of which are Co-permittees. These Co-permittees are referred to as the Dischargers.

2. As outlined in Finding 17 of Order No. 01-024, Provision C.3. of Order No. 01-024 is to be revised in response to the "Cities of Bellflower, et. al." decision by the State Water Resources Control Board (State Board Order No. 2000-11).

3. Order No. 01-024 recognizes the Santa Clara Valley Urban Runoff Management Plan (Management Plan) as the Dischargers' Comprehensive Control Program and requires implementation of the Management Plan, which describes a framework for management of stormwater discharges. The 1997 Management Plan describes the Program's goals and objectives and contains Performance Standards, which represent the baseline level of effort required of each of the Dischargers. The Management Plan contains Performance Standards for seven different stormwater management activities.

Nature of Discharges and Sources of Pollutants

4. Urban Development Increases Pollutant Load, Volume, and Velocity of Runoff: During urban development two important changes occur. First, where no urban development has previously occurred, natural vegetated pervious ground cover is converted to impervious surfaces such as paved highways, streets, rooftops, and parking lots. Natural vegetated soil can both absorb rainwater and remove pollutants providing a very effective natural

purification process. Because pavement and concrete can neither absorb water nor remove pollutants, the natural purification characteristics of the land are lost. Secondly, urban development creates new pollution sources as human population density increases and brings with it proportionately higher levels of car emissions, car maintenance wastes, municipal sewage, pesticides, household hazardous wastes, pet wastes, trash, etc., which can be washed into the municipal separate storm sewer system (MS4). As a result of these two changes, the runoff leaving a newly developed urban area may be significantly greater in volume, velocity and/or pollutant load than pre-development runoff from the same area.

5. Certain pollutants present in stormwater and/or urban runoff may be derived from extraneous sources that dischargers have limited or no direct jurisdiction over. Examples of such pollutants and their respective sources are: PAHs which are products of internal combustion engine operation and other sources; heavy metals, such as copper from brake pad wear and zinc from tire wear; dioxins as products of combustion; mercury resulting from atmospheric deposition; and natural-occurring minerals from local geology. All of these pollutants, and others, may be deposited on impervious surfaces and roof-tops as fine air-borne particles, thus yielding stormwater runoff pollution that is unrelated to the particular activity or use associated with a given new or redevelopment project. However, dischargers can implement treatment control measures, or require developers to implement treatment control measures, to reduce entry of these pollutants into stormwater and their discharge to receiving waters.

6. Pollutants present in stormwater can have damaging effects on both human health and aquatic ecosystems. In addition, the increased flows and volumes of stormwater discharged from new impervious surfaces resulting from new development and redevelopment can significantly impact beneficial uses of aquatic ecosystems due to physical modifications of watercourses, such as bank erosion and widening of channels.

7. Water Quality Degradation Increases with Percent Imperviousness: The increased volume and velocity of runoff from newly developed urban areas can greatly accelerate the erosion of downstream watercourses. A number of studies have demonstrated a direct correlation between the degree of imperviousness of an area and the degradation of beneficial uses of downstream watercourses. Significant declines in the biological integrity and physical habitat of streams and other receiving waters have been found to occur with as little as a 10% conversion from natural to impervious surfaces. Typical medium-density single-family home projects developed in previously unurbanized locations, range between 25 to 60% impervious. Even at very low densities, such as 1-2 housing units per acre, some types of subdivisions built in previously unurbanized locations can result in more than a 10% increase in imperviousness.[1] Studies on the impacts of imperviousness on beneficial uses of waters include "Urbanization of aquatic systems: Degradation thresholds, stormwater detection, and the limits of mitigation," Derek B. Booth and C. Rhett Jackson, Journal of the American Water Resources Association 33(5), Oct. 1997, pp. 1077-1089; "Urbanization and Stream Quality Impairment," Richard D. Klein, Water Resources Bulletin 15(4), Aug. 1979, pp. 948-963; "Stream channel enlargement due to urbanization," Thomas R. Hammer, Water Resources Research 8(6), Dec. 1972, pp. 1530- 1540; and, summaries of work on the impacts

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[1]A discussion of imperviousness based on type of development and time of construction is provided in Heaney, J.B., Pitt, R, and Field, R. **Innovative Urban Wet-Weather Flow Management Systems**, 1999. USEPA Doc. No. EPA/600/R-99/029 (Chapter 2).

of imperviousness, including "The Importance of Imperviousness," in Watershed Protection Techniques 1(3), Fall 1994, pp. 100-111, and "Impervious surface coverage: The emergence of a key environmental indicator," Chester L. Arnold et al., Journal of the American Planning Association 62(2), Spring 1996, pp. 243-259.

Implementation

8. This Order, revising Provision C.3., is intended to enhance the Dischargers' existing Performance Standard for new development and significant redevelopment. This Order more clearly requires a level of implementation of best management practices (BMPs), including treatment measures in new development and significant redevelopment, that reflects the regulatory standard of maximum extent practicable (MEP). This is done through addition of requirements to more effectively incorporate source control measures, site design principles, and structural stormwater treatment controls in new development and redevelopment projects in order to reduce water quality impacts of stormwater runoff for the life of these projects. The consistent application of such measures is intended to greatly reduce the adverse impacts of new development and redevelopment on water quality and beneficial uses by reducing stormwater pollutant impacts, and impacts of increases in peak runoff rate.

9. Cost-effective opportunities to protect water quality in new and redevelopment may exist during the land use approval process. When a Discharger incorporates policies and principles designed to safeguard water resources into its General Plan and development project approval processes, it has taken a far-reaching step towards the preservation of local water resources for future generations.

