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Subgroup: Improve Water Quality

Chapter 14 Drinking Water Treatment and Distribution

Providing a reliable supply of safe drinking water is the primary goal of public water systems in California. To achieve this goal, public water systems must develop and maintain adequate water treatment and distribution facilities. In addition, the reliability, quality, and safety of the raw water supply are critical to achieving this goal. In general, public water systems depend greatly on the work of other entities to help protect and maintain the quality of the raw water supply. Many agencies and organizations have a role in the protection of water supplies. For example, the basin plans developed by the Regional Water Quality Control Boards (Regional Boards) recognize the importance of this goal and emphasize the protection of water supplies in California—both groundwater and surface water.

A public water system is defined[1] as a system for the provision of water for human consumption, through pipes or other constructed conveyances, which has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days of the year.

Public water systems are classified into three categories depending on the permanency of the customers: (1) a *community water system* serves yearlong residents; (2) a *nontransient noncommunity water system* serves the same people for at least six months per year; and (3) a *transient noncommunity water system* serves 25 or more people for at least 60 days per year. Table 14-1 shows the number of public water systems in California by class. Public water systems serve approximately 36.6 million of the estimated 37.7 million people throughout the state, or 97 percent of the state's population. The remaining estimated 1.1 million people in the state (3 percent of the population) receive their drinking water from private wells serving individual residences and from other sources. Figure 14-1 shows water system class by percent of total number of public water systems in California.

Table 14-1 Public water systems in California by class

Public Water System Classification	Number
Community	3,117
Nontransient noncommunity	1,517
Transient noncommunity	3,140
Total number of public water systems	***7,774***

Note: Based on CDPH records. Does not include water systems serving Native American Tribes.

Healthy individuals and communities cannot exist without safe, reliable water

[1] The term "public water system" is defined in statute: California Health and Safety Code, Part 12, Chapter 4, Article 1, Section 116275(h).

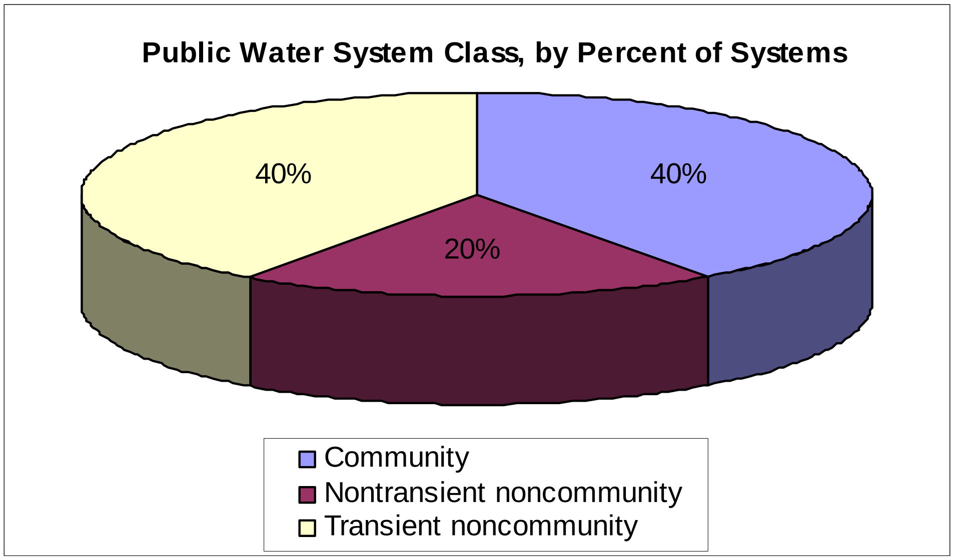

Figure 14-1 Public Water System Class by Percent of Systems

Under the California Safe Drinking Water Act (SDWA), the California Department of Public Health or CDPH (formerly the Department of Health Services) Drinking Water Program has established regulations to ensure high quality drinking water is provided by all public water systems. In developing drinking water regulations and carrying out the public water system regulatory program, CDPH recognizes that healthy individuals and communities cannot exist without safe, reliable water. This is a necessity for both drinking water and to meet basic sanitary needs.

Drinking water regulations mandated by the California SDWA apply to all public water systems regardless of their type of ownership. There are two basic ownership classifications, publicly owned and privately owned water systems. Publicly owned systems include municipalities, districts, and government systems. Privately owned systems include investor-owned utilities, mutual water companies, mobile home parks, and water associations, and may also include various commercial enterprises such as restaurants, hotels, resorts, employee housing, etc., that have their own water supply. While CDPH regulates all public water systems for all aspects that may affect water quality regardless of the type of ownership, the California Public Utilities Commission (CPUC) regulates only privately owned systems for the purposes of establishing appropriate water rates. The CPUC regulates sole proprietorships, partnerships and corporations that provide water service to the public for profit. Mutually owned systems and homeowners associations are exempt from CPUC oversight if they provide water only to their stockholders or members. Table 2 provides a summary of the number and size of the CPUC-regulated water systems.

Table 14-2 Number and type of CPUC-regulated water agencies

CPUC Class	Number of connections served	Number of agencies in class
A	>10,000	10 [a]
B	2,000–10,000	4 [a]
C	500–2,000	24
D	<500	91

Note: Information obtained from the CPUC

[a] Many of the private agencies included in the number shown operate multiple water systems throughout California

At the federal level, the US Environmental Protection Agency (EPA) has the responsibility to ensure the implementation of the federal SDWA and related regulations. The State of California has primacy for the public water system regulatory program in California and works closely with EPA in carrying out the program. In addition, local primacy agencies (typically the county environmental health departments) have the responsibility for the regulation of many small public water systems (typically those serving less than 200 homes) in 39 of the 58 California counties. EPA provides regulatory oversight of Tribal water systems.

Most groundwater wells used for drinking water are constructed in a manner to intercept only high quality groundwater. However, some groundwater wells require some level of treatment to achieve the high level of quality mandated by State and federal regulations for a safe, reliable supply of water. All surface water supplies used for drinking water must receive a high level of treatment to remove dirt, pathogens and other contaminants before they are suitable for consumption. Once the water is treated to drinking water standards, this high level of water quality must be maintained as the water passes through the distribution system to customer taps. Water treatment and distribution issues are discussed in detail in this resource management strategy. An increasing effort is aimed at preventing pollution and matching water quality to water use. This work is described elsewhere in this volume under the resource management strategies Pollution Prevention and Matching Water Quality to Water Use.

The use of bottled water is an increasing trend in the United States and California, with about one-third of Americans consuming it regularly. The National Bottled Water Association reports US consumption of bottled water was 29.3 gallons per person in 2007, and growing by over one gallon annually. In 2005, California ranked No. 1 in the nation for percent of the bottled water share (23.9 percent) and was ranked No. 3 behind Arizona and Louisiana for per capita consumption at 51.2 gallons (Donoho 2007).

Some of the reasons individuals choose to use bottled water include convenience, image, taste, and perceived health benefits. On the other hand, many consumers are becoming aware of the environmental impact associated with the production, transportation and waste disposal of bottled water. While tap water and bottled water are regulated differently, both are generally safe, healthy choices. Tap water (as provided by a public water system) provides public health and fire protection among its other advantages to a modern quality of life. Bottled water costs significantly more than tap water for the volume consumed in cooking and drinking.

