3. Water Reliability

Overview

This chapter describes the balance between water demands (Chapter 1) and water supplies (Chapter 2). In particular, it identifies the current level of reliability of meeting current water demands with current sources of water supplies. Then, it shows how future water supply reliability can be improved via water conservation and water recycling. The appropriate level of reliability for the City is a policy question for the City Council, and depends on the level of risk the City is willing to take and how much the City is willing to pay to minimize this risk with respect to the frequency and magnitude of water shortages.

3.1 Current Water Reliability

The City is in a high risk, low reliability situation at this time. The City has one of the lowest levels of reliability of the 29 BAWUA member agencies. The SFPUC water supply situation will remain unchanged until at least July 2009 when the existing Master Water Sales Contract expires and is renegotiated. It is difficult to predict the outcome of the renegotiations, but it is unlikely that City will improve its water supply reliability from this source.

When the SFPUC declares a water shortage, Redwood City will be required to make relatively large water use cutbacks as specified in the Interim Water Shortage Allocation Plan adopted by the SFPUC and all suburban purchasers (including Redwood City) in 2001, pursuant to section 7.03(a) of the Master Water Sales Contract.

Table 3.1 shows the current level of water supply reliability.[11] Because the future is unknown, reliability must be expressed in probabilistic terms using the best information available. It is important to note that, as part of the 1984 Master Water Sales Contract, the City has a contractual "water supply assurance" of 12,243 acre-feet per year (AFY). However, this amount relates to a legal definition and not an absolute volume guaranteed. In times of shortage, the SFPUC will provide less than the assurance. In non-shortage periods, the City has purchased as much water as it needs.[12] For FY 2000-01, the City purchased 13,199 AF.

From a statistical perspective, given current circumstances for a given year there is a:

[11] Water Supply Reliability, Technical Memorandum dated August 15, 2002 by John Whitcomb, Ph.D.
[12] The Urban Water Management Act in 10631(c) asks agencies to identify water supplies in average, single dry year, and multiple dry years. In an average year, the City is not constrained in its water purchases given current circumstances. A single dry year is best described as a 10% SFPUC system-wide cutback (1931, 1961, 1977). Multiple dry years are best described as a 20% SFPUC system-wide cutback (1990 to 1992).

- 7.6% chance of a 10% Hetch Hetchy system-wide cutback. A 10% system-wide cutback equates to a 12% cutback for BAWUA in aggregate. A 12% cutback for BAWUA equates to a 17.5% cutback for Redwood City. A 17.5% cutback is a "major" event requiring water rationing.
- 2.5% chance of a 20% Hetch Hetchy system-wide cutback. A 20% system-wide cutback equates to a 23.6% cutback for BAWUA in aggregate. A 23.6% cutback for BAWUA equates to a 28.4% cutback for Redwood City. A 28.4% cutback would be a "dramatic" crisis involving significant disruptions and curtailments.

Table 3.1 Current Water Reliability

Scenario	(1) Hetch Hetchy System Demand Cutback	(2) BAWUA Demand Cutback	(3) RWC Demand Cutback	(4) RWC Allocation AFY	(5) Historical Probability	(6) Future Probability 2010
1	0%	0.0%	0.0%	Not limited	NA	NA
2	-5%	-6.4%	-12.2%	11,584	NA	NA
3	-10%	-12.0%	-17.5%	10,891	7.6%	6.3%
4	-15%	-18.2%	-23.3%	10,124	NA	5.1%
5	-20%	-23.6%	-28.4%	9,456	2.5%	2.5%
6	>-20%	>-23.6%	>-28.4%	<9,456	0.0%	2.5%

(1) The Interim Water Shortrage Allocation Plan addresses system wide cutbacks up to 20%.
(2) Values provided by Nicole Sandkulla, Bay Area Water Users Association.
(3) Based on worksheet from Nicole Sandkulla, updated with FY 1999/00 and 2000/01 water use.
(4) Based on FY 2000/01 water use totals.
(5) Probability of each scenario occurring in a given year based on hydrology from 1921 to 1999.
Information taken from Figure 2-5 in SFPUC Water Supply Master Plan, April 2000.
The probability of a 5% and 15% cutbacks not addressed, hence reported as not available (NA).
(6) Future probabilities based on interpolation of the 260 and 325 MGD demand scenarios in master plan.

