CHAPTER 1 INTRODUCTION

1.1 PURPOSE OF REPORT

Since the establishment of the Federal Safe Drinking Water Act (SDWA) in 1974, there have been major improvements to the quality of drinking water for the vast majority of communities served by public water systems. However, for many communities the promise of safe drinking water has not been met. In California there continues to be many communities with drinking water that do not meet standards. In many cases, safe drinking water has not been available for multiple years.

This situation creates an unacceptable risk to the health and well-being of individuals, families, and communities. Given the overall wealth and resources of California, the disparity in health protection is particularly unfair and disturbing. The drinking water standards established under the SDWA apply to all types and sizes of community water systems. However, the compliance rates (and associated public health protection) across public water system sizes and socio-economic characteristics vary dramatically resulting in this fundamental disparity.

This disparity in public health protection is a problem that has grown and become more glaring given that the larger and wealthier community water systems consistently provide drinking water that meets all drinking water standards. Overall, progress has been too slow as communities struggle to find solutions to their drinking water problems. Over the previous three decades this disparity has received increased focus by the Legislature, culminating in major reforms and the adoption of Senate Bill (SB) 200 in 2019 establishing the Safe and Affordable Drinking Water Fund.

This report provides a timely and unique opportunity to chart the overall course toward providing safe drinking water to all communities in California in coordination with a comprehensive analysis of drinking water quality in California. The report includes recommendations to address key issues and challenges that impact drinking water and communities served by public water systems.

1.2 BACKGROUND ON THE SAFE DRINKING WATER PLAN

In 1989, the California Legislature enacted Assembly Bill (AB) 21 (Chapter 823, Statutes of 1989) which directed the California Department of Health Services (CDHS) to undertake a comprehensive assessment of drinking water in California: its quality and safety, types of problems, overall health risks, current and projected costs, and current regulatory programs. From this assessment, CDHS was directed to develop a plan, containing specific recommendations, to resolve any problems and improve the overall quality and safety of California's drinking water.

In 1993, CDHS (now the California Department of Public Health (CDPH)) completed and submitted to the Legislature the report entitled, "Drinking Water into the 21st Century: Safe Drinking Water Plan for California (1993 Plan)." The 1993 Plan, prepared by the CDPH Drinking Water Program (now the Division of Drinking Water (DDW) in the State Water Resources Control Board (State Water Board)) can be accessed at the DDW website: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/dwdocuments/DrinkingWaterintothe21stCenturySafeDrinkingWaterPlanforCA.pdf

In 1996, the California Legislature enacted SB 1307 (Chapter 755, Statutes of 1996) amending Health and Safety (H&S) Code Section 116355 to require a periodic update of the 1993 Plan and to include at least the first ten topics listed below. The subsequent Plan was initiated by CDPH and was completed by the State Water Board in 2015 following transfer of the Drinking Water Program to the Board in the prior year. The 2015 Plan is available here:
https://www.waterboards.ca.gov/publications_forms/publications/legislative/docs/2015/sdwp.pdf.

In 2018, AB 2501 amended H&S Code Section 116355 to specify two additional topics for the Safe Drinking Water Plan. These new topics are numbers 11 and 12 in Section 1.3 below. The additional topics are related to the implementation of new authorities for the appointment of public water system administrators and consolidations.

1.3 TOPICS OF THE SAFE DRINKING WATER PLAN

Pursuant to the statutory requirements set forth in H&S Code Section 116355, Safe Drinking Water Plan updates are to include, but are not limited to:

1. An analysis of the overall quality of California's drinking water and the identification of specific water quality problems.
2. Types and levels of contaminants found in public drinking water systems that have less than 10,000 service connections. The discussion of these water systems shall include the following:
    a. Estimated costs of requiring these systems to meet primary drinking water standards and public health goals.
    b. Recommendations for actions that could be taken by the Legislature, the State Water Board, and these systems to improve water quality.
3. A discussion and analysis of the known and potential health risks that may be associated with drinking water contamination in California.
4. An evaluation of how existing water quality information systems currently maintained by local or state agencies can be more effectively used to protect drinking water.

5. An evaluation of the research needed to develop inexpensive methods and instruments to ensure better screening and detection of waterborne chemicals, and inexpensive detection methods that could be used by small utilities and consumers to detect harmful microbial agents in drinking water.
6. An analysis of the technical and economic viability and the health benefits of various treatment techniques that can be used to reduce levels of trihalomethanes, lead, nitrates, synthetic organic chemicals, micro-organisms, and other contaminants in drinking water.
7. A discussion of alternative methods of financing the construction, installation, and operation of new treatment technologies including, but not limited to, user charges, state or local taxes, state planning and construction grants, loans, and loan guarantees.
8. A discussion of sources of revenue presently available, and projected to be available, to public water systems to meet current and future expenses.
9. An analysis of the current cost of drinking water paid by residential, business, and industrial consumers based on a statewide survey of large, medium, and small public water systems.
10. Specific recommendations, including recommendations developed pursuant to paragraph (6), to improve the quality of drinking water in California and a detailed five-year implementation program.
11. A review of the use of administrators pursuant to Section 116686 in the state, including, but not limited to, the number of communities that have achieved access to safe drinking water through use of an administrator, the costs and duties of the administrator and a comparison of costs, whether rate structures for communities served by an administrator have resulted in significantly higher rates and whether those rates are affordable, and whether the administrator program should be modified to better serve communities.
12. A review of the consolidations pursuant to Section 116682 in the state, including, but not limited to, the number of communities that have achieved access to safe drinking water through consolidation, whether rate structures for communities are affordable following consolidation, barriers to consolidation, and whether the consolidation program should be modified to better serve communities.

These twelve requirements provide the basis for the 2020 Safe Drinking Water Plan (this report). Consistent with the 1993 and 2015 Plans, the 2020 Plan will address issues related to drinking water served by public water systems as defined in H&S Code Section 116275(h). Because of the number and severity of emergencies and severe conditions that have impacted public water systems in recent years, the Plan includes a Chapter on

Emergency Preparedness and related topics.

The past several decades have seen many new issues associated with California's drinking water quality as well as changes to the state and federal programs that are designed to ensure drinking water quality and safety. This updated Plan highlights those issues and changes, and provides recommendations to improve the quality of drinking water in California

1.4 SAFE AND AFFORDABLE FINANCING FOR EQUITY AND RESILIENCE (SAFER)

A recent major safe drinking water initiative is the establishment of a Safe and Affordable Drinking Water program. This program is referred to under the acronym of 'SAFER' which is short for the Safe and Affordable Financing for Equity and Resilience. This acronym is intended to fully capture the scope and emphasis of this program. This program was established and funded pursuant to AB 2501 (Chapter 871, Statutes of 2018) and SB 200 (Chapter 120, Statutes of 2019).

The SAFER program provides a robust framework and stable funding source to support a comprehensive program to resolve drinking water issues facing disadvantaged communities while also addressing broader drinking water issues faced by households and communities that are not served by public water systems (specifically individual wells and state small water systems). SB 200 provides a stable source of funding for the SAFER program through the year 2030 and requires the State Water Board to carry out the program at a very rapid pace including specific milestones and deliverables. For the most current status the SAFER website is available: https://www.waterboards.ca.gov/safer/

When Governor Newsom signed SB 200 in July 2019, he issued the following statement: "The fact that more than a million Californians can't rely on clean water to drink or bathe in is a moral disgrace… Parents shouldn't have to worry about their kids drinking from the water fountain at school, and families shouldn't have to dump water over their heads to shower every day. This funding is critically important to addressing California's long-standing safe drinking water issues, and I would like to thank the Legislature for working collaboratively to pass this solution."

Community and stakeholder involvement is a foundational element of the development and implementation of SAFER. The statutes require that the State Water Board consult with an Advisory Group in the development of the Fund Expenditure Plan. For communities served by water systems for which the State Water Board is seeking to designate an Administrator under SAFER, the statutes mandate a very high level of input from the community throughout the process. In addition, SAFER will feature ongoing, frequent interaction, transparency and dialogue between State Water Board staff and the communities that are to benefit from the program.

A primary focus of SAFER will be the many economically-disadvantaged communities with ongoing violations of primary drinking water standards. SAFER provides new authorities for the State Water Board to address these problems along with funding to carry out the mandates of SAFER. The initial work to carry out SAFER has begun, including the following elements:

1. Adoption of a Policy Handbook for Administrators by the State Water Board. This was adopted by the State Water Board in September 2019.
2. Developing organizational structures, establishing, and filling positions within the State Water Board to carry out the SAFER program.
3. Development of a Fund Expenditure Plan required under the SAFER statutes. SAFER statutes require that on or before July 1, 2020, the State Water Board develop and adopt a policy for developing the fund expenditure plan addressing specific elements enumerated in SB 200. The statute further requires that the State Water Board consult with the Department of Finance on the fund expenditure plan.
4. The initial Fund Expenditure Plan was adopted by the State Water Board on July 7, 2020.

The SAFER program also addresses drinking water quality issues that impact households that are on individual private wells or are served by state small water systems. State small water systems contain between 5 and 14 service connections and do not serve more than 25 individuals daily at least 60 days per year. There are approximately 2,000 state small water systems statewide. These additional program elements include the following:

1. By January 1, 2021, the State Water Board, in consultation with local health officers and other relevant stakeholders, shall use available data to make available a map of aquifers that are at high risk of containing contaminants that exceed safe drinking water standards.
2. Develop an estimate of the number of households that are served by domestic wells or state small water systems in high-risk areas identified pursuant to Article 6 (commencing with Section 116772). The estimate shall identify approximate locations of households, without identifying exact addresses or other personal information, in order to identify potential target areas for outreach and assistance programs.

Throughout the development and implementation of the program there will be extensive outreach to the public, impacted communities and stakeholders. This will include opportunities for both formal and informal public input and comment throughout the development of the program.

1.5 WATER RESILIENCY PORTFOLIO

In April 2019, Governor Newsom issued an Executive Order calling for development of a climate-resilient statewide strategy to protect the state's water infrastructure and reliability.

The full text of the April 20, 2019 press release on this Executive Order is available at: https://www.gov.ca.gov/2019/04/29/water-resilience-portfolio-for-california.

The order seeks to broaden California's approach to a range of challenges, including unsafe drinking water, major flood risks that threaten public safety, severely depleted groundwater aquifers, agricultural communities coping with uncertain water supplies and native fish populations threatened with extinction.

The order directs the secretaries of the California Natural Resources Agency, California Environmental Protection Agency and the California Department of Food and Agriculture to identify and assess a suite of complementary actions to ensure safe and resilient water supplies, flood protection and healthy waterways for the state's communities, economy and environment.

The order directs the state to think more strategically on water by directing the agencies to inventory and assess current water supplies and the health of waterways, future demands and challenges.