Bottled water is regulated by the US Food and Drug Administration under the 1938 Food, Drug and Cosmetic Act (FDCA). California regulates bottled and vended water to a much greater degree than provided in the FDCA. California's Sherman Food, Drug and Cosmetic Law is the basic statute that authorizes such regulation and is implemented by the CDPH Food and Drug Branch.

Drinking Water Treatment in California

Public Health

Water treatment includes processes that treat, blend, or condition the water supply of a public water system for the purpose of meeting primary and secondary drinking water standards. These processes include a wide range of facilities, such as basic chlorine disinfection, surface water filtration, and, more recent, technical advances—membrane filtration, ultraviolet light, and ozone to meet pathogen removal and/or inactivation as well as disinfection requirements (while controlling disinfectant byproducts) for surface waters; chemical removal and blending facilities; or buffering to ensure the water is not corrosive in the distribution system and customers' piping. Blending treatment, a process of reducing the concentration of a contaminant in one water source by blending or dilution with water that has a lower concentration, is an acceptable practice for meeting chemical water quality standards, but not for meeting microbiological standards. Fluoridation treatment, now commonly practiced in California, may be used to add fluoride to an optimal level to provide dental health benefits.

Widespread treatment of drinking water, especially disinfection, filtration and fluoridation, was a great public health advancement of the 20th century. The 21st century promises to bring additional advances in water treatment technologies to improve water use efficiency (increase water recovery and reduce waste streams) and manage energy consumption. Water recovery is the water converted to potable water in a treatment plant—the remainder is a residual or waste stream. It is important for treatment processes in water-short areas to maximize the amount of a water supply that can be converted to potable water by reducing the amount that is discharged as a waste such as water used to backwash, or clean, filter vessels.

Public water systems in California use more than 17,000 groundwater wells and surface water supplies to meet the water supply needs of consumers. Some of these need treatment to meet either aesthetic quality or to remove or inactivate contaminants prior to consumption. These could include minerals, metals, chemicals from industry or agriculture, pathogens and radiological constituents. Information on the number and type of water treatment plants installed on public water system sources in California is shown in Table 14-3.

Table 14-3 Treatment plants on California public water system sources

Type of contaminant	Number of treatment plants
Surface water[1]	660
Nitrate	150 [a]
Arsenic	65 [a]
Radiological	15 [a]
Volatile and synthetic organic chemicals	220 [a]
Aesthetic water quality	350

Note: These estimates are based on a survey of CDPH offices and from CDPH records.

[1]Surface water, as defined under the California Surface Water Treatment Rule, CCR, Title 22, Section 64651.83, means "all water open to the atmosphere and subject to surface runoff..." and hence would include all lakes, rivers, streams and other water bodies. Surface water thus includes all groundwater sources that are deemed to be

under the influence of surface water (i.e., springs, shallow wells, wells close to rivers), which must comply with the same level of treatment as surface water.

[a] Includes chemical removal and blending treatment facilities

Fluoridation

Fluoridation of community drinking water has been practiced in the United States for more than 60 years. It is accepted as a safe and effective public health practice for people of all ages. The previous five Surgeons General have recommended communities fluoridate their water to prevent tooth decay. California's fluoridated drinking water act, Assembly Bill 733, became law in 1995, requiring water systems with 10,000 or more service connections to fluoridate once money from an outside source is provided for both installation and operation and maintenance costs. CDPH is also responsible for identifying funds to purchase and install fluoridation equipment for public water systems.

During fluoridation treatment of public water system supplies, many water systems provide optimal fluoridation treatment. Optimal fluoridation means that the water treatment facility and distribution system are able to provide a consistent level of fluoride at the appropriate prophylactic level. Other water systems provide variable fluoridation at levels up to optimal level depending on many factors, including time of year, water demand, and the use of sources that may not have fluoridation treatment facilities. Variable fluoridation is most often the result of a water system receiving fluoridated water from a wholesale provider, while also using local unfluoridated water sources. Information on the number of public water systems that are providing fluoridation in California is shown in Table 14-4.

Table 14-4 Fluoridation in California

	Number of systems	Population served (millions)
Public water systems providing *optimal* fluoridation		
Systems adding fluoride to the *optimal* level	54	9.5
Systems receiving fluoridated water at the *optimal* level	73	3.0
Total systems implementing *optimal* fluoridation	*127*	*12.5*
Public water systems providing *variable* fluoridation		
Systems providing fluoridated water at *variable* levels	136	9.3

Note: Information obtained from CDPH Web site at
http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Fluoridation.aspx

Regulation

Both the EPA and CDPH have ongoing programs for improving public health through new or more stringent drinking water regulations. These regulations include monitoring requirements, maximum contaminant levels (MCLs) in the water provided to the customer, multi-barrier, treatment requirements, permitting requirements, public notification and more. These regulations include specific maximum contaminant levels (MCL) for constituents of health concern that are found to be present in drinking water sources. In California, new drinking water standards—the MCLs—are adopted only after development of a Public Health Goal (PHG), which is the level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency MCLs take into account not only chemicals' health risks but also factors such as their detectability and treatability, as well as costs of treatment. The Health & Safety Code requires CDPH to establish a contaminant's MCL at a level as close to its PHG as is technically and economically feasible, placing primary emphasis on the protection of public health.

As an example of the adoption of a more stringent drinking water regulation, in 2003, the EPA adopted a reduced MCL of 10 micrograms per liter (ug/L) for arsenic. The previous MCL had been 50 ug/L. The new MCL is based primarily on carcinogenic effects. CDPH is moving toward adopting the arsenic MCL for California by proposing in July 2008 an MCL for arsenic of 10 ug/L, the same as the federal standard. The PHG for arsenic was set at 0.004 ug/L.

Other significant drinking water regulations adopted recently by EPA include the following:

Long Term 1 (2002) and Long Term 2 (2006) Enhanced Surface Water Treatment Rule for improved protection of consumers from Cryptosporidiosis*;*

1. The Stage 2 Disinfection Byproducts Rule (2006) for additional protection against carcinogenic effects of disinfection byproducts.

In some cases, the State of California has adopted MCLs in advance of the federal adoption of an MCL. For example, in 2007, CDPH adopted a perchlorate MCL of 6 ug/L. This MCL is based primarily on potential adverse effects on the thyroid. The EPA has indicated that it does not intend to adopt an MCL for perchlorate; rather, it will leave this up to each state.

Page 14-6, second full paragraph -

There are sometimes issues in achieving simultaneous compliance with two sets of regulations that have different goals. Thus, a water system trying to comply with one regulation may make a change in treatment that results in a violation with another regulation. Balancing the inactivation and removal of pathogens through disinfection with the production of disinfection byproducts (such as trihalomethanes and haloacetic acids) is a problem faced by virtually all water systems in California that treat surface water sources. The work of water agencies towards optimizing treatment to meet multiple regulatory requirements in the disinfection process is now better understood.