3.2 Future Water Reliability

3.1.1 Base Case Situation

Assuming the City does not implement new water conservation programs or develop new water supplies, the frequency and magnitude of the cutbacks will increase as members of BAWUA use more water in the future. In fact, BAWUA's water use has increased in the last few years and is projected to increase over time to at least 2030 (BAWUA Annual Survey of Results FY 2000-01, December 2001). The last column of Table 3.1 shows an estimate of the degradation in water supply reliability for the year 2010. The frequency of cutbacks equal to or exceeding 17.5% will grow from 10.1% to 16.4% over this period. Moreover, the increasing frequency of cutbacks will be of greater magnitude.

3.1.2 Future Alternative

The City can, however, significantly improve its reliability and minimize the magnitude of water cutbacks by implementing water conservation and water recycling projects. Figure 3.1 shows how passive conservation, active conservation, and water recycling can incrementally reduce the City's water demands over time to be closer to the water

supplies available from SFPUC during times of shortage. The "SFPUC Max Supply 10% Risk" line represents the maximum water available from the SFPUC with 10 percent probability (e.g., in 1 out of 10 years the City can expect to get this amount or less).

Figure 3.1 Water Demand and Supply Balance

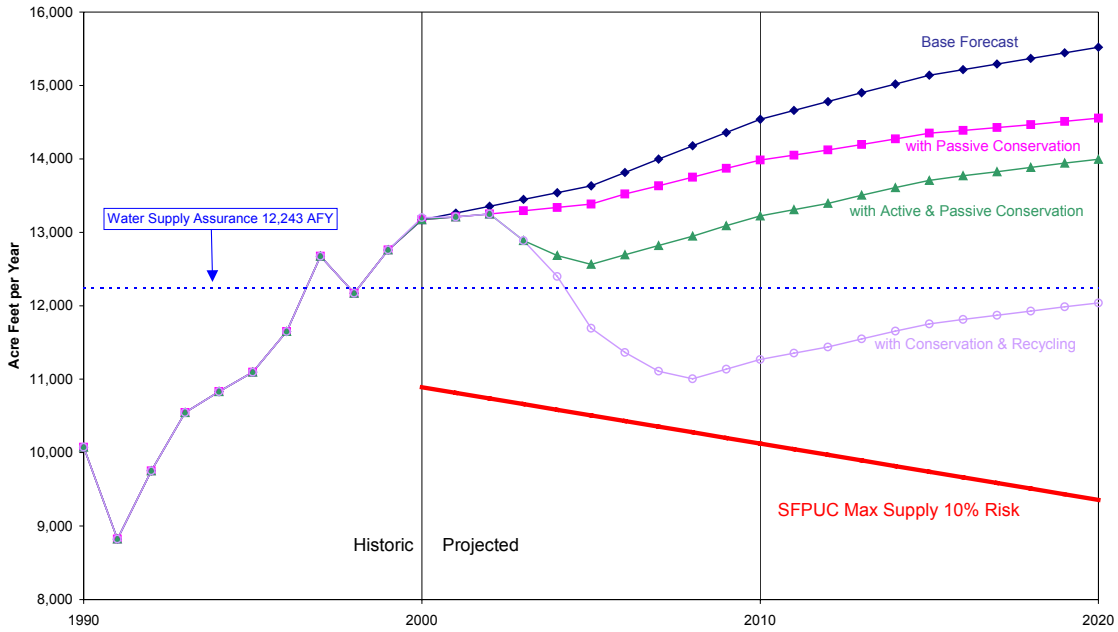
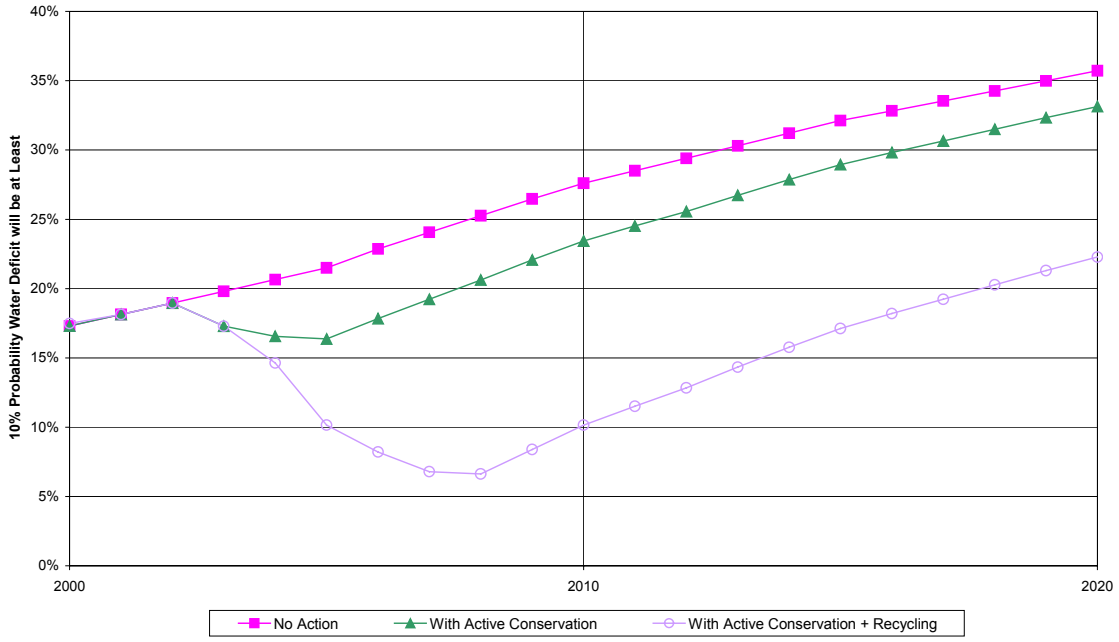