10. The revised Provision C.3. is written with the assumption that Dischargers are responsible for considering potential stormwater impacts when making planning and land use decisions. The goal of these requirements is to address pollutant discharges and changes in runoff flows from significant new and redevelopment projects, through implementation of post-construction treatment measures, source control, and site design measures, to the maximum extent practicable. Neither Provision C.3. nor any of its requirements are intended to restrict or control local land use decision-making authority.

11. Opportunities for Dischargers to address stormwater pollution and hydrograph modification can be limited by their current local design standards and guidance. For example, such standards and guidance may reduce or prohibit opportunities to minimize impervious surfaces, minimize directly connected impervious area, provide for small-scale detention, and implement other management measures. Depending on the existing state of program development/implementation and site-specific conditions, revision of current standards and guidance may result in an increased ability for project designers to minimize project impacts. Revision of standards and guidance can allow implementation of site design measures in projects to meet or help meet the numeric sizing criteria in Provision C.3.d. and/or the hydrograph modification limitation in Provision C.3.f.

12. Provision C.3.f. requires Dischargers to prepare a Hydrograph Modification Management Plan (HMP), for approval by the Regional Board, to manage impacts from changes to the volume and velocity of stormwater runoff from new development and significant

redevelopment projects, where these changes can cause excessive erosion damage to downstream watercourses. Transit village type developments within 1/4 mile of transit stations, and within the 80% developed urban core of cities, are unlikely to fall under the requirements of C.3.f. and the HMP. This is due to the fact that significant change in impervious surface or significant change in stormwater runoff volume or timing is unlikely in this circumstance, because the development would be within a largely already paved catchment, and on a site that is largely already paved or otherwise impervious.

13. Certain BMPs implemented or required by Dischargers for urban runoff management may create a habitat for vectors (e.g., mosquitoes and rodents) if not properly designed or maintained. Close collaboration and cooperative effort between the Dischargers, local vector control agencies, the Regional Board staff, and the State Department of Health Services is necessary to identify appropriate vector control measures that minimize potential nuisances and public health impacts resulting from vector breeding, so that Dischargers and local vector control agencies can implement such control measures without undue adverse effects.

Public Process

14. The action to modify an NPDES Permit is exempt from the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code [California Environmental Quality Act (CEQA)] pursuant to Section 13389 of the California Water Code.

15. The Dischargers and interested agencies and persons have been notified of the Regional Board's intent to modify waste discharge requirements for the existing discharge and have been provided opportunities for public meetings and the opportunity to submit their written views and recommendations. The following is a brief summary of public meetings and comment periods on draft versions of this Order:

    Oct. 13 - Nov. 13, 2000: Formal public comment period on the Tentative Order for reissuance of the Program's entire NPDES permit. Comments were received from Co-permittees, environmental advocacy groups, and industry, and included comments on new development provision.

    Nov. 7, 2000: Regional Board staff held a stakeholder meeting during the formal public comment period to discuss permit issues. Significant unresolved comments remained on the new development provision.

    Dec. 13, 2000: Regional Board staff held a public stakeholder meeting on the new development provision.

    Jan. 10, 2001: Regional Board staff held a public stakeholder meeting on the new development provision.

    Feb. 21, 2001: The Program's NPDES permit is reissued, revision of Provision C.3. on new development is deferred to later date.

    May 7, 2001: Administrative draft of new development provision issued for discussion with stakeholders.

    May 14, 2001: Regional Board staff held a public stakeholder meeting on the new development provision.

    May 18-June 18, 2001: Formal public comment period for the May 18 Tentative Order containing the revised new development provision.

    June 5, 2001: Regional Board staff held a public stakeholder meeting on the new development provision.

    August 6, 2001: Regional Board staff held a public stakeholder meeting on the new development provision.

    August 9 & 10, 2001: Regional Board staff spoke at Bay Area Stormwater Management Agencies Association conferences, "Meeting New Requirements for Stormwater Controls in New and Redevelopment Projects" in Berkeley and Cupertino.

August 17 – Sept. 19, 2001: Formal public comment period for the August 17 Tentative Order containing the revised new development provision.

August 27, 2001: Executive Officer and Board staff met with officials from Milpitas, City of Santa Clara, San Jose, Sunnyvale, Palo Alto, and Santa Clara County to discuss provision revisions.

August 30, 2001: Board staff presented a Workshop in San Jose (courtesy of Altera Corporation) to (1) Bring newly involved stakeholders up to date on the proposed permit amendment, and (2) Get feedback on the specific requirements of revised Provision C.3., and possible provision language improvements.

Sept. 5, 2001: Board staff presented a Workshop in San Jose (courtesy of the SCVWD) to (1) Present and discuss example post-construction controls at development projects—how they work, how they are sized, and other technical details, and (2) Get feedback on the technical requirements of the revised permit Provision C.3., and possible provision language improvements.

Sept. 14, 2001: Executive Officer and Board staff met with officials from Milpitas, City of Santa Clara, San Jose, Sunnyvale, Palo, Alto, Los Altos, Santa Clara County and the SCVWD to discuss provision revisions.

Sept. 20, 2001: Executive Officer gave a presentation on the new development provision to the Santa Clara Council of Cities.

Sept. 26, 2001: Executive Officer gave a presentation on the new development provision to the Silicon Valley Pollution Prevention Committee.

Sept. 28, 2001: Executive Officer met with officials from Milpitas, City of Santa Clara, San Jose, Sunnyvale, and the SCVWD to discuss provision revisions.

Oct. 1, 2001: Board staff met with members of the Western States Petroleum Association to discuss their concerns regarding regulation of retail gasoline outlets under Provision C.3.

16. The Regional Board has conducted public meetings to discuss the draft revised Provision C.3.as follows:

Nov. 18, 2000: Regional Board meeting - Informational Workshop on the Program's Permit Reissuance, focusing on the new development Provision C.3.