The California Natural Resources Agency, California Environmental Protection Agency and Department of Food and Agriculture developed the draft Water Resilience Portfolio for public comment in January 2020. On July 28, 2020, the Governor released a final version of the Water Resilience Portfolio, after input from more than 200 separate individuals and organizations helped shape revisions.

1.6 HUMAN RIGHT TO WATER LEGISLATION

In 2012, California became the first state to enact a Human Right to Water statute (Chapter 524, Statutes of 2012 (AB 685, Eng)) declaring that it is "the established policy of the state that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes."

Water supply, contaminants, costs of treatment and distribution systems, the number and nature of small public water systems, especially in disadvantaged communities, and many other factors will continue to challenge progress in addressing the Human Right to Water.

The 2020 Plan includes a focus on the application of the Human Right to Water to consumer affordability and access to drinking water of good quality, as well as small drinking water system sustainability (and prevention of future unsustainable small water systems), and the adequacy of small water systems funding. These are discussed in detail in Chapters 8 and 9.

The State Water Board is committed to actively pursuing initiatives to address the Human Right to Water, beginning with the state's residents who are served by public water systems but who do not receive safe drinking water. To provide open and transparent access to drinking water data, in 2017 the State Water Board premiered its Human Right to Water data portal that includes a map showing public water systems that do not meet drinking water standards. The portal is located at: https://www.waterboards.ca.gov/water_issues/programs/hr2w/

The 2020 Safe Drinking Water Plan for California discusses how the State Water Board proposes to improve access to reliable and healthy drinking water for communities throughout the state.

1.7 SUSTAINABLE GROUNDWATER MANAGEMENT ACT

The Sustainable Groundwater Management Act (SGMA) became law in 2014 based on a three-bill legislative package, composed of AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley). As a result, for the first time California has a framework for sustainable, groundwater management. As stated in the statutes, this means that many basins are now required to undertake "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results."

In his signing statement, the governor emphasized that "groundwater management in California is best accomplished locally." The statute required the formation of new local agencies, called Groundwater Sustainability Agencies (GSA), by June 30, 2017 to implement SGMA in medium and high priority basins. These GSAs are now required to develop, adopt, and implement Groundwater Sustainability Plans (GSP). Under SGMA, these basins are required to reach sustainability within 20 years of implementing their sustainability plans. For critically overdrafted basins, that will be 2040. For the remaining high and medium priority basins, 2042 is the deadline.

Through the Sustainable Groundwater Management Program, the Department of Water Resources (DWR) provides ongoing support to GSA through guidance and financial and technical assistance. In addition, the State Water Board has specific authorities to intervene when basins do not meet the requirements and time schedules established by SGMA.

1.8 LEGISLATIVE CHANGES

In recent years, the Legislature and Executive Branch (Governor's office) cooperated to enact a number of important bills related to the state's Drinking Water Program. These are in addition to the SAFER program which can be seen as the culmination of this series of legislative initiatives. The major reforms are summarized below.

Mandatory Consolidation Authority

Chapter 27, Statutes of 2015 (SB 88, Committee on Budget and Fiscal Review) provided the State Water Board with authority to require certain water systems that consistently fail to provide safe drinking water to consolidate with, or receive an extension of service from, another public water system. The consolidation can be physical or operational. Although for many years the Drinking Water Program has encouraged – and will continue to encourage – voluntary consolidations of public water systems, this authority allows DDW to mandate consolidation of water systems or extensions of service for disadvantaged communities with water quality or quantity problems, as appropriate.

Administrator Services

Chapter 773, Statutes of 2016 (SB 552, Wolk) authorizes the State Water Board to require public water systems that serve disadvantaged communities and that consistently fail to provide an adequate and affordable source of safe drinking water, to obtain administrative and managerial services from an Administrator selected by the State Water Board. It also made modifications to the State Water Board's mandatory consolidation authority.

Prevention of Proliferation of New, Unsustainable Water Systems

Chapter 843, Statutes of 2016 (SB 1263, Wieckowski) requires applicants for a permit to operate a proposed new water system to evaluate the feasibility of connecting to an existing adjacent public water system, rather than creating a new one. It authorizes the State Water Board to deny a permit for a proposed new public water system if it determines that the area that would be served by the proposed new public water system can be served by one or more existing public water systems, or it is reasonably foreseeable that the proposed new public water system will be unable to provide affordable, safe drinking water in the reasonably foreseeable future.

Expansion of Mandatory Consolidation and Administrator Services

Chapter 871, Statutes of 2018 (AB 2501, Chu) expands the State Water Board's mandatory consolidation authority to include disadvantaged communities relying on domestic wells that consistently fail to provide an adequate supply of safe drinking water; and allows residents of disadvantaged communities to petition the State Water Board to consider ordering consolidation. It also made changes to the State Water Board's administrator services authority to allow for full oversight of construction and development projects related to consolidation and extension of service. The legislation also revised and recast several other provisions.

Needs Assessment Funding

Budget Act of 2018. In September 2018, the Legislature appropriated 2.8 million dollars to the State Water Board to conduct a Needs Assessment to evaluate the condition of California's drinking water and the associated costs to ensure and implement the provisions of the Human Right to Water. The Needs Assessment will identify public water systems and state small water systems that currently are unable to provide safe, affordable, and accessible drinking water supplies as well as those that may be at risk in the future. The Needs Assessment will also develop state-wide hazard maps for common drinking water contaminants and other drinking water reliability factors impacting private domestic wells. The Needs Assessment will also estimate the cost to ensure that public water systems, state small water systems, and individual wells in the Salinas Valley and San Joaquin Valley meet the requirements of the Human Right to Water through consolidation or treatment.

1.9 EXISTING UNSUSTAINABLE WATER SYSTEMS

This 2020 Plan includes a chapter on Sustainability (Chapter 8), a detailed discussion of current efforts and initiatives to improve sustainability along with recommendations. Improving outcomes through sustainability is a major theme of the 2020 Plan.

Despite ongoing efforts to consolidate systems, approximately 7,400 public water systems remain in California; drinking water infrastructure is significantly fragmented compared to other utilities. For example, there are approximately 900 wastewater treatment providers and 75 electrical service providers in California. Approximately 77 percent of the community water systems in California serve less than 1,000 connections. This fragmented system of small drinking water suppliers results in decreased economy of scale, inadequate technical and management capacity, poor emergency planning and infrastructure, and inability to adapt to increasing regulatory changes. While 98 percent of the people served by public water systems get water that meets all water quality requirements of the Safe Drinking Water Act, 93 percent are served by systems with more than 3,300 service connections. Those that are served by smaller water systems are less likely to be provided drinking water that meets drinking water standard. In excess of 90 percent of drinking water violations occur in water systems serving fewer than 500 connections.

The thousands of public water systems in the state can best be described as a sort of public water system sprawl. This sprawl has resulted in a number of unsustainable public water systems. The presence of unsustainable public water systems has historically had many causes, including:

- Easy access to groundwater sources and limited regulatory requirements when many water systems were formed in the pre-1970’s era.
- Developmental pressure on City and County planning agencies that resulted in the creation of smaller water systems, outside of the city limits.
- Small public water systems have often not been desirable for annexation into municipalities, based on potential tax revenues, inability to pay connection fees, or other economic or political factors.

- Developer pressure on local governments to create water systems outside the edges of cities to avoid paying higher city development fees and to avoid the need to meet more stringent city infrastructure requirements.
- Pressure on county planning departments to develop new housing based on increased population growth and low-income housing needs.

There are other concerns that contribute to unsustainability. Chief among them is the number of community water systems that only have one source of drinking water, making them highly susceptible to loss of water, for example, in time of drought or pumping equipment failure.

1.10 PROGRESS ON 2015 IMPLEMENTATION PLAN

The 2015 Safe Drinking Water Plan contained an extensive Implementation Plan containing a range of recommendations. Appendix 7 of the Plan contains a review of progress that has been made on the implementation of the 2015 Plan's recommendations.

1.11 DRINKING WATER INFRASTRUCTURE CONDITION & FUNDING

Capital improvement reserves during the past decades have not kept up with the need for major infrastructure improvements. Even large water systems with significant economies of scale can struggle to replace distribution systems due to the high costs and treatment for new contaminants.

In many cases, this funding inadequacy has resulted in poor asset replacement that results in water outages and leaks, and associated potential for bacteriological contamination in leaking distribution systems. Other problems may include frequent water outages from mainline breaks, which may result in decreased access to water.

For smaller communities, especially those that are economically disadvantaged, funding has been a particularly challenging problem. Even when grant funds are available for treatment facilities, the operation and maintenance costs are often insurmountable. For economically disadvantaged communities, SAFER will provide an important resource to develop sensible and sustainable solutions.

1.12 EMERGENCY PREPAREDNESS, CLIMATE CHANGE, RESILIENCY

The 2020 Plan includes an expanded discussion (Chapter 11) of the elements of climate change, emergency preparedness and water system resiliency. In view of the series of tragic fires and other emergencies in recent years, it is important to evaluate the collective capability and preparedness of public water systems and state and local agencies for future emergencies. In view of the toll that emergencies have on individuals, families and communities, the Plan includes a series of recommendations and an action plan.

The elements of climate change, emergency preparedness and water system resiliency are addressed collectively as they are closely related. For example, the development of public water system resiliency for climate change adaptation also increases the level of emergency preparedness.

CHAPTER 2 CURRENT REGULATIONS OF DRINKING WATER

2.1 GOVERNMENT AGENCIES INVOLVED IN DRINKING WATER

The federal Safe Drinking Water Act (SDWA) establishes the foundation and standards for each state to be the primacy agency for the enforcement of the SDWA for public water systems (PWS) within their boundaries. California has carried out the drinking water program as the primacy agency since the inception of the federal SDWA. The fundamental requirement for primacy is that California adopt and implement standards that are at least as stringent as the federal drinking water standards. Under primacy, each state is free to adopt standards that are more stringent than those adopted at the federal level.

The regulation of drinking water in California has developed over the last 45 years under the SDWA. A major milestone in this development was the transfer of the Drinking Water Program to the State Water Board in 2014. Since that transfer, many facets of the drinking water program within the State Water Board have been bolstered by the growing coordination and assistance of other divisions and programs within the State Water Board. This is discussed in more detail further below.

Although the State Water Board has the fundamental responsibility for the regulatory oversight of drinking water, other agencies play important roles. Because of the importance of drinking water, there has been an increased focus on coordination and communication of the roles and responsibilities.

2.1.1 State Agencies

The regulation of water supply, water quality, and the various types of water systems that serve drinking water is shared among several agencies, including local agencies, in California. However, California took a major step forward in integrating the regulation of water quality when it transferred the state's Drinking Water Program from the California Department of Public Health (CDPH) to the State Water Board on July 1, 2014. One of the Administration's goals in transferring the program was to promote safe drinking water through more integrated water quality management, from source to tap.