New Technology

New or innovative treatment technologies are often developed to address new or more stringent drinking water standards, to improve the efficiency of a contaminant removal, or simply to reduce either the treatment plant footprint, energy consumption or to reduce or eliminate waste streams from the treatment process. Innovative environmental technologies hold the promise of being more effective than traditional methods and able to address the far more complex environmental problems that we face today. Technologies increasingly used in California as a result of new regulations include:

Ultraviolet (UV) disinfection treatment to comply with disinfection byproducts under the Stage 2 Disinfection Byproducts Rule and requirements for the treatment of surface waters under the Long Term 2 Enhanced Surface Water Treatment Rule.

Arsenic removal technologies including adsorptive (disposable) media to allow small water system compliance with the reduced arsenic MCL.

1. Biological treatment in the form of fixed bed, fluidized bed and membrane bioreactors to treat for perchlorate, and now being demonstrated for nitrate and other contaminants.

As a result of both increases in demand and the relative scarcity of new water supplies, many water providers are now shifting toward the treatment of sources formerly considered unsuitable for domestic use. Treatment processes such as reverse osmosis are used to desalt brackish shallow groundwater for potable uses and are discussed in greater detail in the resource management strategy, Desalination. The relatively new technology of membrane filtration is now common for new surface water treatment plants.

Box 14-1 New Membrane Filtration Plant Application

The San Diego County Water Authority began operation of a new 100 million-gallon per day Twin Oaks Valley Water Treatment Plant, a membrane filtration surface water treatment plant, in April 2008—producing enough potable water to supply up to 220,000 typical four-person households each year. The treatment plant is one of the largest submerged membrane treatment plants in the world.

As new treatment technologies are introduced into the water industry, it must be verified that they reliably remove the targeted contaminants and incur only reasonable operating costs. CDPH has an extensive process for reviewing and accepting new treatment technologies proposed for use in California. The EPA Environmental Technology Verification (ETV) Program also verifies the performance of innovative technologies that have the potential to improve protection of human health and the environment, thereby accelerating the entrance of new environmental technologies into the domestic and international marketplaces.

Desalination

Proposition 50 included grant funding under Chapter 6 for demonstration of desalination and new treatment technologies. Funds are available to local agencies, water districts, academic and research institutions. The Proposition 50 desalination funds are being used for construction, pilot and demonstration projects, research and development, and feasibility studies to increase new water supplies using desalinization. The projects funded include desalination facilities in Marin, Alameda, Monterey, Ventura, and San Bernardino counties. Pilot projects in Long Beach, Santa Cruz, San Diego, and Los Angeles are among those that have received grants under the proposed funding plan. Research and development activities at the Lawrence Livermore National Laboratory and the University of California, Los Angeles, are included in the recommendations, as are feasibility studies by agencies in the Bay Area, Monterey, and Riverside County. Proposition 50 grant funding for demonstration of new treatment technologies includes the evaluation of tailored granular activated carbon in Redlands; concurrent removal of nitrate and Dibromochloropropane in the Central Valley; and removal of N-nitrosodimethylamine, endocrine disruptor chemicals, and pharmaceuticals and personal care products in South Delta Water; and a chromium 6 removal demonstration facility in Southern California.

New treatment technologies are often more energy-intensive than traditional water treatment processes, especially as we strive to reduce contaminants in treated drinking water. The Long Beach Water Department is undertaking a long-term study to evaluate the feasibility of desalination treatment with significantly lower energy consumption than typical reverse osmosis desalination.

Box 14-2 Prototype Desalination Facility

In an exclusive public sector partnership, Long Beach Water, along with the Los Angeles Department of Water & Power, and the US Bureau of Reclamation, has constructed a 300,000 gallon-per-day prototype desalination facility, the largest seawater desalination research and development facility of its kind in the United States.

The primary research at the prototype facility will be centered on further development of a breakthrough membrane technology known as the "Long Beach Method". Already, two different—and independent—analyses have shown the technology to be 20 to 30 percent more energy efficient than more traditional desalination methods.

In addition, Long Beach Water and the US Bureau of Reclamation are undertaking design and construction of an "Under Ocean Floor Seawater Intake and Discharge Demonstration System", the first of its kind in the world, and are seeking to demonstrate that viable, environmentally responsive intake and discharge systems can be developed along the coast of California.

Drinking Water Distribution in California

Water that is treated and/or conditioned to the point that it meets drinking water standards is considered to be "finished water", suitable for distribution to consumers for all potable water uses. Water distribution systems consist of pipes, storage tanks, pumps and other physical features that deliver water from the source or water treatment plant to the customer's connection. Even high quality drinking water is subject to degradation as it moves through the distribution system to the tap. For example, contaminants can enter the distribution system via backflow from a cross-connection, permeation and leaching, during water main repair or replacement, and contamination via finished water storage facilities. Within the distribution system, water quality may deteriorate as a result of microbial growth and biofilm, nitrification, corrosion, water age, effects of treatment on nutrient availability (contributing to microbial growth and biofilm), and sediments and scale within the distribution system (EPA 2006c).

CDPH has established laws and regulations for the design, construction, operation and maintenance of distribution systems primarily through the California Waterworks Standards (CDPH 2008a). Regulations mandate monitoring distribution system water quality for coliform bacteria, chlorine residual, lead, copper, physical water quality parameters, and disinfection byproducts. California also has adopted regulations for the control of cross-connections and backflow prevention within a water distribution system to protect the quality of the water.

In 2000, a federal advisory committee working on the development of more stringent EPA regulations for disinfectant byproducts and microbial contamination noted the following as part of its key considerations on developing further regulations in these areas:

> "Finished water storage and distribution systems may have an impact on water quality and may pose risks to public health.
>
> Cross-connections and backflow in distribution systems represent a significant public health risk.
>
> Water quality problems can be related to infrastructure problems and aging of distribution systems may increase risks of infrastructure problems.
>
> Distribution systems are highly complex and there is a significant need for additional information and analysis on the nature and magnitude of risk associated with them."

The maintenance of water quality within the distribution system has received considerable attention in recent years, especially as systems have modified methods of treatment. Changes to the methods and levels of disinfectants can create the potential for reduced control of microbial contaminants that may be present in the distribution system.

An example of the serious consequences of potential degradation in the distribution system occurred during March of 2008 in the town of Alamosa, Colorado. This town of about 8,500 residents experienced an extensive Salmonella outbreak that sickened at least 389 people; 16

were hospitalized. The contamination was attributed to the town's drinking water. In this case, the water supply wells were found to be clean, and the source of the Salmonella within the distribution system has yet to be identified, but were noted to be present in indigenous wildlife.

Water utilities are also constantly making improvements to their distribution systems, including increasing the reliability of their water supplies. One example is the installation of emergency water interties between neighboring water utilities. These provide a backup source (the neighboring water system) in the case of an outage due either to some unforeseen emergency or potential disaster, and also allow a water utility to shut down a part of its system to do necessary maintenance without interrupting service to customers.

For example, there is an emergency intertie between the EBMUD, City of Hayward, and SFPUC to supply **treated** water between the three water systems and is intended to be used during planned outages for needed maintenance and to avoid service interruptions. EBMUD has two small interties, each able to carry 4 million gallons per day, with the City of Hayward, which adjoins its service area. The San Francisco Public Utilities Commission, which is the agency in charge of the Hetch Hetchy water used by many Bay Area water districts and residents, constructed an intertie with the Santa Clara Valley Water Agency and has been considering another. These interties may also play a role in the security of the water distribution system by creating a backup source should a terrorist action disrupt the source of supply from a water provider.