Figure 3.2 redisplays Figure 3.1 information with a focus on the water deficit between the SFPUC water supplies at 10% risk and three water demand scenarios. The top line shows that the water deficit if the City takes no action (this includes only passive conservation) will grow from the current 17.5% to over 35% in 2020. If the City executes the entire BMP implementation plan identified in Chapter 1, the deficit would diminish to 16% in 2005 and would grow again to 33% by 2020. If the City executes active conservation and constructs the expanded water recycling system, the deficit would diminish to 7% in 2007 and would be only 22% in 2020.

This analysis shows that only by implementing a combination of conservation and water recycling can the City bring its water supply/demand balance into a reasonable level of risk, within the next five to seven years.

Figure 3.2 Water Supply Deficit Scenarios



3.3 Water Shortage Contingency Plan

Currently, Redwood City's sole water supplier is the SFPUC through the Hetch Hetchy regional water system. Like other water delivery systems, Hetch Hetchy is vulnerable to periodic, short-term outages.

One shortage scenario would occur from catastrophic interruption (e.g., earthquake). Because Hetch Hetchy water is not filtered, it is subject to strict water standards set by the state Department of Health Services (DHS). Weather and/or other events can increase turbidity levels beyond standards requiring the Hetch Hetchy supply to be shut off until levels drop to within standards. Hetch Hetchy supply outages could last a week or longer. The City is also vulnerable to local failures in its water distribution system.

Assembly Bill 1823, the Wholesale Regional Water System Security and Reliability Act, was passed by the California Legislature on August 28, 2002, and subsequently signed into law by Governor Davis. The Act adds and repeals Division 20.5 to the Water Code, relating to regional water systems, including:

- Adopt a plan to fix the system. The SFPUC, as owner and operator of the Hetch Hetchy regional water system, on or before February 1, 2003 shall adopt a capital improvement program to restore and improve the regional water system and help avoid seismic-related catastrophes. A copy of the program, including a schedule for completion, shall be submitted to DHS. The program shall contain a financing plan. Section 73502(a).