Most of the statutory authority for regulation of drinking water is in the California Health and Safety (H&S) Code. Under the H&S Code, the State Water Board has primary responsibility for regulating all public water systems. There are three other state agencies that also regulate certain aspects of specific classes of systems including:

1. The California Public Utilities Commission (CPUC) for investor-owned systems
2. The Division of Corporations (DOC) for mutual water companies
3. The Department of Housing and Community Development (DHCD) for mobile home parks.

Additionally, the Department of Water Resources (DWR), the Office of Environmental Health Hazard Assessment (OEHHA), the Secretary of State, and the Department of Real Estate are also involved in activities impacting public water systems.

A brief description is provided below for each of the regulatory agencies, including their authority and responsibilities related to the regulation of public water systems.

2.1.1.1 State Water Resources Control Board

Transfer of Drinking Water Program

In January 2014, the state's drinking water and water quality programs were united under the State Water Resources Control Board to create an integrated organizational structure. The goal was to enable the state to both effectively protect water quality and the public health as it relates to water quality, while meeting current needs and future demands on water supplies. This alignment was achieved by transferring the Drinking Water Program from the California Department of Public Health to the State Water Resources Control Board on July 1, 2014 through enactment of the Fiscal Year 2014-2015 budget.

The goals of transferring the Drinking Water Program included the following:

- Establishing a single water quality agency to improve coordination and to enhance accountability for water quality programs.
- Providing better comprehensive technical and financial assistance to help communities, especially small disadvantaged communities, address an array of challenges related to drinking water, wastewater, water recycling, pollution, desalination, and storm water.
- Improving the efficiency and effectiveness of drinking water, groundwater, water recycling, and water quality programs.

As a result of the transfer, the State Water Board has been singularly accountable for integrated water quality program implementation including the Drinking Water Program (now the Division of Drinking Water). Having all water quality program implementation has created synergy resulting in a better understanding of the issues and better ways of addressing problems. This report includes a discussion of the progress the State Water Board has made in achieving the benefits that were envisioned by undertaking this transfer of responsibility. Examples of this improved integration include:

- coordinated efforts on drought curtailments and service connection moratoriums with the Division of Water Rights
- better addressing water quality concerns through coordinated efforts on the PFAS orders, recycled water and Groundwater Ambient Monitoring and Assessment

Program (GAMA) with the Division of Water Quality and the Regional Boards
- addressing funding needs and operator certification requirement with the Division of Financial Assistance
- Executive Office assistance for the Division of Drinking Water with public meetings and hearings, press contacts, legislation, data analysis, information technology, administration and much more.

The Division of Drinking Water and the State Water Board have benefitted from the knowledge and expertise of the each other over the last six years.

Division of Drinking Water (DDW)

The State Water Board carries out the responsibilities as the federally designated primacy agency for the drinking water program in California. This includes responsibility for the implementation of the federal Safe Drinking Water Act (SDWA). Additionally, the State Water Board carries out the responsibility for implementation of the California SDWA. These responsibilities are set forth in Chapter 4 of Part 12 (Drinking Water) of Division 104 (Environmental Health) of California H&S Code (Section116270 *et seq*.) and Articles 1 and 2 of Group 4, of Subchapter 1 of Chapter 5 (Sanitation) of Division 1 (Department of Health Services) of Title 17 and Chapters 1 through 19 of Division 4 (Environmental Health) of Title 22 of the California Code of Regulations (CCR). The DDW within the State Water Board carries out the drinking water regulatory responsibilities.

DDW implements the Safe Drinking Water Act and California regulations applicable to public water systems. This direct implementation of the program is carried out at the local and regional level by DDW District Offices and Local Primacy Agencies. The overall management, support and control of the program is accomplished through the larger management structure, ultimately under the State Water Board members. The program includes a broad range of elements and functions discussed further below.

DDW includes the Environmental Laboratory Accreditation Program (ELAP) which is responsible for accreditation of laboratories that analyze environmental samples for regulatory purposes, including drinking water laboratories performing analyses pursuant to the California SDWA. The ELAP program is of critical importance to a range of programs other than drinking water within the State Water Board and other partner agencies.

DDW is also responsible for adopting uniform criteria for the use of recycled water that is protective of public health. The Regional Water Boards or the Division of Water Quality (DWQ) within the State Water Board incorporate DDW-developed criteria in Water Reclamation Permits or Waste Discharge Requirements, which set out the specific requirements that a water recycling project must meet.

DDW and the Regional Water Boards/DWQ work cooperatively on regulating water recycling projects including those that are designed to augment drinking water supplies, including recharging groundwater supplies and augmenting surface water supplies such as reservoirs, as well as implementing statutory requirements with the goal of developing standards for the safe use of recycled water for direct potable reuse.

To better demonstrate the work performed by DDW, program metrics on completed sanitary surveys and permits are reported by the State Water Board annually as part of the annual performance report available to view on the State Water Board website. The most recent annual performance report is for the Fiscal Year 2018-19 posted here: https://www.waterboards.ca.gov/about_us/performance_report_1819/regulate/25111_ddw_comm_inspections.html

Division of Financial Assistance (DFA)

The Division of Financial Assistance (DFA) is responsible for the administration of the Drinking Water State Revolving Fund (DWSRF) Program, including the review and processing of applications from water systems for funding under the DWSRF. It also administers and reviews and processes applications for funding under various state Proposition funding programs, and funding to address drought conditions through resources that the Legislature recently made available to assist public water systems, as well as emergency grants to address serious water quality contamination and water outages.

DFA also administers the Drinking Water Operator Certification program, which certifies water treatment plant operators and water distribution system operators, including providing testing of operators and renewing of their certificates. The Office of Operator Certification presently certifies approximately 35,000 water treatment and water distribution operators.

Within DFA the Office of Sustainable Water Solutions (established by Chapter 2, Statutes of 2015, AB 92, Committee on Budget) provides technical and financial assistance for small, disadvantaged communities and seeks to promote permanent and sustainable drinking water and wastewater treatment solutions and to ensure that safe, clean, affordable, and reliable drinking water and wastewater treatment services are provided effectively and efficiently.

Safe and Affordable Financing for Equity and Resiliency (SAFER) Program

The SAFER program is a coordinated effort across several divisions within the State Water Board. These divisions include the Division of Drinking Water, Division of Financial Assistance, Division of Administrative Service, Office of Public Participation, and Office of Chief Counsel. The goal of the SAFER program is to resolve drinking water issues facing disadvantaged communities while also addressing broader drinking water issues faced by households and communities that are not served by public water systems (specifically individual wells and state small water systems).

Division of Water Quality (DWQ) and Regional Water Boards

DWQ and the Regional Water Boards are responsible for protecting the quality of surface and groundwater (namely lakes, rivers, and groundwater basins) for all beneficial uses including municipal and domestic supply. DWQ and the Regional Water Boards adopt statewide and regional water quality control plans that establish beneficial uses of surface and groundwaters, water quality objectives for a variety of constituents to protect those uses, and a program of implementation to achieve the water quality objectives. The program of implementation typically includes monitoring and surveillance, permitting, and enforcement. DWQ and the Regional Water Boards have the authority to issue waste discharge permits to the following:

- any entity that discharges wastes to surface or groundwaters including municipal or industrial wastewater treatment plants
- municipalities or facilities that discharge stormwater
- agricultural operations
- food processing facilities
- mining facilities
- timber harvest operations

As a part of these permitting programs, DWQ and the Regional Water Boards also issue orders to clean up and abate spills and leaks.

DWQ administers the state's GAMA program, which collects data from private wells and groundwater basins and makes it available through the GeoTracker GAMA online data system. The GAMA program coordinates and shares monitoring data with DDW to avoid duplication of effort and increase the amount of data that DDW can use to advise water systems about the underlying groundwater quality.

DWQ establishes statewide policies for water quality control such as the Recycled Water Policy. The Recycled Water Policy establishes monitoring requirements for water recycling facilities including those that propose to produce recycled water for indirect potable reuse.

2.1.1.2 California Public Utilities Commission (CPUC)

The CPUC is responsible for ensuring that California's investor-owned water utilities deliver clean, safe, and reliable water to their customers at reasonable rates. The CPUC Water Division regulates 93 investor-owned water and 12 sewer utilities under the CPUC's jurisdiction providing water service to about 16 percent of California's residents. Approximately 98 percent of is the customers are served by 9 large water utilities each serving more than 10,000 connections. Annual water and wastewater revenues under the CPUC's regulation total $1.96 billion.

The CPUC's five commissioners are appointed by the Governor and confirmed by the state Senate. The CPUC's primary source of funding is from a "user fee" that is assessed on utility customers as a percentage of each regulated utility's gross in-state operating revenues.

The CPUC ensures that customers of regulated water utilities receive safe and reliable water service while allowing the utility to earn a reasonable return on its investment. Its functions include: (1) authorizing utility service within defined service areas, (2) setting rates, and (3) regulating the quality of service.

As a result of shared responsibility for the regulation of investor-owned utilities with respect to water quality, the CPUC and the State Water Board's DDW have maintained a formal memorandum of understanding (MOU) to ensure consistency and coordination between the agencies' two programs. This memorandum defines common objectives, principles, agency responsibilities, and project coordination. The staff of the two agencies routinely meet to ensure that the goals of the MOU are being complied with, and to coordinate the activities between the two agencies. The large (Class A) investor-owned utilities have acknowledged the coordination between the two organizations and may participate in joint meetings with the staff of both agencies. The CPUC can impose stricter water quality requirements; an example being the CPUC requirement that Class A utilities implement the distribution system operations plan of the California Water Works Standards, which is a more stringent requirement than that which DDW mandates.

Issues related to the small investor-owned utilities continue to be difficult to resolve because these systems may lack the Technical, Managerial and Financial (TMF) capacity to secure rate relief and have an insufficient number of customers to properly fund infrastructure improvements. Incentives offered by the CPUC to encourage large investor-owned utilities (Class A companies) to acquire small investor-owned utilities have included allowing them:

1) to apply a consolidated water rate structure across their water systems within a defined region, which allows the Class A company to apply revenue generated from a sustainable system for improvements and the operation at a less sustainable system; and
2) an opportunity to earn a greater return on the small system assets if it is willing to purchase such Class C and Class D systems, which are generally in need of improvements and, in some cases, serve disadvantaged communities.

These incentives have had some success in reducing the number of CPUC-jurisdictional water utilities by one-third over the last twenty years. Many of the small investor-owned utilities experience significant infrastructure problems, such as leaking water pipes, undersized water storage facilities, inadequate fire service, and their revenue from water sales being insufficient to address these problems. In addition, present state infrastructure funding opportunities generally prohibit investor-owned utilities from receiving grants. Thus, the small companies are limited to seeking loans, for which they may have difficulty meeting the TMF capacity requirements, which would demonstrate their capability of managing the infrastructure project and paying back the loan.