In other cases, interties can provide untreated water between utilities to provide untreated source water in an emergency. For example, Contra Costa Water District (CCWD), whose service area is crossed by East Bay Municipal Utility District's (EBMUD) Mokelumne pipeline, has an intertie which can be used to transfer untreated water from EBMUD to CCWD in an emergency.

Interties are one of the strategies for improving water supply reliability and quality which were recommended by the CALFED August 28, 2000, Record of Decision.

Potential Benefits of Drinking Water Treatment and Distribution

Improved water quality can directly improve the health of Californians, thereby improving the state's standard of living and reducing the burden and costs on the state's healthcare system.

The recently adopted California MCL for perchlorate and the federal MCL for arsenic reduce the permissible level of these contaminants and result in direct benefits. Perchlorate exposure is of public health concern because it interferes with the ability of the thyroid gland to produce hormones. In the very young, hormones are needed for normal prenatal and postnatal growth and development, particularly normal brain development. Therefore, a reduction of thyroid hormones is a serious concern. In adults, thyroid hormones are needed for normal body metabolism. About 515,000 people in California will avoid exposure to perchlorate at levels above the MCL annually as a direct result of the perchlorate regulation (CDPH 2007). The federal arsenic MCL of 10 ug/L will result in a reduction in exposure for more than 790,000 people and a theoretical reduction of 57 lung and bladder cancer cases per year in California (CDPH 2004).

Adequate operation and maintenance of the distribution system network will reduce delivery problems (main or tank ruptures, water outages) and ensure delivery of high quality water. In California, operators of drinking water distribution systems must be certified at the appropriate level depending on the size and complexity of the distribution system. This requirement for certification helps to ensure a competent level of operation of distribution systems.

Similarly for water treatment facilities, proper operation and maintenance is essential for achieving optimum water treatment plant performance. In California, operators of drinking water treatment facilities must be certified at the appropriate level depending on the size and complexity of the treatment facilities.

Water fluoridation ranks as one of ten great public health achievements of the 20th century according to the Surgeon General in 2000. Fluoridation of public water supplies targets the group which would benefit the most from its addition, namely infants and young children under the age of 12, decreasing cavities and improving dental health. Studies have shown unequivocally that fluoridation, at the optimal concentration of 1.0 ppm, reduces the incidence of dental caries by 50-70 percent. It has also been demonstrated that caries will increase if water fluoridation is discontinued in a community for an extended period. One example is in Antigo, Wisconsin. Antigo started fluoridating its community water supplies in 1949 and discontinued it in 1960. Five and one-half years later, second graders had more than 200 percent more decay, fourth graders had 70 percent more, and sixth graders had 91 percent more decay than those of the same age in 1960 (CDPH, Community Water Fluoridation Program).

Potential Costs of Drinking Water Treatment and Distribution

The cost of providing drinking water in compliance with all drinking water standards is steadily increasing due to increasing costs for energy and materials and increasing regulations requiring higher levels of treatment. Water bills reflect the costs of pumping, treating and delivery of water, as well as the operation and maintenance of the system, water quality testing and debt repayment. Water treatment costs may include the cost of chemicals, energy, and operation and maintenance of the treatment facilities. Drinking water treatment costs will vary widely from plant to plant. Many different factors can affect the cost of water treatment, including the choice of which water treatment technology to use. The design-build award price for the San Diego County Water Authority’s Twin Oaks Valley Water Treatment Plant, a new 100-million gallons per day membrane filtration plant highlighted in Box 14-2, was $157.2 million, and the annual service fee is $6.5 million, subject to contract escalators for materials and chemicals. Power (energy usage) is a pass-through cost and not included in the annual service fee. It was estimated to be $1.0 million for the first year of operation.

Table 14-5 summarizes the past and future estimated costs of treated full service water provided by the Metropolitan Water District of Southern California (MWDSC), which treats a blend of surface water from the Colorado River and the California Aqueduct.

Table 14-5 Metropolitan Water District of Southern California treated water rate history

Year	Cost of treated water ($/AF)	
Historical & current water rates		
1994	412	
1995-1996	426	
1997-2002	431	
	Tier 1 [a]	**Tier 2** [b]
2003	408	489
2004	418	499
2005	443	524
2006	453	549
2007	478	574
2008	508	606
2009	579	695
Projected future water rates		
2010	665	793
2011	691	809
2012	714	832
2013	730	784

Note: Data obtained from Metropolitan Water District of Southern California

Web site at http://www.mwdh2o.com/mwdh2o/pages/finance/finance01.html

[a] Tier 1 supply rate – recovers the cost of maintaining a reliable amount of supply

[b] Tier 2 supply rate – set at MWDSC cost of developing additional supply and to encourage efficient use of local resources

This shows an increase of between 40 and 68 percent in the cost of providing treated water in an area serving a large rate base. There was a moderate increase in cost per acre foot (AF) from 1994 to 2002 and a more rapid increase in cost from 2003 to 2009, which reflects improvements to the treatment provided, increased cost for chemicals and energy, and reduced availability of new water supplies. The primary cost factors causing the 2009 MWDSC rate increase include increased conservation efforts, the quagga mussel control program, litigation and the higher cost for State Water Project deliveries during FY 2008/2009. MWD may not capture the true cost of service with these rates, and must cover some costs through the use of reserves. The increase in cost to provide drinking water for smaller systems may be significantly greater, and they will not have reserves to offset rate increases.

Per household costs for compliance with new regulations for small water systems can be over four-fold higher than those for medium to large water systems (EPA 2006a).

Trends of increasing water rates and connection fees can be partially attributed to aging infrastructure and rising construction costs. In the Black & Veatch 2006 California Water Rate Survey, the survey results revealed that the average residential monthly charge for 1,500 cubic feet (11,000 gallons) of water a month increased from $30.33 in 2003 to $36.39 in 2006. This is a 16.7 percent increase during the three-year period (Black & Veatch 2006). The survey also compared the average and range of monthly charges in California by region for 2001, 2003, and

2006, as shown in Table 14-6. This shows that the coastal communities continue to have the highest average residential monthly water charge, while the San Joaquin Valley has consistently had the lowest average residential monthly water charge. The highest percent increase in average residential monthly water charge occurred in the San Joaquin Valley with a 27.5 percent increase.

Table 14-6 Monthly water charges in California by region

	2001 Survey		2003 Survey		2006 Survey	
Region	**Average**	**Range**	**Averag e**	**Range**	**Average**	**Range**
Northern	$29.76	$6.3-$91.24	$31.85	$7.5-$112.6	$38.65	$7.50-$130.9
Coastal	$38.40	$11.25-$85.13	$38.96	$12.49-$85.13	$42.99	$18.15-$79.35
San Joaquin Valley	$16.15	$8.00-$26.89	$17.64	$9.00-$36.60	$28.34	$9.65-$48.71
Southern	$29.28	$8.21-$69.90	$17.64	$9.45-$77.72	$28.34	$14.57-$82.55

Source: data from Black & Veatch 2006 California Water Rate Survey; per 1,500 cubic feet (11,000 gallons) of water used.