July 18, 2001: Regional Board meeting - Informational Workshop on the new development Provision C.3. proposed Tentative Order for permit amendment.

Sept. 19, 2001: Regional Board meeting – Informational Workshop on the types of stormwater treatment controls that are appropriate for new development and significant redevelopment under Provision C.3.

17. The Regional Board, through public testimony in public meetings and in written form, has received and considered all comments pertaining to the revision of Provision C.3.

IT IS HEREBY ORDERED that the Dischargers, in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted hereunder and the provisions of the Clean Water Act as amended and regulations and guidelines adopted hereunder, shall comply with the following:

Provision C.3. New and Redevelopment Performance Standards of Order No. 01-024 is hereby revised to read as follows:

The Management Plan contains performance standards and supporting documents to address the post-construction and construction phase impacts of new and redevelopment projects on stormwater quality (Planning Procedures and Construction Inspection Performance Standards). The Dischargers shall continue to implement these performance standards and continuously improve them to the maximum extent practicable in accordance with the following sections.

a. **Performance Standard Implementation:** The Dischargers shall continue to implement and continually improve, as necessary and appropriate, the following performance standards for planning procedures:

   i. Each Discharger shall have adequate legal authority to implement new development control measures, including all requirements of this Provision C.3., as part of its development plan review and approval procedures, and other appropriate new development and redevelopment permitting procedures;

   ii. Each Discharger shall provide developers with information and guidance materials on site design guidelines, building permit requirements, and BMPs for stormwater pollution prevention early in the application process, as appropriate for the type of project;

   iii. Each Discharger shall require developers of projects that disturb a land area of five acres or more to demonstrate coverage under the State's General Permit for Storm Water Discharges Associated with Construction Activity;

   iv. Each Discharger shall require developers of projects with potential for significant erosion and planned construction activity during the wet season (as defined by local ordinance) to prepare and implement an effective erosion and/or sediment control plan or similar document prior to the start of the wet season;

   v. Each Discharger shall ensure that municipal capital improvement projects include stormwater quality control measures during and after construction, as appropriate for each project, and that contractors comply with stormwater quality control requirements during construction and maintenance activities; and,

   vi. Each Discharger shall provide training at least annually to its planning, building, and public works staffs on planning procedures, policies, design guidelines, and BMPs for stormwater pollution prevention.

b. **Development Project Approval Process:** Dischargers shall modify their project review processes as needed to incorporate the requirements of Provision C.3. Each Discharger shall include conditions of approval in permits for applicable projects, as defined in Provision C.3.c., to ensure that pollutant discharges are reduced by incorporation of treatment measures and other appropriate source control and site design measures, and increases in runoff flows are managed in accordance with C.3.f., to the maximum extent practicable. Such conditions shall, at a minimum, address the following goals:

   i. Require project proponent to implement site design/landscape characteristics where feasible which maximize infiltration (where appropriate), provide retention or detention, slow runoff, and minimize impervious land coverage, so that post-development pollutant loads from a site have been reduced to the maximum extent practicable; and

   ii. For new and redevelopment projects that discharge directly to water bodies listed as impaired by a pollutant(s) pursuant to Clean Water Act Section 303(d), ensure that post-project runoff does not exceed pre-project levels for such pollutant(s), through implementation of the control measures addressed in this provision, to the maximum extent practicable, in conformance with Provision C.1.

Modification of project review processes shall be completed by July 1, 2003, subject to a workplan, submitted by March 1, 2002, acceptable to the Executive Officer, identifying incremental progress already made and to be made toward this completion by July 1, 2003. If no acceptable workplan is received, modification of project review processes shall be completed by October 15, 2002.

c. **Applicable Projects – New and Redevelopment Project Categories:** New development and significant redevelopment projects that are subject to Provision C.3. are grouped into two categories based on project size. New and redevelopment projects that do not fall into Group 1 or Group 2 are not subject to the requirements of Provision C.3. Provision C.3. shall not apply to projects for which a privately-sponsored development application has been deemed complete by a Discharger or, with respect to public projects, for which funding has been committed and for which construction is scheduled by October 15, 2003.

i. **Group 1 Projects:** Dischargers shall require Group 1 Projects to design and implement stormwater treatment BMPs to reduce stormwater pollution to the maximum extent practicable. Implementation of this requirement shall begin on July 15, 2003, subject to a workplan, submitted March 1, 2002, acceptable to the Executive Officer, identifying incremental progress already made and to be made toward implementation of C.3.c.i. by July 15, 2003. If no acceptable workplan is received, implementation of C.3.c.i. requirements shall begin on October 15, 2002. Group 1 Projects consist of all public and private projects in the following categories:

1. *Commercial, industrial, or residential developments that create one acre (43,560 square feet) or more of impervious surface, including roof area, streets and sidewalks.* This category includes any development of any type on public or private land, which falls under the planning and building authority of the Dischargers, where one acre or more of new impervious surface, collectively over the entire project site, will be created.

2. *Streets, roads, highways, and freeways that are under the Dischargers' jurisdiction and that create one acre (43,560 square feet) or more of new impervious surface.* This category includes any newly constructed paved surface used for the transportation of automobiles, trucks, motorcycles, and other motorized vehicles.