In 2012, the Legislature passed Chapter 539, Statutes of 2012 (AB 1830), which allowed complaints to be filed by tenants of mobile home parks claiming that their water rates were not just and reasonable or that the service was inadequate. The CPUC reported to State Water Board staff that they had received no AB 1830 complaints as of September 2019.

2.1.1.3 Division of Corporations

The Division of Corporations (DOC, formerly the Department of Corporations) within the Department of Financial Protection and Innovation has responsibility under the Corporate Securities Law of 1968 (Corporations Code Section 25000 et seq.) to approve and register the security offering of mutual water companies. Mutual water companies are privately owned water companies in which each lot owner is entitled to one share per lot that they own. They are managed and operated in accordance with Articles of Incorporation and bylaws approved by the DOC and filed with the Secretary of State. Title 10, CCR, Subarticle 7.1 of Article 4 of Subchapter 2 of Chapter 3 sets forth the standards governing the regulation of mutual water companies. These regulations do not deal with the quality of the drinking water served. DOC regulations for incorporated mutual water companies require compliance with DOC standards and financial responsibility requirements before DOC will approve the security offering.

DOC regulations require a mutual water company to contact the State Water Board when it is being formed. Compliance with this requirement has been inconsistent in the past due to a history of conflicting and duplicative requirements on the regulated water systems. In addition, there has been no agreement to coordinate the State Water Board and DOC programs to provide for an effective means of conflict resolution.

Chapter 512, Statutes of 2011 (AB 54) requires that mutual water companies meet the California Waterworks Standards and that mutual water companies that operate as public water systems maintain a financial reserve fund for repairs and replacement to their water production, transmission, and distribution facilities at a level sufficient for continuous operation of facilities in compliance with the California SDWA. In addition, AB 54 requires that board members of a mutual water company, within six months of taking office, complete a two-hour training course on their fiduciary duties, duties of public water systems, and long-term management of a public water system.

Additional legislation enacted in 2013, Chapter 633, Statutes of 2013 (AB 240) the Mutual Water Company Open Meeting Act, permits an eligible person to attend a meeting of a mutual water company and to speak during the meeting; requires the board of the mutual water company that operates a public water system to adopt, in an open meeting, an annual budget on or before the start of each fiscal year; requires the board of a mutual water company that operates a public water system to contract with a certified public accountant or public accountant to conduct an annual review of the financial records and reports of the mutual water company; and requires the board of directors of a mutual water company that operates a public water system to make specified documents available to an eligible person upon payment of fees covering the direct costs of duplication.

2.1.1.4 Secretary of State

The Secretary of State interacts with water suppliers who are also considered business entities. As a business entity, a water supplier needs to submit required documents including Articles of Incorporation and periodic statements of information to the Business Programs Division. All non-profit, non-stock corporations organized under the Non-Profit Corporation Law are required to have Articles of Incorporation certified by, and on file with, the Secretary of State. This includes all mutual water companies as well as homeowners' associations, religious, charitable, social, educational, and recreational associations. When the water supplier is considered a public entity and not required to register with other public agencies, the water supplier submits a "Statement of Facts" to the Special Filings Unit, within the Business Programs Division.

2.1.1.5 Department of Housing and Community Development (DHCD)

DHCD is responsible for the regulation of the construction and maintenance of mobile home parks, private campgrounds, RV parks, and employee housing facilities, such as labor camps, many of which have independent public water systems. The authorizing statutes for DHCD's regulations are the Mobile Home Parks Act (H&S Code Sections 18200 – 18700), the Special Occupancy Parks Act (H&S Code 18860 – 18874) and Employee Housing Act (H&S Code Sections 17000 – 17062.5) with regulations adopted under these statutes included in Title 25, CCR.

Recently, DDW and DHCD have been meeting to discuss how their respective programs can better work together to address problems at public water systems that serve mobile home parks, special occupancy parks, and employee housing. DHCD has identified a process for DDW staff to use to identify systems that are not meeting drinking water standards. DHCD has the ability to suspend a mobile home park's operating permit where there is contamination that could have acute impacts on health, such as nitrate and bacteria. Suspending a park's operating permit is a powerful incentive for owners to bring the public water system into compliance. This is due to it being unlawful for a mobile home park or special occupancy parks to collect rent without a valid permit to operate.

There are, however, several inconsistencies between DHCD and DDW's requirements that need to be addressed by changes to statute or regulations in order to help address safe and affordable drinking water issues at mobile home parks, special occupancy parks and employee housing. First, the DHCD’s construction standards require mobile home parks to comply with the state's uniform building codes when developing its water distribution system, and those requirements are less stringent than DDW's Waterworks Standards. The State Water Board is unable to permit any public water system that does not comply with the California Waterworks Standards. Not meeting Waterworks Standards also hinders consolidation of mobile home parks and special occupancy parks not meeting drinking water standards with nearby public water systems or including them within other regional solutions because of the costs to retroactively bring these systems into compliance.

Another problem is that the Employee Housing Act through DHCD requires owners of employee housing with its own water system to conduct an annual test of the potability of the water delivered to the facility. The Mobile Home Parks Act, Special Occupancy Park’s Act, or Employee Housing Act have not, however, defined the term “potability” and rely upon certification from Local Enforcement Health Jurisdictions (LEHJ), which by law may assume responsibility for enforcement of the Mobile Home Parks Act and Special Occupancy Park’s Act. By regulation, the responsibility for testing the water supply falls to local county health departments (Title 25, CCR, Section 772) to assure compliance with this requirement. DHCD also has the authority under law to enforce the potability requirement, but the Mobile Home Parks Act, the Special Occupancy Parks Act and Employee Housing Act do not require a demonstration that the facility has a public water system that has received the State Water Board permit approval. The State Water Board sees this is a problem because LEHJ have not had the resources to seek out these facilities to ensure they are inventoried and have been permitted. As such, the LEHJ does not inspect or regulate employee housing facilities unless they have been delegated the Employee Housing Act enforcement authority from DHCD. As a result, many water systems for such facilities may be unregulated even if they meet public water system criteria.

To assist in helping mobile home parks, special occupancy parks, or employee housing that are public water systems to understand the requirements of owning a public water system, DDW has put together a one-page information sheet for DHCD to share with owners of mobile home parks, special occupancy parks, or employee housing, notifying them of their responsibilities as a public water system. It is hoped that this outreach might encourage some of the mobile home parks, special occupancy parks, and employee housing owners that have their own water systems to contact DDW about their responsibilities and to obtain a permit.

2.1.1.6 Department of Real Estate

The Department of Real Estate, operating under the authority of the Subdivision Law, is involved in the regulation of water systems through its approval process for the sale of subdivided lands. Subdivision laws were enacted to ensure that subdividers deliver to buyers what was agreed to at the time of sale. Before real property that has been subdivided can be marketed in California, a public report from the Department of Real Estate must be obtained by the subdivider disclosing pertinent information about a particular subdivision, including the details of the water system serving the area. Prior to the issuance of a public report, the subdivider must file an application along with supporting documents.

2.1.1.7 Department of Public Health (CDPH)

DDW interacts with a number of entities within CDPH including the Oral Health Unit, which oversees the Community Water Fluoridation Program, and the Food and Drug Branch, which is responsible for the regulation of bottled water and water sold through vending machines, as well as the licensing of water haulers that transport drinking water. DDW also collaborates with the CDPH's Division of Communicable Disease Control in the investigation of suspected drinking water-related infectious disease outbreaks.

CDPH maintains the State's Drinking Water and Radiation Laboratory, which serves as the State's principal laboratory as required for primacy under the federal SDWA. The State Water Board has an Interagency Agreement with CDPH for it to provide laboratory services and technical support to DDW, including analyzing drinking water samples collected for special studies or enforcement cases and the development of analytical methods for measuring chemical contaminants as well as to provide support to ELAP.

2.1.1.8 Department of Water Resources (DWR)

DWR has the responsibility to manage the water resources of California in cooperation with other agencies. Most important is the operation of the State Water Project, which supplies water to public water systems that serve many of California's citizens. DWR is responsible for the development of the California Water Plan, which serves as a guide to the development and management of the State's water resources. The California Water Plan is required to be updated every five years. DWR has directly funded drinking water related projects under Propositions 50 and 84, primarily through Integrated Regional Water Management funds.

On September 16, 2014, Governor Jerry Brown signed into law a three-bill legislative package, composed of AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA requires governments and water agencies of high and medium priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge.

DWR additionally has several responsibilities related to implementation of SGMA. These include adoption of emergency regulations for the evaluation of groundwater sustainability plans (GSP) and alternative plans (completed in 2016), evaluation of submitted GSP, alternative plans, and annual reports, providing support to local agencies through facilitation and technical support services, and administration of the Sustainable Groundwater Planning Grant Program.

2.1.1.9 Office of Environmental Health Hazard Assessment (OEHHA)

OEHHA is responsible for providing to state and local government agencies toxicological and medical information relevant to decisions involving public health. OEHHA has the statutory responsibility for assessing the public health risks of chemical and radiologic contaminants in drinking water. That responsibility includes establishing Public Health Goals (PHG), which are the health-based levels that the State Water Board uses in the development of state primary drinking water standards (maximum contaminant levels, MCL). OEHHA also often assists DDW in establishing drinking water notification levels, which are advisory in nature.

2.1.1.10 Department of Pesticide Regulation (DPR)

DPR is responsible for identifying agricultural pesticides with the potential to pollute groundwater. DPR obtains reports and analyzes the results of well sampling for pesticides conducted by public agencies and, if a pesticide is detected, reviews the detected pesticide to determine if its continued use can be allowed. DPR adopts use modifications to protect groundwater from pollution if the formal review indicates that continued use can be allowed. The State Water Board provides public drinking water quality monitoring data to DPR for its groundwater protection program.

2.1.1.11 Department of Fish and Wildlife (DFW)

The State Water Board and DFW collaborate on projects dealing with the protection of drinking water quality and the maintenance of native fish species in surface waters that are used as a drinking water supply. H&S Code Section 116751 states that DFW may not introduce a poison to a drinking water supply for purposes of fisheries management unless the State Water Board determines that the activity will not have a permanent adverse impact on the quality of the drinking water supply or wells connected to the drinking water supply. In making this determination, the State Water Board must do the following:

1) evaluate the short- and long-term health effects of the poison on drinking water;
2) ensure that an alternative supply of drinking water is provided to the users of the drinking water supply while the activity takes place; and
3) in cooperation with DFW, develop and implement a monitoring program to ensure

that no detectable residuals of the poison, breakdown products, and other components of the poison formulation remain in the drinking water supply or adjoining wells after the activity is completed.