Table 14-7 shows the actual average annual water bill for water usage by area as a share of median household income for the period of 2004 to 2006 (Public Policy Institute, 2006).

Table 14-7 Water charges as a share of median household income, 2004-2006

	Average annual water use (af)	**Average annual water bill ($)**	**Water bill as share of median income (%)**
San Francisco Bay Area	**0.37**	**412**	**0.58**
Southern Coast	0.58	535	0.97
Central Coast	0.38	661	1.14
Inland Empire	0.59	413	0.87
San Joaquin Valley	0.63	321	0.74
Sacramento Metro Area	0.49	362	0.69
Rest of State	0.47	390	1.06
California	0.52	467	0.86

Source: Public Policy Institute of California & Ca2025, September 2006.

Treatment costs for compliance with the arsenic MCL in California will affect more than one million households in about 275 water systems. The average annualized cost per household to comply with the federal MCL for arsenic in California is estimated to range from $140 to $1,870 depending on the size of the water system (CDPH 2008b). These treatment costs are in addition to current costs for drinking water.

Up to one-third of the operations and maintenance costs for some water utilities are energy related, including energy used for water treatment and pumping. One factor in water-related energy consumption is the use of new technologies that are more energy intensive than most previous treatment technologies—UV treatment and high pressure membranes for example.

Desalination will play an increasing role in water supply in California, both for brackish groundwater desalination and seawater desalination. Historically, the high cost and energy requirements of desalination had confined its use to places where energy is inexpensive and freshwater scarce. Recent advances in technology, especially improvements in membranes, have made desalination a realistic water supply option. The cost of desalinating seawater is now competitive with other alternatives in some locations and for some high-valued uses. However, although process costs have been reduced due to the newer membranes that allow for lower energy consumption, the total costs of desalination, including the costs of planning, permitting and concentrate management, remain relatively high, both in absolute terms and in comparison with the costs of other alternatives (National Resource Council 2008). Since development of other traditional sources of supply in California is limited and may require substantial capital investment to develop (such as new storage or canal systems), the expanded development of brackish water and seawater desalination may become more cost-competitive.

The condition of infrastructure is a growing concern in California and throughout the country. In its “Report Card for America’s Infrastructure” (2005), the American Society of Civil Engineers gave water infrastructure across the country a D-minus. The EPA has conducted a Drinking Water Infrastructure Needs Survey and Assessment in 1995, 1999, and most recently in 2003. The 2003 survey shows a total investment need of $276.8 billion over the next 20 years nationwide. For California, it identified a total need of $27.9 billion. This is more than 10 percent of the national need. The majority of this need is for transmission and distribution systems. This estimate does not include the infrastructure needs for Tribes, documented at $602 million over the three-state area of California, Nevada, and Arizona (EPA 2005). Extrapolating the infrastructure need based on the 2003 Needs Survey into the future results in a total need of $66 billion through 2050, or $1.4 billion annually. This cost does not include the costs for treatment of new water supplies needed to offset losses in water resources from the Colorado River and the State Water Project, nor current drought conditions.

Box 14-3 Success Story to Reduce the Cost of Water Supply

Officials from the Elsinore Valley Municipal Water District expect that a new water treatment plant will, in addition to reducing arsenic levels in the drinking water, cut the district’s dependence on water from sources such as the Colorado River Aqueduct system by 10 to 15 percent, saving ratepayers more than $1.2 million annually. This was accomplished by providing treatment to two high-producing local groundwater wells shut down in 2007 because of arsenic concentrations above the reduced maximum contaminant level of 10 ug/L. The total cost of the new treatment facility was $8.5 million; it produces water that meets the EPA arsenic standard.

The EPA has used the Needs Survey to establish the amount of Drinking Water State Revolving Fund (DWSRF) capitalization grants allotted to states. Table 14-8 shows the DWSRF grants awarded to California since 1997. These funds provide loans and grants to public water systems for capital projects to address public health risk problems and Safe Drinking Water Act violations.

Table 14-8 California Drinking Water State Revolving Fund: Capitalization Grants from the EPA

Fiscal year	DWSRF grant ($ million)	% of national funds
1997	75.68	--
1998	77.11	10.83% (FY1998-2001)
1999	80.82	
2000	83.99	
2001	84.34	
2002	82.46	10.24% (FY2002-2005)
2003	81.97	
2004	85.03	

2005	84.85	
2006	67.10	8.15% (FY2006-2009)
2007	67.10	

Note: Data from EPA Needs Survey Web site: http://www.epa.gov/safewater/dwsrf/allotments/funding_dwsrf_allotments.html

Funding for drinking water projects on Tribal lands is provided by the federal government as part of the Drinking Water Infrastructure Grants: Tribal Set-aside Program, which was established by the federal Safe Drinking Water Act of 1996. The program allows the EPA to award federal grants for infrastructure improvements for public drinking water systems that serve Tribes.

Major Issues Facing Drinking Water Treatment and Distribution

Based on a review of issues discussed within the water supply industry and regulatory agencies, the following represent some of the most significant challenges facing public water suppliers and the regulatory agencies today.

Deteriorating Infrastructure

With the aging of the nation's infrastructure and the growing investment needed to replace deteriorated facilities, the water industry faces a significant challenge to sustain and advance its achievements in protecting public health and the environment (Grumbles 2007). Over the last several decades, the public investment has been toward expanding and upgrading service levels, such as providing higher levels of treatment. At the same time, our urban areas have expanded with a reduced density of urban population. This means we are living farther away from the central hub of the community. This requires more investment in water and wastewater facilities for the same number of people. Both of these issues—higher treatment levels and expanded service areas—result in less available funds to maintain the present infrastructure.

New solutions are needed for critical drinking water investments over the next two decades. Not meeting the investment needs of the next 20 years risks reversing the public health, environmental, and economic gains made within our communities. Water utilities are moving to the concept of asset management to better manage and maintain their water facilities and infrastructure (Cromwell et al. 2007) for greater operational efficiency and effective use of limited funds. However, addressing infrastructure will add to the cost of water.

Asset management alone will not fix the basic problem. Current water rates in the majority of water systems are typically not adequate to address new regulatory requirements as well as maintain the existing facilities, and often do not generate adequate reserves to address infrastructure replacement. Water supplies may be undervalued based on the typical water rate paid by consumers versus the great role water plays in the health and well-being of our communities. However, with increasing costs for food, fuel, and energy, additional increases in the cost of receiving potable water may be a serious problem for many residents, especially those on fixed income.

CDPH also has set aside funding from the DWSRF program to provide technical assistance to small water system operators and managers on technical, managerial, and financial areas. Additional funding in this area would allow the expansion of this program into more detailed areas of asset management and rate setting.

Source Water Protection

There is an increasing need to protect source water quality as the first critical barrier in the multiple barrier approach to providing safe drinking water. A key issue is the increasing difficulty of protecting source water quality as the population of the state increases resulting in increased discharge of wastewater and urban runoff into surface water supplies. Another major issue is that some drinking water contaminants (organic carbon, nutrients, pathogens such as *Giardia* and *Cryptosporidium)* are not currently regulated by the Regional Boards in Basin Plans. Thus, there are generally not requirements for dischargers to control these contaminants.