3. *Significant redevelopment projects.* This category is defined as a project on a previously developed site that results in addition or replacement which combined total 43,560 ft^2 or more of impervious surface on such an already developed site ("Significant Redevelopment"). Where a Significant Redevelopment project results in an increase of, or replacement of, more than fifty percent of the impervious surface of a previously existing development, and the existing development was not subject to stormwater treatment measures, the entire project must be included in the treatment measure design. Conversely, where a Significant Redevelopment project results in an increase of, or replacement of, less than fifty percent of the impervious surface of a previously existing development, and the existing development was not subject to stormwater treatment measures, only that affected portion must be included in treatment

design. Excluded from this category are interior remodels and routine maintenance or repair, including roof or exterior surface replacement and repaving.

ii. **Group 2 Projects:** The Group 2 Project definition is in all ways the same as the Group 1 Project definition above, except that the size threshold of impervious area for new and Significant Redevelopment projects is reduced from one acre (43,560 ft^2) to 5000 square feet. Dischargers shall require Group 2 Projects to design and implement stormwater treatment BMPs to reduce stormwater pollution to the maximum extent practicable. Implementation of this requirement shall begin on October 15, 2004, at which time the definition of Group 1 Project is changed to include all Group 2 Projects.

iii. **Alternative Project Proposal:** The Program may propose, for approval by the Regional Board, an alternative Group 2 Project definition. Any such proposal shall contain supporting information about the Dischargers' development patterns, and pollutant source information, that demonstrates that the proposed definition is comparable in effectiveness to the Group 2 Project definition (i.e., that a comparable development area and/or pollutant loading would be addressed under the proposed alternate definition). Proposals must be submitted by April 15, 2004, in order to be considered by the Regional Board before the Group 2 Project implementation date in C.3.c.ii.

d. **Numeric Sizing Criteria For Pollutant Removal Treatment Systems:** All Dischargers shall require that treatment BMPs be constructed for applicable projects, as defined in C.3.c., that incorporate, at a minimum, the following hydraulic sizing design criteria to treat stormwater runoff. As appropriate for each criterion, the Dischargers shall use or appropriately analyze local rainfall data to be used for that criterion.

i. **Volume Hydraulic Design Basis:** Treatment BMPs whose primary mode of action depends on volume capacity, such as detention/retention units or infiltration structures, shall be designed to treat stormwater runoff equal to:

1. the maximized stormwater quality capture volume for the area, based on historical rainfall records, determined using the formula and volume capture coefficients set forth in *Urban Runoff Quality Management, WEF Manual of Practice No. 23/ ASCE Manual of Practice No. 87, (1998*), pages 175-178 (e.g., approximately the 85th percentile 24-hour storm runoff event); or

2. the volume of annual runoff required to achieve 80 percent or more capture, determined in accordance with the methodology set forth in Appendix D of the *California Stormwater Best Management Practices Handbook,* (1993), using local rainfall data.

ii. **Flow Hydraulic Design Basis:** Treatment BMPs whose primary mode of action depends on flow capacity, such as swales, sand filters, or wetlands, shall be sized to treat:

1. 10% of the 50-year peak flow rate; or
2. the flow of runoff produced by a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the applicable area, based on historical records of hourly rainfall depths; or
3. the flow of runoff resulting from a rain event equal to at least 0.2 inches per hour intensity.

e. Operation and Maintenance of Treatment BMPs:

Each Discharger shall implement an operation and maintenance (O&M) verification program, which shall include the following:

i. Compiling a list of properties (public and private) and responsible operators for all treatment BMPs. In addition, the Dischargers shall inspect a subset of prioritized treatment measures for appropriate operation and maintenance, on an annual basis, with appropriate follow-up and correction.

ii. Verification at a minimum shall include: Where a private entity is responsible for O&M, the developer's signed statement accepting responsibility for maintenance until the responsibility is legally transferred; and either

1. A signed statement from the public entity assuming post-construction responsibility for treatment BMP maintenance and that the BMP meets all local agency design standards; or
2. Written conditions in the sales or lease agreement, which require the recipient to assume responsibility for maintenance consistent with this provision; or
3. Written text in project conditions, covenants and restrictions (CCRs) for residential properties assigning maintenance responsibilities to the Home Owners Association for maintenance of the treatment BMPs; or
4. Any other legally enforceable agreement or mechanism that assigns responsibility for the maintenance of post-construction treatment BMPs.

iii. O&M Reporting: The Dischargers shall report on their Treatment BMPs Operation and Maintenance Verification program in each Annual Report. The Annual Report shall contain: a description of the organizational structure of the Discharger's O&M Verification program; an evaluation of the Discharger's O&M verification program's effectiveness; summary of any planned improvements in O&M Verification; and a list or summary of treatment BMPs that have been inspected that year with inspection results.

f. Limitation on Increase of Peak Stormwater Runoff Discharge Rates:

i. The Dischargers shall manage increases in peak runoff flow and increased runoff volume, for all Group 1 Projects, where such increased flow and/or volume can cause increased erosion of creek beds and banks, silt pollutant generation, or other impacts to beneficial uses. Such management shall be through implementation of a Hydrograph Modification Management Plan (HMP). The HMP, once approved by the Regional Board, will be implemented so that post-project runoff shall not exceed estimated pre-project rates and/or durations, where the increased stormwater discharge rates and/or durations will result in increased potential for erosion or other adverse impacts to beneficial uses, attributable to changes in the amount and timing of runoff. The term duration in this section is defined as the period that flows are above a threshold that causes significant sediment transport and may cause excessive erosion damage to creeks and streams.

ii. This requirement does not apply to new development and redevelopment projects where the project discharges stormwater runoff into creeks or storm drains where the potential for erosion, or other impacts to beneficial uses, is minimal. Such situations may include discharges into creeks that are concrete-lined or significantly hardened (e.g., with rip-rap, sackrete, etc.) downstream to their outfall in San Francisco Bay, underground storm drains discharging to the Bay, and construction of infill projects in highly developed watersheds, where the potential for single-project and/or cumulative impacts is minimal. Guidelines for identification of such situations shall be included as a part of the HMP. However, plans to restore a creek reach may re-introduce the applicability of HMP controls, and would need to be addressed in the HMP.