2.1.1.12 Coastal Commission

The Coastal Commission has the responsibility to use a balanced approach to the conservation and use of coastal resources, to the rights and responsibilities of individuals and the public in the protection and use of these resources, and the need to limit human use of some resources in order to avoid their degradation or destruction. For desalination/brackish water supply projects Coastal Commission approval of the intake structure, treatment facilities and transmission pipelines is required.

2.1.2 Federal Agencies

2.1.2.1 United States Environmental Protection Agency (USEPA)

USEPA administers the nationwide drinking water program as authorized under the 1974 federal SDWA, which was substantially amended in 1986 and 1996. The federal program consists of the establishment of drinking water standards, monitoring and reporting requirements, and public notification, which are applicable to all public water systems. USEPA can directly enforce compliance of these standards, or authorize primary enforcement of the federal SDWA to any state that has an authorizing state statute at least as stringent as the federal SDWA, and a state regulatory program for public water systems that meets various enforcement, planning, and record keeping requirements.

Authorization of primary enforcement of the federal SDWA to a state is known as "primacy." As part of the delegation of primacy to a state, USEPA provides oversight and partial grant funding of the state program as well as annual capitalization grants under the Drinking Water State Revolving Fund (DWSRF). The oversight by USEPA requires an annual work plan, an annual (DWSRF) Intended Use Plan, and specific reporting requirements including an annual PWS compliance report.

2.1.3 Local Agencies

Chapter 1182, Statutes of 1990 (AB 2158) allows the State Water Board to delegate the authority for regulating small water systems (public water systems with fewer than 200 service connections) to a local county health officer. In addition, there are several other organizations that indirectly impact public water systems, including planning departments, building departments, Local Agency Formation Commissions (LAFCO), and Boards of Supervisors. The respective roles, responsibilities, and areas of concern for each of these units of government are described below.

2.1.3.1 Local Primacy Agency Counties

Currently, 29 local primacy agency counties (identified in Table 2-2) have been delegated authority to regulate small water systems. Although the delegation agreement is with the local county health officer, the regulatory program is typically operated by the LEHJ.

2.1.3.2 Local Agency Formation Commissions (LAFCO)

LAFCO basic authority is to approve, deny, or modify boundary changes requested by public agencies or individuals. LAFCO provide input to public water systems during the formations of new communities, special districts, and "spheres of influence" for all public agencies. In 2011, LAFCO were provided authority through Chapter 512, Statutes of 2011 (AB 54) to approve the annexation of a mutual water company that operates as a public water system into the jurisdiction of a city, a public utility or a special district, with the consent of the respective public agency or public utility and mutual water company. LAFCO have authority to conduct municipal service reviews to ascertain whether the entity is providing municipal services in a satisfactory manner.

2.1.3.3 County Planning Departments

County planning departments may impact public water systems through the development of county-wide plans, which set the framework for specific county ordinances.

2.1.3.4 Local Building Departments

Local building departments have a responsibility to enforce building standards and so ensure compliance with implementation of the state's lead ban regulations, including the use of low-lead solders and prevention of the use of lead plumbing materials.

2.2 PUBLIC WATER SYSTEM

Any water system serving 15 residences or an average of at least 25 people more than 60 days out of the year is a public water system. A source of confusion is the term “public water system” that is established in federal law and is used in California as well. The handout titled “What is a Public Water System” provides additional clarification. “Public” water systems serve the public but can be either publicly-owned or privately-owned.

Public water systems can be broken down into community and non-community systems and non-community systems can either be transient or non-transient, resulting in three types of water systems (community, transient non-community and non-transient non-community). A flowchart showing the differences between community water systems and non-community water systems can be found on the State Water Board’s website.

2.2.1 Organizational Structures

All types of public water systems, regardless of organizational type, are regulated by the State Water Board or a local primacy agency for compliance with Safe Drinking Water Act requirements. However, there may be additional State or local agencies with oversight authority depending on the governance structure. Depending on the nature of an individual water system and their problem, the additional oversight authority can augment actions being performed by the State Water Board for the purpose of providing safe drinking water, or be at odds with these actions due to another agency's competing mandates.

2.2.1.1 Publicly-owned Public Water Systems

- Publicly-owned Community Water Systems examples include:
  - Municipal
  - County
  - Special district, Community Services District, Public Utilities District, County Water District, Metropolitan Water District, Irrigation District, etc.

Publicly-owned public water systems have oversight by both the State Water Board and the LAFCO of the county where the water system resides. The State Water Board, or the local primacy agency, regulates compliance with the Safe Drinking Water Act, while LAFCO controls the water system's boundary and has authority to perform municipal service reviews. LAFCO also have a mandate to preserve agricultural land resources and discourage urban sprawl, and ensure organized growth. These other mandates often result in the formation of small water systems adjacent to cities and other LAFCO regulated entities.

Publicly-owned public water systems also have special rate setting requirements under Proposition 218 (Prop 218). Under Prop 218, these publicly owned water systems' residents may protest new rate structures, even if the water system is raising rates to correct public health violations or necessary infrastructure upgrades. Publicly-owned public water systems also have requirements regarding the noticing of their board meetings in accordance with the Brown Act. It is important to understand that Prop 218, LAFCO jurisdiction and the Brown Act are not applicable to most other types of public water systems. For example, LAFCO has no jurisdiction over mobile home parks, investor owned utilities, etc.

- Publicly-Owned Non-Community Water Systems examples include:
  - Public Schools (owned by Local Education Agencies)
  - Publicly-owned prisons and correctional facilities
  - Publicly-owned campgrounds with transient populations, such as State Parks
  - Publicly-owned marinas with transient populations

Public schools that are served by their own water supply facilities are required to have new water system changes and modifications reviewed by both the State Water Board and the State Architects office. Other regulatory review such as by LAFCO is not applicable, unless there is a consolidation with a LAFCO-regulated public water system. Campgrounds and marinas have no similar requirements.

2.2.1.2 Privately-owned Public Water Systems

- Privately-owned Community Water Systems examples:
    - Mutual Water Companies, as described in Corporations Code Sections 14300 through 14307 through 14307
    - Investor-Owned Utilities, regulated by the CPUC as described under the Public Utilities Code Sections 2701 through 2715
    - Other Privately-owned public water systems (not actively regulated by the CPUC)
    - Mobile Home Parks
    - Farmworker housing / Labor camps
    - Apartments (with their own water supply facilities)
    - Condominium and townhouse developments (with their own water supply facilities)
    - Other community water systems owned by individuals or partnerships but not actively regulated by the CPUC, such as County Water Companies or individual owners

Privately-owned public water systems fall generally into two types: those regulated by the State Water Board / local primacy agency and CPUC, and those regulated only by the State Water Board / local primacy agency. Of the privately-owned public water systems, investor owned utilities serve the largest population, while other privately-owned public water systems represent a larger number of water systems. Investor owned utilities are regulated both by the State Water Board / local primacy agency for compliance with the Safe Drinking Water Act and the CPUC for water rates, boundaries, and other matters. There are 93 investor owned utilities operating in California providing water service to about 16 percent of California's residents. Approximately 95 percent of that total is served by 9 large water utilities, as stated on the CPUC's website. As rate structures are different than publicly-owned public water systems, many investor owned utilities are able to have low income assistance programs where publicly owned public water systems are constrained by Proposition 218 in their ability to do so.

Mutual water companies do not fall under CPUC oversight, but have their own financial budgeting, training and public noticing requirements under Section 14300-14307 of the

Corporations Code. These sections require financial reserve funds for repairs, annual budget audits by a certified public accountant, educational training requirements for board members and specific public meeting notice requirements. However, only “eligible persons,” which include mutual water company customers and city or county officials, may require financial records for review. Since the passage of AB 54 in 2012, LAFCO have increased jurisdiction over mutual water companies. Section 14301.1 of the Corporations Code requires mutual water companies to submit information for the purpose of municipal service reviews and sphere of influence changes at the request of its local LAFCO agency. However, limited staffing of LAFCO agencies results in municipal service reviews not being completed for mutual water companies in many areas. Historically, no other state authority has jurisdiction to require submittal of financial information or training records from mutual water companies, including the State Water Board. Therefore, it has been difficult to verify financial capacity of these water systems. However, the passage of SB 200 provides the State Water Board with increased authority to require on-going technical, managerial and financial reporting in Section 116530 of the H&S Code.

Approval of the location of a new mutual water company is under the jurisdiction of City or County Planning Offices. Mutual water companies have been created by developers that do not want the expense of paying city development fees or building pipelines to connect to municipal water systems. In these cases, the mutual water company board members must come from the future residents, who may not understand all the requirements of being a public water system or their legal responsibilities upon buying a home.

Mobile home parks that have their own water supply sources and facilities are public water systems regulated by both the State Water Board / local primacy agencies and the DHCD. However, if 10 percent of the mobile home residents file a complaint with the CPUC in a 12-month period claiming rates are unreasonable or service is inadequate then the CPUC may review the merits of the complaints and take certain actions, in accordance with Section 2705.6 of the Public Utilities Code. The State Water Board’s information is that no such complaints have been filed, despite Safe Drinking Water Act violations by mobile home park water systems. Other privately-owned public water systems such as apartments and condominiums are not regulated by DHCD; their water systems are only under the jurisdiction of the State Water Board/ local primacy agencies.

- Privately-owned Non-community Water Systems examples:
  - Private Schools
  - Privately-owned Campgrounds, RV Parks, Resorts, etc.
  - Privately-owned Marinas
  - Businesses such as restaurants, gas stations, manufacturing plants, etc.

Non-community water systems are typically private businesses that do not have residents that spend more than 6 months per year at their facility. These privately-owned non-community water systems typically only have oversight by the State Water Board or local primacy agencies; except for restaurants, which have additional local environmental health requirements.

2.3 STATE DRINKING WATER REGULATORY PROGRAM

2.3.1 Division of Drinking Water (DDW)

DDW's enforcement capability and responsibilities have grown over the last three decades. Along with the ability to issue citations and compliance orders to water utilities in noncompliance with state laws and regulations, DDW was recently provided the ability to revoke permits, consolidate water systems, and to contract with, or provide a grant to, an administrator to provide administrative, technical, operational, or managerial services, or any combination of those services, to a designated water system to assist the designated water system with the provision of an adequate supply of affordable, safe drinking water.

At the national level, emphasis continues to be placed on compliance and enforcement activities, with a greater degree of reporting on these activities. New state and federal regulations to control chemical and radiologic contaminants and microbial agents have added to the technical complexity of the program, as well as making compliance among smaller water systems challenging due to TMF capacity issues.

At the same time, new state and federal sources of funding for water system improvements have helped to achieve greater rates of compliance. Drinking water quality and reliability have become even more important particularly as competition for the state's limited supply of high quality water becomes more intense.

Recent legislation has also given additional responsibilities to DDW, as presented in Appendix 9. For example, DDW is now involved in activities related to lead exposures in drinking water, such as lead sampling in schools and childcare centers, and lead service line inventory requirements. In addition, there are new requirements for regulations related to recycled water, including those related to on-site reuse, and to the use of recycled water for drinking water for animals. DDW is also required to develop analytical methods for microplastics in drinking water.