Inadequate Financial Assistance to Address Water Treatment and Infrastructure Issues

Three major funding programs for California public water systems include DWSRF, Proposition 50[2], and Proposition 84.[3] Combined, these programs have provided $970 million to 200 public water systems to solve health risk problems and Safe Drinking Water Act violations, resulting in an overall reduction in risk for consumers. However, this funding has not been adequate to address all of the needs identified in California. The combined project priority list for these three funding programs includes more than 4,000 projects, many of which have been on the list since its inception in 1997. The estimated value of unfunded need on the combined project priority list exceeds $8.2 billion.

Likewise, California has seen a reduction in the federal annual capitalization grants that fund the DWSRF program (see Table 14-8, above). This reduction resulted from inadequate estimate of infrastructure needs in California under the 2003 Needs Survey. CDPH is working on the 2007 Needs Survey to accurately identify infrastructure funding requirements for California drinking water systems. Funding from Proposition 50, which also has a portion targeted to disadvantaged communities, will likely be fully committed by 2009.

For water systems that received either low interest loans through the DWSRF program or grants through Propositions 50 and 84, these funds are used to design and build the project. The funds are not used for ongoing operation and maintenance of the water project. Water utilities must pay for the operation and maintenance costs, which can be significant, through water rates or other revenues.

Regionalization/Consolidation

One way to improve the economy of scale (resulting in the potential for many benefits including lower costs) is to increase regionalization of water supply systems. This can be achieved by physical interconnections between water systems or managerial coordination among utilities. CDPH has established a requirement for consolidation to be evaluated as part of every project funded under the available financial assistance programs. To successfully address deteriorating infrastructure for the hundreds of smaller public water systems in California, regionalization and consolidation may be necessary on a larger scale. It is not cost effective for a small system to fully replace aging and deteriorated sources, treatment plants, and distribution systems. However, with a larger rate base to spread costs across, the economies of scale improve for consolidated systems. Managerial consolidation of water districts, even where the boundaries are not

[2] Proposition 50: Water Quality, Supply and Safe Drinking Water Projects, Coastal Wetlands Purchase and Protection Act of 2002.
[3] Proposition 84: Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006

contiguous, can provide great savings to the consumers by sharing the costs of oversight and management of the systems, thus freeing up funds to be used for system upgrades.

Environmental Justice

Interest in environmental justice issues has heightened as a result of nitrate contamination problems in public water systems, particularly those in agricultural areas such as the Central Valley. It is the role of the federal government to ensure that, in the development and implementation of new regulations, disadvantaged communities are protected at levels afforded to other demographic communities. Federal Executive Order 12898 establishes a federal policy for incorporating environmental justice into federal agencies' missions by directing agencies to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

Each of the three major water system funding programs implemented by CDPH provide some special financing for water systems that serve areas with relatively low median household income (MHI). For example, the DWSRF can provide grant funds and zero-interest loans to water systems serving a community with a low MHI. Proposition 50 funding has a target goal of 25 percent of the funding to be provided to low-MHI communities. A significant portion of the Proposition 84 funds allocated to drinking water are specifically targeted at small disadvantaged communities with contamination problems. Funding from both Propositions 50 and 84 is limited due to the one-time allocation specified for drinking water.

Impact of Climate Change

The impact of climate change on water quality has been estimated scientifically (Cromwell et al. 2007, IPCC 2007). Earlier snowmelt and more intense episodes of precipitation will likely increase turbidity in source waters. Increased flooding may lead to sewage overflows, resulting in higher pathogen loading in the source waters. Increased water temperatures and shallower reservoirs may result in more prevalent eutrophic conditions in storage reservoirs, increasing the frequency and locations of cyanobacterial blooms. These potential changes could result in challenges for surface water treatment plants and require additional monitoring to quantify changes in source water quality and better control of finished water quality. Higher sea levels could impact coastal groundwater basins making the protection of groundwater from seawater intrusion more difficult (CUWA 2007).

Increasing demand on the limited valuable water resources available in California will compound any impact from climate change. The continued growth in the state will continue to stress the availability of the freshwater resources needed for domestic, agricultural, and industrial uses. California coastal water providers have begun evaluating the feasibility of desalination of seawater as an additional supply. Desalinated seawater, although more expensive to develop due to the high energy requirements and planning and permitting costs, has been identified as a reliable drought-proof supply.

As highlighted earlier, Proposition 50 funding of desalination construction and demonstration projects is a critical resource to drive evaluation and implementation of desalination technologies in California.

Efficient Use of Water

The efficient use of water is seen as a viable complement to—and in some instances, a substitute for—investments in long-term water supplies and infrastructure. Water use efficiency is a concept to maximize the use of water or to minimize its waste. Water use efficiency will continue to be a key element of addressing reduced water availability and is seen as a major step to be addressed before turning to more costly water sources such as desalinated seawater. Water efficiency programs and practices may include utility leak detection, water conservation programs, water efficiency pricing and incentives for installing water efficient appliances and landscaping, as well as improvements in water recovery as part of water treatment plants (reducing water used in treatment plant processes for backwash, etc.).

An important aspect of strongly encouraging water conservation is the ability of the water utility to establish an escalating metered rate based on the volume of water used—full cost, conservation or efficiency pricing. Since 1992, California law has required urban water suppliers (those serving more than 3,000 connections or delivering more than 3,000 AF of water per year) to install a water meter on new connections. More recently, AB 2572 established the requirement for retrofitting water meters on pre-existing connections and charging customers for water based on the actual volume of water used. Neither of these laws addresses smaller water systems that do not meet the definition of an urban water supplier.

However, many larger water agencies have already taken advantage of conservation programs to reduce the need for new water supplies. The Los Angeles Department of Water and Power (LADWP) has shown success in conservation where water use today is the same as it was 25 years ago, despite an increase in population of nearly 1 million people (LADWP 2007). Obtaining additional increases in conservation will be more difficult and may result in higher costs to achieve.

To address water losses, or unaccounted for water, water utilities are conducting audits to identify water main leaks, unmetered water use for parks and recreation consumption, water theft and inaccurate meters. Deteriorated and aging infrastructure can play an important role in water losses, contributing to significant water leakage and a high rate of main breaks.

Maintaining a Trained Workforce

The State of California requires that operators of water treatment plants and distribution systems receive certification to perform these duties. This certification is designed to ensure that operators have adequate knowledge, experience, and training to properly operate these facilities. In view of the increased complexity of water system facilities, the importance of properly trained and certified operators is increasing.

Sustaining a trained workforce to maintain an adequate level of qualified oversight at water treatment plants and operation of distribution systems has been identified as an important issue. This is in part a result of the increased number of people from the large Baby Boomer generation beginning to leave the workforce. CDPH data indicate that the average age of operators certified in California is about 50 years, while Grade 5 treatment plant operators (the highest treatment certification available) is greater than 55 years of age (Jordan 2006). Many water utilities will lose 30 to 50 percent of their current workforce within the next 5 to 7 years, which will result in an unprecedented knowledge drain. A knowledge-retention strategy is necessary to ensure long-term success.