- Emergency response. The SFPUC shall prepare an emergency response plan describing how water service will be restored in the event of a catastrophic interruption. During a major water outage, available water shall be distributed on an equitable basis, to the extent feasible given physical damage to the regional system. Section 73503.

Redwood City, via its membership in BAWUA and in the newly forming Bay Area Water Supply and Conservation Agency, is currently collaborating with San Francisco, neighboring water service areas and with the County of San Mateo Office of Emergency Services in the formulation of the San Francisco Emergency Repair and Response Recovery Plan (ERRP). The draft ERRP is due to the State by June 30, 2003, with a final plan due in September 2003.

Another source of outage could occur from hydrologic water shortages such as the 1976-77 and 1987-92 droughts. The analysis included in the last section factored such droughts into its estimates of reliability.

When City water demands exceed SFPUC water supplies, the City must intervene to moderate its demands or acquire supplemental supplies. Although purchasing supplemental supplies is conceptually possible, neighboring water agencies will likely be in similar water shortage conditions and finding willing sellers maybe impossible. Hence, the water shortage contingency plan focuses on mechanisms necessary to reduce water demands to meet balance the supply situation.

Table 3.2 summarizes the water shortage contingency plan. It contains five stages successively addressing cutbacks of greater magnitude. The City will largely rely on its Water Allocation Program to allocate maximum water use for its customers during shortages. Customers exceeding their water allocations will face higher water rates, especially during the higher stages of the plan.

The water shortage contingency plan has two guiding principles:

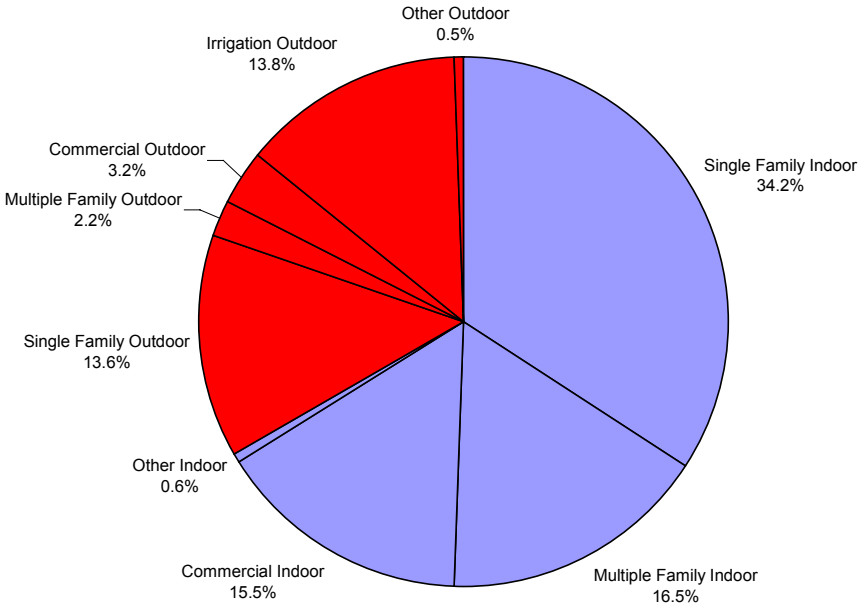
1. Water cutbacks are in proportion to outdoor water use. Outdoor water use is an important, but relatively discretionary end use in comparison to indoor water uses related to drinking, cooking, and sanitary activities.
2. Water cutbacks are to be based on water needs, not historical water use whenever possible. Customers knowing water shortage allocations are based on historic water use may tend to overuse water during non-drought periods so as to give them a bigger allocation during a shortage. Expressed in a different way, customers implementing water conservation activities (“demand hardened”) should not be penalized by receiving the same percentage cutback as non-conserving customers.