The following sections describe the regulatory and technical programs within DDW.

2.3.1.1 Regulatory Program

Included under the regulatory portion of DDW program are:

1. Issuance of permits for public water systems and their sources, treatment and critical facilities,
2. Periodic inspections of water systems known as sanitary surveys,
3. Tracking of monitoring data to determine compliance, and

4. Taking timely and appropriate enforcement actions.

DDW field activities also include training, technical assistance, plan review, and prompt responses to water quality problems and water system issues that may impact public health.

As noted above, DDW's responsibilities have not historically included ongoing and direct involvement with the regulation or oversight of private domestic wells or water systems that are not public waters systems. These categories of drinking water are under the oversight of local agencies. However, with the establishment of the SAFER program, DDW has a more direct and much more active role in addressing problems in these facilities. This is discussed further in Chapter 8 on Sustainability.

There are a total of 7,369 public water systems in California as of November 2020. For regulatory purposes, there are three categories of public water systems as follows:

1. Community water systems (CWS) – These systems serve residential areas.
2. Non-transient non-community water systems (NTNCWS) – These systems serve the same people daily for at least six months per year (for example schools and businesses with 25 or more employees).
3. Transient non-community water systems (TNCWS) - These systems serve a varying population in nonresidential settings for a minimum of 60 days per year. This includes facilities such as restaurants and campgrounds where there are different people visiting throughout the year.

See Appendix 2 for the definitions and expanded discussion. Table 2-1 shows the total number and types of public water systems operating under permit in California. The majority of CWS are relatively small and lack significant economy of scale. For example, over half of the CWS serve fewer than 100 service homes (service connections).

Table 2-1: Number of California Public Water Systems by Type as of November 2020

Public Water System by Type	Number
Community Water System	2,884
Non-transient, Non-community Water System	1,497
Transient, Non-community Water System	2,988
Total	**7,369**

2.3.1.2 Permits

All public water systems must have a permit to operate issued by the State Water Board. These permits and their accompanying engineering reports may place specific conditions on various aspects of individual water systems such as operation, monitoring and management. The system-specific conditions are an important and powerful regulatory tool to address system-specific issues in a proactive way.

Permits typically include special provisions established specifically for the individual water system, setting forth operating requirements that, if not met, could result in a formal enforcement action. Permits do not have expiration dates. However, the public water system must apply for an amendment to the water supply permit in the event of:

1. A water system proposes to use a new water source
2. A proposed change to the types of water treatment provided
3. Changes in ownership
4. Proposed modifications of facilities that differ with a specific element of a DDW standard (such as an alternate pipe material for a specific reason).
5. Use of a storage tanks and reservoirs with capacities greater than 100,000 gallons.

2.3.1.3 Inspections

DDW performs periodic, detailed inspections of public water system facilities along with reviews of operational records. These inspections are known as “sanitary surveys” under the Safe Drinking Water Act. These surveys are foundational to the regulatory program, in that they provide a detailed evaluation of the status of facilities and identification of potential problems. The routine water quality sampling required for public water systems serves to identify and provides documentation of the actual quality of water being served. However, this sampling alone does not prevent problems from occurring. Inspections and sanitary surveys are needed to detect potential problems and eliminate them before the problem results in a water quality failure.

H&S Code Section 116735(b) requires that public water systems be inspected according to the following schedule:

1. Annually for systems with a surface water source with treatment;
2. Biannually for systems with groundwater subject to treatment;
3. Every three years for systems with groundwater not subject to treatment.

2.3.1.4 Compliance Tracking

DDW electronically tracks the water quality monitoring performed by water systems to ensure they are doing what is required of them, and to determine if they are in compliance with all drinking water standards. USEPA requires the State Water Board to submit an annual compliance report containing information on noncompliance with drinking water standards by public water systems.

2.3.1.5 Enforcement

DDW has several mechanisms available to obtain compliance with drinking water standards, including:

1. Specifying corrective action provisions in permits,
2. Issuance of citations and compliance orders,
3. Revocation or suspension of permits,
4. Initiation of a court action, including the petition for a court-appointed receivership.

DDW can issue citations and monetary penalties of up to $1,000 a day for violations of the Safe Drinking Water Act, a regulation, permit, standard, or previously issued citation or compliance order. DDW may also issue compliance orders directing water systems to take corrective actions as an alternative to issuing penalties. If a water system fails to remedy a violation, DDW can revoke the public water system's operating permit. DDW's recent enforcement actions are available for individual public water systems via drinking water watch: https://sdwis.waterboards.ca.gov/PDWW/

DDW can also work with Attorney General's Office to seek judicial remedies, including injunctive relief and the imposition of civil penalties. A court may also appoint a receiver to assume possession of the water system and operate it. The State Water Board worked with the Attorney General for a total of 5 cases since 2015, including two receivership requests.

2.3.1.6 Consolidation

The State Water Board was given authority to order mandatory consolidations under SB 88 in June 2015. Two subsequent bills, SB 552 and AB 2501, added additional clarifying language and expanded the scope of the initial legislation to include state small water systems (serving 5 to 14 connections and fewer than 25 individuals for more than 6 months a year) and domestic well owners that petition the State Water Board to be consolidated. Mandatory consolidation can only be completed for water systems that include all the following conditions: (1) are public water systems serving disadvantaged communities (with a median income less than 80 percent of the state median), (2) the water system consistently fails to provide an adequate supply of safe drinking water (a primary or secondary MCL standard failure), and (3) where another water system is close enough to be cost effective. As presently written, mandatory consolidations must also meet several criteria prior to the State Water Board issuing an order, including: a voluntary negotiation period (typically 6 months), public meetings, a finding that no local area formation commission action will address the water supply issue in the near future, and that water rights and contracts have been addressed.

2.3.1.7 Administrators

SB 552, approved in September 2016, gave the State Water Board the authority to contract with an administrator to provide administrative and managerial services to disadvantaged public water systems and state small systems, which is particularly useful where it is not feasible to do physical consolidation. The legislation specifically stated that systems would not be responsible for the costs associated with the administrator. Since no State or Federal funds were available for this purpose, no administrators were appointed until the passage of AB 1577 and SB 862, which appointed and funded an administrator for the Sativa-Los Angeles County Water District. However, with the passage of SB 200, more funding for a larger variety of administrators has become available. Administrators may now also include investor owned utilities.

The State Water Board has developed adopted an administrator policy in accordance with Section 116686 of the H&S Code.

2.3.1.8 Technical Programs

DDW carries out several other program elements in support of the overall regulatory program. These elements are important to the effectiveness of drinking water regulatory programs and protection of public health.

Among these activities are the certification of drinking water laboratories, through DDW's Environmental Laboratory Accreditation Program (ELAP), and ensuring, through DDW's quality assurance program, the integrity and validity of drinking water analytical data that is received from certified environmental laboratories for use by DDW and other partner agencies for compliance purposes.

In addition, DDW develops regulations related to drinking water, including primary and secondary drinking water standards; issues advisory Notification and Response Levels, and provides information to other state agencies regarding activities that might impact drinking water sources. Furthermore, DDW aids water systems, in terms of their resiliency to attacks on security systems equipment, disasters and emergencies.

DDW reviews potential water recycling projects, such as indirect potable reuse, using groundwater recharge or surface water augmentation, recycled water distribution, and development of criteria for possible direct potable reuse.

Finally, DDW provides technical support to DFA, oversees the state's drinking water fluoridation program and maintains a registry of residential point-of-entry (POE) and point-of-use (POU) water treatment devices. DDW also implements the Residential Water Treatment Device registration program which provides oversight and a registry of water treatment devices that make contaminant-reduction claims for residential use.

Over the past few decades, California has adopted new or more stringent drinking water standards for 16 inorganic and 34 organic contaminants, two groups of disinfection byproducts (DBP), two individual DBP, and two treatment technique requirements. These and other regulated contaminants are presented in Appendix 2.

The state has also adopted regulations that identify unregulated contaminants for required monitoring to determine the extent of their presence in drinking water, beginning with several dozen chemicals in the 1980s, many of which have subsequently become regulated. The most recent unregulated contaminant monitoring requirements were established in 2001 for nine unregulated organic and inorganic chemical contaminants (presented in Appendix 3); these resulted in MCL for perchlorate, and 1,2,3-trichloropropane, as well as for hexavalent chromium. These are discussed further in Chapter 3. Although there are currently no monitoring requirements for unregulated contaminants, this remains a valuable tool available to the State Water Board for the collection of information about drinking water quality.

In 2011 and again in 2016, emergency regulations were adopted for the use of POE and POU treatment devices. The POE/POU regulations became permanent in 2019. The use of these devices is limited to public water systems serving less than 200 service connections. State law further limits the use of POE devices to only three years or less if centralized treatment is installed before that time.

In addition, requirements were updated that address standards covering the design and operation of public water systems such as minimum operating water pressure and water source capacity, water pipe materials, and well construction.

Regulations that were adopted since the 2015 Plan are included in Appendix 6.

2.3.2 Local Environmental Health Jurisdictions (LEHJ)

The State Water Board may, pursuant to state law, delegate to the local county health officer the responsibility for enforcement of the California Safe Drinking Water Act and regulations for small public water systems (public water systems with less than 200 service connections) in their jurisdiction. These counties are known as Local Primacy Agency (LPA) counties. The actual delegation activities are carried out by the LEHJ. Table 2-2 provides information on the number of public water systems within each of the 58 counties as well as denoting the counties with delegated authority. As of November 2020, DDW had delegation agreements with 29 LPA counties. In the last several years, some LPA have chosen to no longer operate as LPA. In these cases, DDW assumed regulatory jurisdiction for these water systems.

LPA must meet the requirements of their delegation agreement. DDW reviews the performance of each LPA annually and makes recommendations for program improvements. The LPA has a ‘reasonable amount of time’ to make program improvements required by DDW. Should an LPA fail to make needed improvements to their program, DDW has the authority to revoke the LPA’s delegation agreement.

There are several challenges facing LPA that are seeking to continue the delegation of primacy including:

1. The increasing number and complexity of drinking water standards and regulations;
2. The technical expertise required to operate water treatment facilities;
3. The amount of time and resources required to carry out enforcement actions;
4. Complex compliance issues, such as regional nitrate and arsenic problems that disproportionately impact small water systems.

In 2014, DDW issued updated delegation agreements to the 29 LPA reflecting current primacy delegation requirements. The goal of these updated delegation agreements is to ensure that all program objectives are clearly stated so that LPA understand all required program elements. Since 2014, the LPA programs have been evaluated based on the new delegation agreements. DDW is reporting to the Board and the public on the effectiveness of the LPA programs annually in the Water Boards Performance Report. Tracking the LPA's programs more closely allows DDW to prioritize technical assistance and training for LPA or to take other appropriate actions if necessary.