Knowledge-retention, broadly termed “succession planning,” is the process of identifying and preparing suitable employees through mentoring, training, and job rotation, to replace key players—such as treatment or utility managers—within an organization as their current managers retire. Succession planning will grow in importance in the near future to ensure the transfer of knowledge as less experienced staff moves into higher decision-making positions. This issue applies to both the public and private water sector, as well as the government agencies in place to regulate the water industry. Graduating engineering students show a noticeable lack of interest in the water industry.

One California agency is making direct efforts to begin the training process of the youth for jobs of the future. LADWP has developed an Infrastructure Academy in which they work with local high schools to recruit 10th-graders to “job shadow” the construction field as 11th- and 12th-graders. LADWP supplies funds to the schools with the ultimate goal of creating a training plan designed by employees and instructors.

In November 2006, CDPH introduced the Expense Reimbursement Grant Program for small water system operators. This program provides funding for small water system operators to receive reimbursement for training taken to maintain and advance their operator certification levels.

Treatment Technologies for Small Water Systems

Providing safe and affordable drinking water is still a significant challenge for small water systems. Economies of scale typically become more limited for the small system size categories, resulting in per-household costs for compliance with new regulations that can be over four-fold higher than those for medium to large water systems (EPA 2006a). Advances have been made in the effective use of point-of-use (POU) and point-of-entry (POE) technologies for certain contaminants under controlled circumstances for some small drinking water systems (EPA 2006b). POU devices are those that treat water at the location it is to be consumed, such as at the tap or a drinking fountain. POE devices are those that treat all of the water entering a home or building, not just that which is consumed. POE technologies would treat all water that a consumer comes in contact with, such as through bathing and handwashing, while a POU will only provide treated water at one tap intended for drinking and cooking (usually installed in the kitchen). The California SDWA allows the consideration and approval of POE for compliance with drinking water standards where it can be demonstrated that centralized treatment (at the well head or surface water intake) is not economically feasible. However, installation of POU for compliance with drinking water standards by a public water system is not yet allowed under the California SDWA and regulations.

New treatment technologies are often needed to address chemical contaminants that affect small water systems - technologies that can be cost-effective and do not require extensive operator attention. Proposition 50 has provided funding for demonstration of such technologies. As new technologies are proposed to treat water to drinking water standards, CDPH must review and approve these technologies, using staff dedicated to these technical aspects of drinking water treatment reviews. This would include reviews of studies demonstrating the efficacy of the use of POU/POE for compliance with some MCLs.

Treatment Residuals Disposal

In many areas, treatment options for contaminants are limited due to residual disposal issues. For example, the disposal of brine from ion exchange and reverse osmosis treatment is being identified as a potential source of salinity in groundwater. California, and especially the central San Joaquin Valley, is experiencing increasing salts in the groundwater water. As the salinity of local groundwater sources increase, more water customers use water softeners to improve the quality at their tap. This in turn results in a higher discharge of salts to the wastewater treatment plants, increasing the salinity of wastewater and exacerbating the problem. The Central Valley Regional Water Quality Control Board completed a study in May 2006 on salinity in groundwater in the Central Valley, introducing the concept of a long-term salinity management program for the Central Valley and the State of California (CVRWQCB 2006).

Disposal of residuals such as backwash water or spent media poses additional costs for water treatment, especially those that may be classified as a hazardous or radioactive waste due to the concentration and leaching characteristics of the contaminant. Selection of treatment alternatives for arsenic, especially, must consider disposal issues. The spent treatment plant media must be evaluated under the California Waste Extraction Test (WET) for classification prior to determining appropriate disposal options due to the potential for the arsenic to leach off the media in a landfill environment. The California WET classification is more stringent than federal leaching tests.

Security of Drinking Water Facilities

Water system facilities are vulnerable to security breaches, intentional acts of terrorism, and natural disasters. Both water system personnel and the general public have developed a greater awareness of this vulnerability of our infrastructure as a result of the events of September 11, 2001, and Hurricane Katrina in 2005. The enhancement of security and emergency response capability are crucial in maintaining a reliable supply and delivery of drinking water.

Under the US Public Health Security and Bioterrorism Preparedness and Response Act of 2002, drinking water utilities serving more than 3,300 people are required to conduct Vulnerability Assessments and develop Emergency Response Plans. All of California’s water utilities in this category prepared these documents. These documents are an important element in building and maintaining the ability to respond to security breaches and other catastrophes.

Accomplishments to protect our water and wastewater facilities from terrorism by the water and wastewater industry and regulatory agencies include the following:

- Emergency Water Quality Sample Kit developed by CDPH, based on the EPA Response Protocol Toolbox, to quickly provide water systems with a resource to sample drinking water for an unknown contaminant during a credible event.
- Partnerships between water agencies and the regulatory community established to address emergency response, including the California Water/Wastewater Agency Response Network (WARN); Laboratory Response Network (LRN); and the California Mutual Aid Laboratory Network (CAMAL Net).
- Water Infrastructure Security Enhancement (WISE) Guidelines drafted for the Physical Security of Water/Wastewater Utilities by national water and wastewater organizations. It provides recommendations for the management, operation, construction, and retrofit of water and wastewater treatment plants and distribution/collection systems to enhance physical security. The WISE Guidelines can be found at the following Web page: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Security.aspx

Water/Wastewater Agency Response Network (WARN) systems facilitate a utilities-helping-utilities approach to providing assistance during times of crisis. By establishing mutual aid agreements before a crisis occurs, WARN participants pave the way for member utilities within (and outside) of their respective states to send valuable aid in a quick and efficient manner. WARN participants can access specialized resources to assess and assist water and wastewater systems until such time as the system can develop a permanent operating solution.

Existing and Emerging Contaminants

New contaminants in drinking water are often discovered and then regulated because of increased pollution, improved analytical abilities, and/or understanding of health effects. Media attention to a particular contaminant has also resulted in a legislative response to address or speed up the regulatory process. Examples of these include hexavalent chromium (Chrome-6) and pharmaceuticals and personal care products. In addition, the health effects of many known contaminants are re-evaluated, and reregulated, in light of new information. For many emerging contaminants, such as pharmaceuticals and personal care products, there may not yet be a full understanding of the health risks and available treatment technologies to remove them from drinking water. For such contaminants, the pollution prevention and matching water quality to water use resource strategies will help address water quality concerns while additional information is gathered. For pharmaceuticals and personal care products, control of discharge to the environment is the best initial approach (via source control programs and reduction through wastewater treatment) rather than relying on treatment of drinking water.

Emerging contaminants may be created by treatment itself, for instance, when water utilities implement new methods or processes for disinfecting water that may create new disinfection byproducts. For some contaminants, treatment options may be available, but may be relatively expensive.