iii. The HMP may identify conditions under which some increases in runoff may not have a potential for increased erosion or other impacts to beneficial uses. Reduced controls or no controls on peak stormwater runoff discharge rates and/or durations may be appropriate in those cases, subject to the conditions in the HMP. In the absence of information demonstrating that changes in post-development runoff discharge rates and durations will not result in increased potential for erosion or other adverse impacts to beneficial uses,the HMP requirements shall apply.

iv. The HMP proposal shall include:

1. A review of the pertinent literature;
2. A protocol to evaluate potential hydrograph change impacts to downstream watercourses from proposed projects;
3. An identification of the rainfall event below which these standards and management requirements apply, or range of rainfall events to which this limitation applies;
4. A description of how the Dischargers will incorporate these requirements into their local approval processes, or the equivalent; and
5. Guidance on management practices and measures to address identified impacts.

v. The identified maximum rainfall event or rainfall event range may be different for specific watersheds, streams, or stream reaches. Individual Dischargers may utilize the protocol to determine a site- or area-specific rainfall event standard.

vi. The HMP's evaluation protocols, management measures, and other information may include the following:

1. Evaluation of the cumulative impacts of urbanization of a watershed on stormwater discharge and stream morphology in the watershed;
2. Evaluation of stream form and condition, including slope, discharge, vegetation, underlying geology, and other information, as appropriate;
3. Implementation of measures to minimize impervious surfaces and directly connected impervious area in new development and redevelopment projects;
4. Implementation of measures including stormwater detention, retention, and infiltration;

5. Implementation of land use planning measures (e.g., stream buffers and stream restoration activities, including restoration-in-advance of floodplains, revegetation, use of less-impacting facilities at the point(s) of discharge, etc.) to allow expected changes in stream channel cross sections, stream vegetation, and discharge rates, velocities, and/or durations without adverse impacts to stream beneficial uses;
6. A mechanism for pre- vs. post-project assessment to determine the effectiveness of the HMP and to allow amendment of the HMP, as appropriate; and,
7. Other measures, as appropriate.

vii. Equivalent limitation of peak flow impacts: The Dischargers may develop an equivalent limitation protocol, as part of the HMP, to address impacts from changes in the volumes, velocities, and/or durations of peak flows through measures other than control of those volumes and/or durations. The protocol may allow increases in peak flow and/or durations, subject to the implementation of specified BMPs and land planning practices that take into account expected stream change (e.g., increases in the cross-sectional area of stream channel) resulting from changes in discharge rates and/or durations, while maintaining or improving beneficial uses of waters.

viii. The Dischargers as a group shall complete the HMP according to the schedule below. All required documents shall be submitted acceptable to the Executive Officer, except the HMP, which shall be submitted for approval by the Regional Board. Development and implementation status shall be reported in the Dischargers' Annual Reports, which shall also provide a summary of projects incorporating measures to address this section and the measures used.

1. March 1, 2002: Submit a detailed workplan and schedule for completion of the literature review, development of a protocol to identify an appropriate limiting storm, development of guidance materials, and other required information;
2. September 15, 2002: Submit literature review;
3. March 1, 2003: Submit a draft HMP, including the analysis that identifies the appropriate limiting storm and the identified limiting storm event(s) or event range(s);
4. October 15, 2003: Submit the HMP for Regional Board approval; and,
5. Upon adoption by the Regional Board, implement the HMP, which shall include the requirements of this measure. Prior to approval of the HMP by the Regional Board, the early implementation of measures likely to be included in the HMP shall be encouraged by the Dischargers.

g. Waiver Based on Impracticability and Compensatory Mitigation:

i. The Dischargers may establish a program under which a project proponent may request a waiver from the requirement to install treatment BMPs for a given project, upon an appropriate showing of impracticability, and with provision to treat an equivalent pollutant loading or quantity of stormwater runoff, or provide other equivalent water quality benefit. The location of this equivalent stormwater treatment, or water quality benefit, would be where no other requirement for treatment exists, within the same stormwater runoff drainage basin and treating runoff discharging to the same receiving water, where feasible. The Dischargers should specifically define the basis for impracticability or infeasibility, which may include situations where treatment is technically feasible, but excessively costly, as determined by set criteria.

ii. **Regional Solutions:** The waiver program may allow a project to participate in a regional or watershed stormwater treatment facility, without a showing of impracticability on the individual project site, if the regional or watershed stormwater treatment facility discharges into the same receiving water, where feasible.

iii. The Program is encouraged to propose a model waiver program on behalf of the Dischargers, for approval by the Regional Board, and for potential adoption and implementation by the Dischargers.

iv. The waiver program proposal should state the criteria for granting waivers; criteria for determining impracticability or infeasibility; and criteria for use of regional or watershed stormwater treatment facilities. The proposal should also describe how the project sponsor will provide equivalent water quality benefits or credit to an alternative project or to a regional or watershed treatment facility and tracking mechanisms to support the reporting requirements set forth in Section C.3.g.v. below.

v. **Reporting:** Each year, as part of its Annual Report, each Discharger shall provide a list of the waivers it granted. For each project granted a waiver, the following information shall be provided:

1. Name and location of the project for which the waiver was granted;
2. Project type (e.g., restaurant, residence, shopping center) and size;
3. Percent impervious surface in final design;
4. Reason for granting the waiver;
5. Terms of the waiver; and,
6. The stormwater treatment project receiving the benefit, and the date of completion of the project.