Table 2-2: 2020 Inventory of Water Systems in California

County	LPA?	CWS	NTNCWS	TNCWS	Total
Alameda	No	14	5	9	28
Alpine	Yes	5	2	35	43
Amador	No	21	5	47	73
Butte	Yes	44	25	30	99
Calaveras	Yes	18	6	29	53
Colusa	No	9	6	15	30
Contra Costa	Yes	40	8	45	93
Del Norte	No	16	3	13	32
El Dorado	Yes	19	9	101	129
Fresno	No	106	95	119	320
Glenn	No	15	13	11	39
Humboldt	No	47	9	34	90
Imperial	Yes	31	24	24	79
Inyo	Yes	47	11	53	111
Kern	No	175	82	89	346
Kings	Yes	13	13	8	34
Lake	No	51	1	39	91
Lassen	No	15	13	13	41
Los Angeles	Yes	206	24	63	293
Madera	Yes	68	46	93	207

County	LPA?	CWS	NTNCWS	TNCWS	Total
Marin	No	15	8	25	48
Mariposa	No	14	10	41	65
Mendocino	No	43	26	68	137
Merced	No	22	57	45	124
Modoc	No	5	2	7	14
Mono	Yes	17	3	72	92
Monterey	Yes	162	101	69	332
Napa	Yes	31	64	93	188
Nevada	Yes	21	14	49	84
Orange	No	40	4	3	47
Placer	Yes	58	14	57	129
Plumas	Yes	29	7	80	116
Riverside	Yes	102	26	84	212
Sacramento	Yes	63	35	78	176
San Benito	No	34	17	13	64
San Bernardino	Yes	149	44	135	328
San Diego	Yes	79	20	98	197
San Francisco	No	5	1	2	8
San Joaquin	Yes	95	101	120	316
San Luis Obispo	Yes	68	49	38	155
San Mateo	No	37	3	14	54
Santa Barbara	Yes	63	22	59	144
Santa Clara	No	68	23	28	119
Santa Cruz	Yes	49	16	35	100
Shasta	Yes	63	34	82	179
Sierra	No	8	0	26	34
Siskiyou	No	32	10	32	74
Solano	No	26	14	23	63
Sonoma	No	128	106	207	441
Stanislaus	Yes	61	69	73	203
Sutter	No	7	18	13	38
Tehama	Yes	53	27	37	117
Trinity	No	18	5	23	46
Tulare	No	98	81	142	321
Tuolumne	No	53	10	58	121
Ventura	No	68	20	12	100
Yolo	Yes	17	23	45	85
Yuba	Yes	23	12	32	67

County	LPA?	CWS	NTNCWS	TNCWS	Total
Total	**29**	**2,884**	**1,497**	**2,988**	**7,369**

CWS: Community Water System
TNCWS: Transient Non-community Water System
NTNCWS: Non-transient, Non-community Water System

2.4 FUNDING ASSOCIATED WITH STATE DRINKING WATER PROGRAM

The funding for state drinking water regulatory program activities is derived from several sources including the state General Fund, cost recovery and fees from public water systems for regulatory program activities (Safe Drinking Water Account), operator certification program fees, Environmental Laboratory Improvement Fund, Propositions 50 and 84, and Federal Funds.

2.5 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

There are a multitude of state and local agencies involved in the regulation of public water systems and water supplies. Coordination among agencies continues to improve, and the regulation of public water systems has become more consistent. This improvement has principally been the result of more defined regulatory authority. In addition, close cooperation and coordination among agencies has resulted in improvements in areas such as source water quality protection, water supply reliability, enforcement, and financial responsibility requirements.

Further collaboration with other state agencies is needed to address differences between the regulatory requirements of the respective agencies that affect the provision of drinking water that meets quality standards. Similarly, more collaboration is needed with local agencies to prevent the proliferation of new housing developments that do not provide adequate sources of drinking water that meet quality standards, as well as to address areas that are not served, or are inadequately served, by a public water system.

Recommendations

2-1 The State Water Board will continue to work closely with DHCD to develop a coordinated strategy to address water quality and water quantity in mobile home parks, special occupancy parks, and employee housing.

2-2 The State Water Board will continue to work closely with LAFCO to help address technical, managerial, and financial issues with small agencies under their purview that operate a public water system.

2-3 The State Water Board will coordinate with local county and city planning departments, LAFCO, and LEHJ, to coordinate elements of the SAFER program and to identify : 1) areas that may be at a higher risk of contamination 2) areas currently developed without safe drinking water to determine where Community Services Districts or County Service Area could be created or where other actions could be taken, and 3) areas where new development or issuance of new building permits should be postponed until safe water is demonstrated.

2-4 Provide authority for LAFCO and/or the State Water Board to deny any type of new public water system, including mutual water companies, mobile home parks, and neighborhood associations within City boundaries or within the sphere of influence of any municipality serving drinking water.

2-5 The State Water Board will report on the effectiveness of the LPA programs annually in the State Water Board's Performance Report and will use this information to track progress and prioritize activities related to LPA.

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State Water Board annual performance report Fiscal Year 2018-19 (https://www.waterboards.ca.gov/about_us/performance_report_1819/regulate/25111_ddw_comm_inspections.html)

State Water Board's "What is a Public Water System" guidance document (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/waterpartnerships/what_is_a_public_water_sys.pdf)

State Water Board's "Decision Tree for Classification of Water Systems" document (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/class_dec_tree.pdf)

State Water Board's public Drinking Water Watch (https://sdwis.waterboards.ca.gov/PDWW/)

CPUC website (https://www.cpuc.ca.gov/water/)

CPUC Customer Assistance Programs (https://www.cpuc.ca.gov/General.aspx?id=2417)

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CHAPTER 3 QUALITY OF CALIFORNIA'S DRINKING WATER

Ensuring adequate and safe water supplies for Californians requires vigilance by public water system operators and managers along with a strong regulatory structure. Both of these components must focus on continuously meeting standards while developing proactive approaches to prevent future problems. There is a wide range and variety of challenges to drinking water quality both on a local level and across regions of the state. The challenges come in many forms including local incidents such as potential contamination from water main breaks to local or regional groundwater contamination issues. Groundwater contamination can be caused by human actions, both historic and current, and by naturally occurring processes. For example, arsenic is primarily a naturally-occurring contaminant but in some rare cases is a result of improper disposal practices. Our ability to measure a wider range of contaminants at very low levels continues to grow as industry develops the ability to test more constituents at lower detection limits.

Annual compliance reports provided to USEPA indicate that over 98 percent of the population served by PWS receives drinking water that meets federal and state drinking water standards. As discussed in Chapter 4, public water systems that do not meet drinking water standards generally serve smaller communities, particularly those communities that are disadvantaged. In support of the Human Right to Water, the State Water Board is pursuing initiatives to ensure that Californians receive affordable, safe, and reliable drinking water.

This Plan focuses on sources associated with public water systems. The statute that requires updates of the Safe Drinking Water Plan does not include a requirement to discuss other sources of drinking water, such as private wells that serve individual households, or systems with so few connections that they are not considered PWS. Nonetheless, much of the discussion of drinking water contaminants that impact PWS is also pertinent to individual wells and surface water sources that serve only a few people.

In addition, the State Water Board will continue to partner with local agencies as they address the drinking water needs of residents who are not served by PWS. Those residents, too, should have access to safe and reliable sources of drinking water.

Since the 2015 Plan, the State Water Board has made considerable improvements in public access to information about drinking water quality. On-line access is available at the following websites:

- Human Right to Water Portal (https://www.waterboards.ca.gov/water_issues/programs/hr2w/index.html)
- My Water Quality (https://mywaterquality.ca.gov/safe_to_drink/)
- Drinking Water Watch (https://sdwis.waterboards.ca.gov/PDWW/)

Under the Safe Drinking Water Act, public water systems have specific requirements to provide information to their customers. These requirements include:

- Consumer Confidence Report - Community water systems and non-transient non-community water systems are required to provide their customers with an annual report on the quality of water delivered to the customers. This report must also include information on violations of primary drinking water standards that may have occurred during the calendar year.
- All public water systems are subject to requirements for notifying their customers in the event of violations of primary drinking water standards or water quality monitoring requirements.

3.1 SOURCES OF DRINKING WATER

3.1.1 Surface and Groundwater Sources

The state's water supplies are from surface water sources such as rivers, streams, and lakes and from groundwater sources, which are present in groundwater basins throughout the state. The amount of drinking water derived from surface water sources versus groundwater sources can vary annually depending on rainfall and snowpack conditions. In general, surface water sources provide a larger portion of the drinking water supply than groundwater sources; however, 90 percent of the public water systems only have groundwater. For example, the United States Geological Survey (USGS) estimated that, in 2015 in California, 54 percent of the drinking water provided by public water systems was from surface water sources (https://pubs.er.usgs.gov/publication/cir1441). This is down dramatically from the 2010 report, were it was over 80 percent of the state's drinking water was from surface water sources. This change may be due to drought conditions, which significantly increases reliance on groundwater sources. Table 3-1: shows over 90 percent of the source drinking water facilities are groundwater wells.

Table 3-1: Number of Water System Facilities as of August 2020

Water Source	Number of Facilities
Surface Water	939
Groundwater under direct influence of surface water	281
Groundwater	15,041

As most of the surface water sources are already allocated, additional water needs have been met through groundwater sources. Historically, the use of groundwater was not regulated. As demand for groundwater continued to increase, effective management was needed to protect the future availability and quality of the supply. In September 2014, Governor Edmund G. Brown Jr. signed a three-bill package known as the Sustainable Groundwater Management Act (SGMA). The legislation allows local agencies to adapt groundwater sustainability plans to their regional economic and environmental needs. The

Act creates a framework for sustainable, local groundwater management for the first time in California history. The primary responsibility assigned to the State Water Board is to protect groundwater resources if a local agency cannot or will not manage its groundwater sustainably. If local efforts fail to adequately manage groundwater, the State Water Board has the authority to step in and collect groundwater data, designate the basin as probationary, develop groundwater management plans, and collect fees for these activities. More information about the State Water Board's implementation of SGMA is available online (https://www.waterboards.ca.gov/water_issues/programs/sgma/).

There are several conditions that have altered and will continue to affect the adequacy of the state's drinking water sources. These include increasing requirements for water due to population growth; uncertainty in water supplies as a result of drought conditions and climate change; demands for water by agriculture and industry, as well as for environmental purposes; contaminating activities that threaten surface water and groundwater quality (therefore affecting available quantity); and reductions in access and use of the Colorado River as a source.