Table 3.2
Water Shortage Contingency Plan

Stage	Water Reduction	City Actions
1	0 to 10%	❑ Public education and voluntary cutback request ❑ Purchase limited amounts of San Francisco water from as needed at perhaps increased prices ❑ Cutback flushing of water distribution mains for water quality purposes
2	10 to 20%	❑ Aggressive public conservation education and request ❑ Acceleration of conservation BMP implementation ❑ Water Allocation Program combined with moderate water rate incentives ❑ Landscapes using potable water cutback up to 60% ❑ Moratorium on new water connections ❑ Cutback flushing of water distribution mains for water quality purposes
3	20 to 30%	❑ Aggressive public conservation education and request ❑ Acceleration of BMP implementation ❑ Water Allocation Program combined with significant water rate incentives ❑ Landscapes using potable water cutback up to 90% ❑ Moratorium on new water connections ❑ Cutback flushing of water distribution mains for water quality purposes
4	30 to 50%	❑ Aggressive public conservation education and request ❑ Acceleration of BMP implementation ❑ Water Allocation Program combined with severe water rate incentives ❑ Ban potable water used for irrigation of turfgrass or all outdoor uses ❑ Moratorium on new water connections ❑ Cutback flushing of water distribution mains for water quality purposes
5	50% or greater	❑ If system is operational, prohibit all but water used for basic drinking, cooking, and necessary human hygiene. ❑ If system is not operational, establish basic water ❑ distribution stations/nodes for essential living conditions ❑ Moratorium on new water connections

Figure 3.3 shows that about one third of water use over all customer classes is associated with outdoor water use.

Figure 3.3 Indoor/Outdoor Water Use, 2000



Based on this information and the first guiding principle, Table 3.3 shows the water cutbacks by customer class associated with 20% and 30% cutback scenarios. The irrigation class will get burdened with the largest percentage reductions. The single-family class will have cutbacks just under the total required cutback. The multiple-family and commercial classes will experience the smallest percentage cutbacks because their water uses are largely related to indoor purposes.

Table 3.3
Water Cutbacks by Customer Class

Customer Class	20% Total Cutback	30% Total Cutback
Single Family	17.1%	25.7%
Multiple Family	7.2%	10.8%
Commercial	10.2%	15.2%
Irrigation	60.2%	90.3%
Other	26.6%	39.9%

Regarding the second guiding principle, the Water Allocation Program (WAP) will be used to allocate water for different cutback scenarios. Cutback percentages will be applied to each individual customer's water allocation. Allocations for single-family customers, as described in Chapter 1, are based on number of occupants, size and type of landscaping, weather, and presence of a pool. The allocations are not based on historical water use.

Currently, the WAP is setup for single-family customers only. The WAP could easily be adjusted to include the multiple-family class, and to the landscape class using landscape area measurements collected via the BMP 5 program. For the commercial class, it is difficult to assess water need because of the heterogeneous nature of how water is used. For this class, other approaches will be needed to avoid basing cutbacks on historical water use.[13]

During droughts, the City will cutback or suspend its proactive program of flushing water distribution mains. The City can also read its water production on a daily basis to keep close watch on water consumption.

The City has a policy of retaining $2 million as an emergency reserve, which may include financial contingency to drought circumstances. The City also has the ability to changes its water rates relatively quickly to secure the financial integrity of its water enterprise. Extra revenues collected via higher rates associated with WAP and other conservation incentives will also be used to offset loss of revenues from lower water sales.

The City's draft contingency ordinance consists of the format of the water shortage ordinance used in the early 1990s as shown in Appendix D. The content of the ordinance follows the water shortage contingency plan shown in Table 3.2.

[13] For example, a surcharge on all commercial water use could be employed to moderate water demands to acceptable levels. Surplus revenues would need to be distributed back to the class via lower meter charges, expanded commercial conservation programs, or other to ensure cost-of-service equity over the long term.