Recommendations

Because of the importance of drinking water, there is strong interest from many groups to promote improvements to the drinking water treatment and distribution facilities, operation, and management. These groups include:

- Water system managers and operators
- Local governmental agencies – city, county, planning
- Regulatory agencies such as CDPH, local primacy agencies (county-level) and EPA
- Environmental and community stakeholders

Based on the major issues outlined in this chapter, the following additional actions are needed to ensure there is adequate protection of public health through the maintenance of infrastructure, advancements in water treatment, and developing and maintaining relationships among the groups that advocate for safe drinking water:

1) The legislature should take steps necessary to develop a more sustainable source of funding of water supply, water treatment, and infrastructure projects to ensure a safe and reliable supply of drinking water for individuals and communities.
2) Additional funding should be provided to CDPH to provide increased technical assistance to small water systems related to asset management and rate setting.
3) CDPH should work closely with public water systems to quantify the total needs for water system infrastructure improvement and replacement.
4) State government should support enactment of a federal water infrastructure trust fund act that would provide a reliable source of federal assistance for the construction and repair of water treatment plants.
5) The legislature should develop a reauthorization bill to extend the funding benefits of both Proposition 50 and Proposition 84 for drinking water systems.

6) Additional programs should be developed to encourage regionalization and consolidation of public water systems. Regionalization and consolidation are useful both in achieving compliance with water quality standards and in providing an adequate economy of scale for operating and maintaining existing facilities as well as planning for future needs.

7) State government should continue to develop funding for small water systems and disadvantaged communities to assist in complying with drinking water standards.

8) State government should continue to encourage conservation and develop additional incentives, such as expanded rebate programs, to allow water systems to reduce the waste of limited water resources.

9) Public water systems that provide flat rate water service should strongly consider moving to a metered water rate structure to discourage waste. In addition, water systems that do have water meters on some customers but not all connections should strongly consider providing water meters for all customers.

10) State government should consider providing incentives that would encourage water systems to adopt rate structures that encourage conservation and discourage the waste of water.

11) CDPH should evaluate the inclusion of funding for water meters for each water system service connection for all drinking water projects funded under the DWSRF program, Proposition 50 and Proposition 84. Additional funds may need to be allocated for this purpose from future water bonds.

12) The legislature should establish a requirement for all public water systems (whether in urban areas or other areas of the state) to install a meter on each service connection and charge a metered rate for actual volume of water used.

13) California's regulatory agencies, such as the State Water Resources Control Board and California Department of Public Health, should be able to maintain internship programs for college students to continue the interest of the next generation in the water and environmental regulatory agencies.

14) The CDPH Operator Certification Expense Reimbursement Grant Program for small water system operators should be expanded to include medium size water utility operators, focusing on training for entry-level operators.

15) CDPH should develop a partnership with the Employment Development Department (EDD) to establish an employment and training program for water utility operators. This should include development of a retraining program to fill the coming shortage of workers in the public/private water sector.

16) State government should support research and development of new treatment technologies through expansion of the funding provided through Proposition 50 for demonstration of new treatment technologies. Additional program funding is also needed by CDPH to adequately address the review and acceptance of these new treatment technologies.

17) The legislature should adopt statutes authorizing the development of regulations addressing the use of POU treatment for small water system applications for some specific contaminants.

18) In view of the increased costs and other issues associated with disposal of residual wastes, water systems should fully evaluate residual disposal issues in the planning of new water treatment facilities.

19) All public water systems should be encouraged to join the California WARN program. This program will be able to provide mutual aid and assistance more quickly than the normal resource requests through SEMS. CDPH will encourage this recommendation as part of security training and emergency response exercises conducted with water utilities.

20) The control of pharmaceuticals and personal care products in our environment should be addressed initially via source control programs and reduction through wastewater treatment.

Selected References

Black & Veatch Corporation. 2006. *2006 California Water Rate Survey.*

CDPH, Community Water Fluoridation Program. Fluoridation information obtained from: http://www.cdph.ca.gov/programs/Pages/FluorideandDocumentation.aspx

(CDPH 2004) California Department of Public Health. 2004. Procedure for Cost-Benefit Analysis of Arsenic. Sep 13.

(CDPH 2007) California Department of Public Health. 2007. Final Statement of Reasons, Perchlorate Primary Maximum Contaminant Level (MCL), Title 22, California Code of Regulations; R-16-04, June 25. http://www.cdph.ca.gov/services/DPOPP/regs/Pages/R-16-04-PerchlorateinDrinkingWater.aspx

(CDPH 2008a) California Department of Public Health. 2008. Revision of Waterworks Standards (effective March 9, 2008) available at http://www.cdph.ca.gov/services/DPOPP/regs/Pages/R-14-03-RevisionofWaterworksStandards.aspx

(CDPH 2008b) California Department of Public Health. 2008b. Initial Statement of Reasons, Arsenic Primary Maximum Contaminant Level (MCL) Revision, Title 22, California Code of Regulations; DPH-04-017, April 8.

(CUWA 2007) California Urban Water Agencies. 2007. "Climate Change and Urban Water Resources," Dec.

(CVRWQCB 2006) Central Valley Regional Water Quality Control Board, "Salinity in the Central Valley, an Overview." May 2006.

Cromwell, JE, E Speranza, H Reynolds. 2007. "The Infrastructure Crisis," Journal AWWA. April, 99(4):109-115.

Cromwell, JE, JB Smith, RS Raucher. 2007. "No Doubt About Climate Change and Its Implications for Water Suppliers," Journal AWWA. Sep, 99(9):112-117.

Donoho, P. (International Bottled Water Association). 2007. *Overview of Bottled Water*, presented to the San Francisco Environmental Commission. Jul 16.

(EPA 2006a) US Environmental Protection Agency. 2006. Federal Register, Vol. 71, No. 41, March 2. *Small Drinking Water Systems Variances – Revision of Existing National-Level Affordability Methodology and Methodology to Identify Variance Technologies that Are Protective of Public Health.*

(EPA 2006b) US Environmental Protection Agency. 2006. *Point-of-Use or Point-of-Entry Treatment Options for Small Drinking Water Systems*, EPA 815-R-06-010, April.

(EPA 2006c) US Environmental Protection Agency. 2006. *Total Coliform Rule (TCR) and Distribution System Issue Papers Overview*, Dec.

(EPA 2005) US Environmental Protection Agency. 2005. *Drinking Water Infrastructure Needs Survey and Assessment, Third Report to Congress*, June.

US Environmental Protection Agency. Data from EPA Needs Survey Web site: http://www.epa.gov/safewater/dwsrf/allotments/funding_dwsrf_allotments.html

Grumbles, Benjamin H. (Assistant Administrator for Water, EPA). 2007. Testimony before the Subcommittee on Water Resources and Environment, Committee on Transportation and Infrastructure, US House of Representatives, Jan 19.

(IPCC 2007) Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report: Climate Change 2007.

Jordan B. 2006. "Creating Our Future," Journal AWWA. Oct, 98(10):54-55.

Los Angeles Department of Water and Power. 2007. Presentation by Alvin Bautista, *Seawater Desalination Update*. Oct.

Metropolitan Water District of Southern California. Data obtained from Web site at http://www.mwdh2o.com/mwdh2o/pages/finance/finance01.html

National Resource Council. 2008. Executive Summary *Desalination: A National Perspective.* The National Academies Press, Washington, D.C.

Public Policy Institute of California and Ca2025. 2006. Just the Facts - Water Supply and Quality. Sep.