vi. **Interim Waiver:** In the event that a waiver program has not been proposed by the Program, approved by the Regional Board, or implemented by a particular Discharger by the date of implementation of Group 1 Projects, an interim waiver may be granted by a Discharger. An interim waiver may be granted if the project proponent (1) demonstrates impracticability due to extreme limitations of space for treatment and lack of below grade surface treatment options, and (2) presents assurance of provision of equivalent stormwater pollutant and/or volume treatment at another location within the drainage basin, for which construction of stormwater treatment measures is not otherwise required, discharging into the same receiving water, where feasible. The Discharger will be responsible for assuring that equivalent treatment has occurred for any use of this interim waiver, within six months of project construction, and will report the basis of impracticability and the nature of equivalent treatment for each project in its Annual Report. Any equivalent treatment that does not include construction of stormwater treatment BMPs must be approved by the Executive Officer. This interim waiver clause will be void when the waiver program described in C.3.g.i-iv. above is approved by the Regional Board.

h. Alternative Certification of Adherence to Design Criteria for Stormwater Treatment Measures: In lieu of conducting detailed review to verify the adequacy of measures required pursuant to Provisions C.3.d. and C.3.f., a Discharger may elect to accept a signed certification from a Civil Engineer or a Licensed Architect or Landscape Architect registered in the State of California, or another Discharger that has overlapping jurisdictional project permitting authority, that the plan meets the criteria established herein. The Discharger should verify that each certifying person has been trained on BMP design for water quality not more than three years prior to the signature date, and that each certifying person understands the groundwater protection principles applicable to the project site (*see Provision C.3.i. Limitations on Use of Infiltration Treatment Measures*). Training conducted by an organization with stormwater treatment BMP design expertise (e.g., a university, American Society of Civil Engineers, American Society of Landscape Architects, American Public Works Association, or the California Water Environment Association) may be considered qualifying.

i. Limitations on Use of Infiltration Treatment Measures - Infiltration and Groundwater Protection: In order to protect groundwater from pollutants that may be present in urban runoff, treatment BMPs that function primarily as infiltration devices (such as infiltration trenches and infiltration basins) must meet, at a minimum, the following conditions:

- **i.** Pollution prevention and source control BMPs shall be implemented at a level appropriate to protect groundwater quality at sites where infiltration devices are to be used;
- **ii.** Use of infiltration devices shall not cause or contribute to degradation of groundwater water quality objectives;
- **iii.** Infiltration devices shall be adequately maintained to maximize pollutant removal capabilities;
- **iv.** The vertical distance from the base of any infiltration device to the seasonal high groundwater mark shall be at least 10 feet. Note that some locations within the Dischargers' jurisdiction are characterized by highly porous soils and/or a high groundwater table; in these areas BMP approvals should be subject to a higher level of analysis (e.g., considering the potential for pollutants such as on-site chemical use, the level of pretreatment to be achieved, and similar factors);
- **v.** Unless stormwater is first treated by a means other than infiltration, infiltration devices shall not be recommended for areas of industrial or light industrial activity; areas subject to high vehicular traffic (25,000 or greater average daily traffic on main roadway or 15,000 or more average daily traffic on any intersecting roadway); automotive repair shops; car washes; fleet storage areas (bus, truck, etc.); nurseries; and other high threat to water quality land uses and activities as designated by each Discharger;
- **vi.** Infiltration devices shall be located a minimum of 100 feet horizontally from any water supply wells.

j. Site Design Measures Guidance and Standards Development:

- i. The Dischargers shall review their local design standards and guidance for opportunities to make revisions that would result in reduced impacts to water quality and beneficial uses of waters. In this event, the Dischargers shall make any such revisions and implement the updated standards and guidance, as necessary.

Areas that may be appropriate to address include the following, which are offered as examples:

1. Minimize land disturbance;
2. Minimize impervious surfaces (e.g., roadway width, driveway area, and parking lot area), especially directly connected impervious areas;
3. Minimum-impact street design standards for new development and redevelopment, including typical specifications (e.g., neo-traditional street design standards and/or street standards recently revised in other cities, including Portland, Oregon, and Vancouver, British Columbia);
4. Minimum-impact parking lot design standards, including parking space maximization within a given area, use of landscaping as a stormwater drainage feature, use of pervious pavements, and parking maxima;
5. Clustering of structures and pavement;
6. Typical specifications or "acceptable design" guidelines for lot-level design measures, including:
    - Disconnected roof downspouts to splash blocks or "bubble-ups;"
    - Alternate driveway standards (e.g., wheelways, unit pavers, or other pervious pavements); and,
    - Microdetention, including landscape detention and use of cisterns.
7. Preservation of high-quality open space;
8. Maintenance and/or restoration of riparian areas and wetlands as project amenities, including establishing vegetated buffer zones to reduce runoff into waterways, allow for stream channel change as a stream's contributing watershed urbanizes, and otherwise mitigate the effects of urban runoff on waters and beneficial uses of waters; and,
9. Incorporation of supplemental controls to minimize changes in the volume, flow rate, timing, and duration of runoff, for a given precipitation event or events. These changes include cumulative hydromodification caused by site development. Measures may include landscape-based measures or other features to reduce the velocity of, detain, and/or infiltrate stormwater runoff.

ii. The standards and guidance review shall be completed according to the schedule below. A summary of review, revision, and implementation status shall be submitted for acceptance by the Executive Officer and reported in the Dischargers' Annual Reports.

1. No later than March 1, 2002: The Dischargers shall submit a detailed workplan and schedule for completion of the review, revision, and implementation of revised standards and guidance;
2. No later than September 15, 2003: The Dischargers shall submit a draft review and analysis of local standards and guidance, opportunities for revision, and proposed revised standards and guidance; and,

3. No later than September 15, 2004: The Dischargers shall incorporate any revised standards and guidance into their local approval processes and shall be fully implementing the revised standards and guidance.

k. **Source Control Measures Guidance Development:** The Dischargers shall, as part of their continuous improvement process, submit enhanced New and Redevelopment Performance Standards which summarize source control requirements for new and redevelopment projects to limit pollutant generation, discharge, and runoff, to the maximum extent practicable.

Examples of source control measures may include the following, which are offered as examples:

i. Indoor mat/equipment wash racks for restaurants, or covered outdoor wash racks plumbed to the sanitary sewer;

ii. Covered trash and food compactor enclosures with a sanitary sewer connection for dumpster drips and designed such that run-on to trash enclosure areas is avoided;

iii. Sanitary sewer drains for swimming pools;

iv. Sanitary drained outdoor covered wash areas for vehicles, equipment, and accessories;

v. Sanitary sewer drain connections to take fire sprinkler test water;

vi. Storm drain system stenciling;

vii. Landscaping that minimizes irrigation and runoff, promotes surface infiltration where appropriate, minimizes the use of pesticides and fertilizers, and where feasible removes pollutants from stormwater runoff; and,

viii. Appropriate covers, drains, and storage precautions for outdoor material storage areas, loading docks, repair/maintenance bays, and fueling areas.

A model enhanced Performance Standard and proposed workplans for its implementation shall by submitted by March 1, 2003. Implementation shall begin no later than July 1, 2003, and the status shall thereafter be reported in the Dischargers' Annual Reports, which shall also provide appropriate detail on projects reflecting the application of the enhanced performance standards consistent with Provision C.3.b. above.

l. **Update General Plans:** At the next scheduled update/revision of its General Plan occurring after October 15, 2004, each Discharger shall confirm that it has incorporated water quality and watershed protection principles and policies into its General Plan or equivalent plan, to the extent necessary, if any, to require implementation of the measures required by Provision C.3. for applicable development projects. These principles and policies shall be designed to protect natural water bodies, reduce impervious land coverage, slow runoff, and where feasible, maximize opportunities for infiltration of rainwater into soil. Such water quality and watershed protection principles and policies may include the following, which are offered as examples:

i. Minimize the amount of impervious surfaces and directly connected impervious surfaces in areas of new development and redevelopment and where feasible maximize on-site infiltration of runoff;

ii. Implement pollution prevention methods supplemented by pollutant source controls and treatment. Use small collection strategies located at, or as close as possible to, the source (i.e., the point where water initially meets the ground) to minimize the transport of urban runoff and pollutants offsite and into an MS4;

iii. Preserve, and where possible, create or restore areas that provide important water quality benefits, such as riparian corridors, wetlands, and buffer zones. Encourage land acquisition of such areas;

iv. Limit disturbances of natural water bodies and natural drainage systems caused by development including roads, highways, and bridges;

v. Prior to making land use decisions, utilize methods available to estimate increases in pollutant loads and flows resulting from projected future development. Require incorporation of structural and non-structural BMPs to mitigate the projected increases in pollutant loads and flows;

vi. Avoid development of areas that are particularly susceptible to erosion and sediment loss; or establish development guidance that identifies these areas and protects them from erosion and sediment loss; and,

vii. Reduce pollutants associated with vehicles and increased traffic resulting from development.

If amendments of General Plans are determined to be legally necessary to allow for implementation of any aspect of Provision C 3., such amendments shall occur by the implementation date of the corresponding component of the Provision.

m. **Water Quality Review Processes:** When Dischargers conduct environmental review of projects in their jurisdictions, the Dischargers shall evaluate water quality effects and identify appropriate mitigation measures. This requirement shall be implemented by March 1, 2003. Questions that evaluate increased pollutants and flows from the proposed project include the following, which are offered as examples:

i. Would the proposed project result in an increase in pollutant discharges to receiving waters? Consider water quality parameters such as temperature, dissolved oxygen, turbidity and other typical stormwater pollutants (e.g., heavy metals, pathogens, petroleum derivatives, synthetic organics, sediment, nutrients, oxygen-demanding substances, and trash).

ii. Would the proposed project result in significant alteration of receiving water quality during or following construction?

iii. Would the proposed project result in increased impervious surfaces and associated increased runoff?

iv. Would the proposed project create a significant adverse environmental impact to drainage patterns due to changes in runoff flow rates or volumes?

v. Would the proposed project result in increased erosion in its watershed?

vi. Is the project tributary to an already impaired water body, as listed on the Clean Water Act Section 303(d) list? If so, will it result in an increase in any pollutant for which the water body is already impaired?

vii. Would the proposed project have a potentially significant environmental impact on surface water quality, to marine, fresh, or wetland waters?

viii. Would the proposed project have a potentially significant adverse impact on ground water quality?

ix. Will the proposed project cause or contribute to an exceedance of applicable surface or groundwater receiving water quality objectives or degradation of beneficial uses?

x. Will the project impact aquatic, wetland, or riparian habitat?

n. **Reporting, including Pesticide Reduction Measures:** The Dischargers shall demonstrate compliance with the requirements of Provision C.3. by providing in their Annual Reports the information described in Table 1, beginning with the dates shown in Table 1 and continuing thereafter. In addition, the following information shall be collected for annual report submittal, beginning six months after adoption of this amendment, unless otherwise specified below.

i. For all new development and significant redevelopment projects which meet the Group 1 or Group 2 definitions in C.3.c., collect and report the name or other identifier, type of project (using the categories in Provision C.3.c.), site acreage or square footage, and square footage of new impervious surface. For significant redevelopment projects, the square footage of land disturbance will be reported.

ii. For projects that must implement treatment measures, report which treatment BMPs were used and numeric-sizing criteria employed, the operation and maintenance responsibility mechanism including responsible party, site design measures used, and source control measures required. This reporting shall begin in the annual report following the implementation date specified in C.3.c.

iii. A summary of the types of pesticide reduction measures required for those new development and significant redevelopment projects to be addressed under Provision C.3.c., and the percentage of such new development and significant redevelopment projects for which pesticide reduction measures were required. These measures are required under Provision C.9.d.ii., and relate directly to Provision C.3. requirements.

o. **Implementation Schedule:** The Dischargers shall implement the requirements of Provisions C.3.b. through C.3.n. according to the schedule in Table 2.

I, Loretta K. Barsamian, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on October 17, 2001.

original signed by

Loretta K. Barsamian
Executive Officer

ATTACHMENTS:
Table 1. Summary of Annual and One-Time Reporting Requirements
Table 2. Implementation Schedule

Table 1. Summary of Annual and One-Time Reporting Requirements

Provision	Information to Report	Date
C.3.b *Develop't Project Approval Process*	List of any modifications made to development project approval process	2002 & 2003 annual reports
	Optional: Submit workplan for completion of C.3.b. requirements by July 1, 2003	March 1, 2002
C.3.c.i *Group 1 Workplan*	Optional: Submit workplan identifying incremental progress toward implementation of C.3.c.i. requirements by July 15, 2003	March 1, 2002
C.3.c.iii *Project Categories*	Optional: Propose an alternative minimum project size	April 15, 2004, may submit any time
C.3.e *O & M*	Details of O&M verification program: organizational structure, evaluation, proposed improvements, list/# of inspections and follow-up	beginning with 2003 annual report
C.3.f *Peak Runoff Limitation*	Submit a detailed workplan and schedule	March 1, 2002
	Submit literature review	Sept. 15, 2002
	Submit draft Hydrograph Modification Management Plan (HMP)	March 1, 2003
	Submit final HMP	October 15, 2003
C.3.g *Waiver*	Name and location of project which was granted a waiver; Project type and size; Percent impervious surface; Reason for granting the waiver; Terms of the waiver; The stormwater treatment project or regional treatment receiving the benefit, and the date of completion of the treatment project.	In each annual report; Begin the year a waiver is granted
C.3.h *Alternate Certification*	List the projects certified by someone other than a Discharger employee.	In each annual report
C.3.j *Site Design Guidance*	Summarize the status of review, revision, and implementation of Site Design Measures Guidance and standards	In each annual report, as applicable
	Submit workplan and schedule for revision of guidance	March 1, 2002
	Submit draft proposal of revised standards and guidance	Sept. 15, 2003
	Summarize how any revisions to site design standards and/or guidance have been incorporated into local approval process	Sept. 15, 2004 Annual report
C.3.k *Source Control*	Submit draft conditions of approval document for source control measures	Sept. 15, 2002
	Summarize how any revisions to source control measures guidance document have been implemented	2003 annual report

Table 1. Summary of Annual Reporting and One-Time Requirements, continued

C.3.1 *General Plan*	Summarize any revisions to General Plans that direct land-use decisions and require implementation of consistent water quality protection measures for development projects	Year revision is made, no later than July 1, 2005
C.3.m *Environ'l Review*	Summarize any revisions to Environmental Review Processes	2003 & 2004 annual reports
C.3.n *Reporting*	List new development and redevelopment projects by name, type of project (using the categories in Provision C.3.c.), site acreage or square footage, square footage of new impervious surface. Where applicable, report treatment BMPs and numeric sizing criteria used, O&M responsibility mechanism, site design measures used, and source control measures required	In each annual report following implementation
	Describe the pesticide reduction measures required for new development and redevelopment projects; give percentage of new development and redevelopment projects for which pesticide reduction measures were required	In each annual report

Table 2: Implementation Schedule

Provision	Action	Implementation Date
C.3.b	Modify development project approval process as needed	July 1, 2003*
C.3.c	Require stormwater treatment BMPs at Group 1 Projects	July 15, 2003*
Project Categories	Require stormwater treatment BMPs at Group 2 Projects in addition to Group 1 Projects	October 15, 2004
	Optional: Propose an alternative minimum project size	April 15, 2004
C.3.e *O & M*	Implement an O&M verification program for Group 1 Projects with structural in-ground BMPs such as sand filters, filter inlets, detention/ retention basins	July 15, 2003
	Implement an O&M verification program for Group 1 Projects with landscape and all other BMPs, such as vegetated swales, dry or wet ponds	October 15, 2003
	Begin reporting on O&M verification program in Annual Report	September 15, 2003

* This implementation date is subject to submittal of an acceptable workplan by March 1, 2002. If no acceptable workplan is received, the implementation date shall be October 15, 2002.

Table 2: Implementation Schedule, continued

C.3.f *Peak Runoff Limitation*	Submit a detailed workplan and schedule	March 1, 2002
	Submit literature review	Sept. 15, 2002
	Submit draft HMP	March 1, 2003
	Submit final HMP for Regional Board approval	October 15, 2003
	Implement HMP	Following Regional Board approval
C.3.g *Waiver*	Report on any waiver(s) granted by the Discharger in Annual Report, due September 15 of each year	Begin the year a waiver is granted
C.3.j *Site Design*	Submit workplan and schedule for completion of review, revision, and implementation of design standards and guidance	March 1, 2002
	Submit draft proposal of revised standards and guidance	September 15, 2003
	Incorporate revisions into local process and fully implement site design standards and guidance	September 15, 2004
C.3.k *Source Control*	Submit draft conditions of approval document for source control measures	September 15, 2002
	Implement source control measures guidance document	March 1, 2003
C.3.1 *General Plans*	Confirm that any water quality and watershed protection principles and policies necessary to implement measures required by Provision C.3. for applicable development projects have been incorporated into General Plan or equivalent plan	Next scheduled update/revision to occur after October 15, 2004
C.3.m	Revise Environmental Review Processes as needed to evaluate water quality impacts of stormwater runoff from new development and significant redevelopment	March 1, 2003
C.3.n *Reporting*	See Table 1	See Table 1