There are many existing water systems, particularly small ones, that depend on a single source of supply, which renders them highly vulnerable to system outages, contamination plumes, drought depletion, and other challenges. As discussed in Chapter 8, there are approximately 1,050 community water systems with a single source. Accordingly, the Waterworks Standards currently require new community water systems to have access to multiple sources. However, current law does not require existing community water systems to have access to multiple sources. This has resulted in numerous instances where water systems faced dire emergency situations when their single source of water supply failed or was curtailed. Especially considering the persisting severe drought, these situations will become more common, more information on impacts to Climate Change is in Chapter 11.

Groundwater Overdraft, Water Loss, and Land Subsidence

Over-extraction of groundwater to meet community and agricultural needs, particularly during times of drought, can reduce the availability of this important source of drinking water. Monthly monitoring of both the static and pumping water levels will provide information on the effects of drought-related and overdrafting stresses on groundwater sources. The California Water Plan Update 2018 points out the significance of groundwater withdrawal, particularly to the Central Valley, where most of California's groundwater extraction occurs (https://water.ca.gov/Programs/California-Water-Plan/Update-2018).

The loss of groundwater can lead to increased pumping costs to access water from greater soil depths. In addition, groundwater loss from its aquifers can result in land subsidence, which can damage water-related infrastructure such as canals, resulting in water loss. The associated collapse of the hydrogeological structure of aquifers is problematic for their ability to rehydrate, and can interfere with the functionality of drinking water wells. A 2019 DWR press release on subsidence in the Sacramento Valley presents an example of the problems that subsidence presents: https://water.ca.gov/News/News-Releases/2019/January/Survey-Shows-Areas-of-Land-Subsidence

3.1.2 Alternative or Supplemental Sources of Drinking Water

In addition to the usual surface and groundwater sources of drinking water, there are alternative or supplemental sources of water, which may be used to augment drinking water supplies. These include recycled water and desalination, which may be used to treat seawater or brackish groundwater.

3.1.2.1 Recycled Water

There has been considerable development in the use of recycled water to supplement drinking water supplies. Recycled water is obtained from municipal wastewater (sewage) treatment plants and is treated prior to its reuse. It is likely that recycled water will become a more significant source of drinking water in some areas of California.

Recycled water may be used as an indirect source of drinking water (called indirect potable reuse), wherein recycled water is used to augment groundwater or surface water sources, by being introduced into those sources after additional treatment and prior to further treatment before it is made available for consumption by drinking water customers.

Most of the indirect potable reuse water activity to date has been in Orange County, in San Bernardino County, and in Los Angeles County, where recycled water has been highly treated and reintroduced to groundwater by direct injection or by the use of recharge basins, from which the recycled water percolates into underground aquifers. New projects are also planned in Monterey County. In addition, the City of San Diego is planning a surface water augmentation project. San Diego has extensively studied the use of highly treated recycled water to supplement its surface water drinking water supplies.

Indirect potable reuse projects operate under permits issued by the Regional Water Boards, who consult with DDW to establish conditions necessary to protect drinking water supplies. In addition, the State Water Board now has authority to issue indirect potable reuse permits.

To assist in the development of recycled water projects for groundwater replenishment that are protective of public health, regulations for such projects were adopted and became effective on June 18, 2014. More information about the State Water Board's recycled water regulations are available online (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RecycledWater.html).

Since the 2015 Plan, as required by Chapter 700, Statutes of 2010 (SB 918), the State Water Board adopted regulations for surface water augmentation in December 2016.

These regulations were developed following the findings of the Expert Panel formed pursuant to SB 918 that such regulations would be protective of public health for this use. The regulations are found at the DDW website mentioned above.

Recycled water is also being considered as a direct source of drinking water, which would be introduced directly into a public water system's distribution system for customer use (direct potable reuse). Under SB 918 and SB 322 (Chapter 637, Statutes of 2013), the State Water Board was required to investigate and report on the feasibility of developing uniform water recycling criteria for direct potable reuse. A report to the legislature was submitted in December 2016; it concluded that the development of such criteria was feasible, but that there were significant data gaps and research needs to ensure adequate public health protection. The report is available here: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/rw_dpr_criteria/final_report.pdf .

Use of alternative water supplies such as indirect potable reuse for groundwater replenishment and surface water augmentation for drinking water requires considerable treatment to provide adequate public health protection. Care must be taken to ensure the required high level of water treatment does not fail, so customers do not receive unsafe drinking water. For direct potable reuse projects, where the connection between highly treated wastewater and treated drinking water is more proximal and immediate than it is in indirect potable reuse projects, more treatment and highly focused operations will be required for the protection of public health.

The purpose of current and potential future State Water Board water recycling regulations is to ensure that project design, construction, and operation are protective of public health. Regulations for direct potable reuse are under development in accordance with the 2018 State Water Board document, "A Proposed Framework for Regulating Direct Potable Reuse in California" (available here: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/direct_potable_reuse/dprframewk.pdf).

In 2019, the State Water Board completed a revision to the Framework (Framework Second Edition) to reflect the State Water Board's current thinking on regulating direct potable reuse. The Framework Second Edition includes a discussion of the regulatory approach for direct potable reuse, as well as an update on the consideration of drinking water treatment plants. The Framework Second Edition is presented in a format that highlights the revisions that were made. (available here: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/direct_potable_reuse/dprframewkseced.pdf)

3.1.2.2 Desalination

Desalination of water that is otherwise not fit for consumption may provide another source of supplemental water supply. Typically, desalination is either categorized as seawater or brackish water desalination. Seawater desalination treats ocean water obtained from either an open water intake or a subsurface intake to a treatment plant is located near the coast, Brackish water desalination treats groundwater with elevated salt levels and can occur in both inland and coastal aeras.

There are four seawater desalination facilities in California that produce drinking water. The permitted seawater desalination facilities are shown in Table 3-2:. Other coastal counties have proposed desalination facilities but have not yet begun construction.

Table 3-2: Permitted Seawater Desalination Facilities

Desalination Project	Production	County Served
Claude "Bud" Lewis Carlsbad Desalination Plant	56,000 acre-ft per year (50 MGD)	San Diego
Charles E. Meyer Desalination Plant	3,125 acre-ft per year (2.8 MGD)	Santa Barbara
Santa Catalina Island Desalination Plant	364 acre-ft per year (0.33 MGD)	Santa Catalina Island
Sand City Coastal Desalination Plant	336 acre-ft per year (0.30 MGD)	Monterey

Brackish groundwater may also be desalinated for human consumption after treatment. The 2013 Update to the California Water Plan shows an annual capacity of 139,627 acre-ft per year (125 MGD) from brackish groundwater desalination from 23 different plants, primarily in Southern California. This annual capacity nearly doubled from 2009 to 2013 and is likely to continue to grow.

As an example, the Chino Basin Desalter Authority operates two brackish water desalination treatment facilities that treat contaminated groundwater in the southern portion of the Chino Basin. The facilities have a combined capacity of 34.7 million gallons per day (MGD). The treated water is used to supplement the drinking water supplies of several communities in San Bernardino and Riverside Counties.

3.2 THREATS TO THE SAFETY OF DRINKING WATER SUPPLIES

Drinking water sources have inherent vulnerabilities to contaminations. Threats can either impact the supply for a short amount of time, for example a minor spill, or can have long term impacts, for example a contaminated aquifer. Although there are different vulnerabilities for surface water and groundwater sources, either can pose a risk to a public water systems ability to supply safe, clean and affordable water.

3.2.1 Contamination Threats

Threats to a safe drinking water supply include:

- microbiological organisms, such as viruses, bacteria, *Giardia*, and *Cryptosporidium*
- inorganic chemical contaminants, many of which may be naturally occurring
- radiological contaminants, from natural radioactivity or from human activities that may release radionuclides into the environment, and
- organic chemical contaminants, many of which are of industrial, agricultural, or household origin.

3.2.1.1 Microbiological Contaminants

Microbiological contamination of drinking water is a public health concern, and is the basis for water treatment and disinfection for the prevention of infectious disease. Typically, microbiological contamination is considered to be a greater concern for surface water sources rather than for groundwater sources. Nevertheless, groundwater contamination by microbiological contaminants may be a concern when water wells are improperly sealed, or when there is release of sewage or septage directly into groundwater. Groundwater under the influence of surface water (for example, shallow groundwater near a stream) is at an increased risk of microbial contamination similar to a surface water source. Additionally, groundwater sources can be impacted by anoxic microorganisms, such as iron reducing bacteria, which can reduce production by clogging the screens. Because of the microbiological risk, all surface water and most groundwater sources collect microbiological samples.

Because of the acute health risk posed by microbial contamination, the drinking water program focuses on ensuring microbial safety from source to tap. To ensure that the risk of microbial contamination is mitigated, the drinking water program requires:1) drinking water source selection and assessment, 2) proper treatment, filtration, and disinfection, and 3) overall operation of the treatment and distribution systems.

Generally, the requirements for microbiological treatment are focused on surface water. Significant surface water sources such as the Colorado River and the State Water Project are used predominantly by larger water systems to provide service to their primarily urban customers. Inadequately treated wastewater from treatment plants or stormwater from municipalities that discharge into rivers and streams may result in elevated levels of pathogens (for example viruses, bacteria, *Giardia*, *Cryptosporidium*) and pose unacceptable health risks to those who use the surface water for supply of drinking water; the Water Boards issue permits to require treatment preventing such discharges. While DDW is tasked within the State Water Board to oversee the regulation of the treatment of water used for drinking water, DDW is not involved in the regulation of wastewater treatment. Rather wastewater discharge is overseen by the DWQ and the Regional Water Boards. DDW does provide consultation to the Regional Water Boards.

Microbiological contaminants may also reach groundwater through untreated or partially treated sewage leaking from septic systems (septage) or from wastes from confined animal feeding operations. Wildlife and facilities that enhance wildlife habitat can also be a source of pathogens. These kinds of contamination sources are generally rural in nature and would be more likely to pose risks of contamination to private well owners and small public water systems, especially in rural areas, than they would to larger urban public water systems.

Groundwater under the influence of surface water may be susceptible to surface waterborne pathogens. There are State Water Board and USEPA regulatory requirements to treat groundwater under the influence of surface water as a surface water supply and to filter and disinfect the water accordingly.

As mentioned above, the State Water Board has regulations, guidance and permits that ensure that indirect potable reuse projects using recycled water safely augment their groundwater and surface water sources. In addition, to prevent drinking water source contamination from inadequately-treated recycled water used for non-potable activities such as landscape irrigation, DDW makes recommendations to the Regional Water Boards, which include these recommendations in their permits of wastewater dischargers/water recyclers.

3.2.1.2 Chemical and Radiological Contaminants

Water systems may use water from sources that have detectable levels of chemical contaminants, provided they meet health protective drinking water standards, called maximum contaminant levels (MCL) in accordance with the Safe Drinking Water Act. If the chemicals are present in concentrations greater than the MCL, the water systems must take measures to treat the source, blend it with a clean source to a concentration less than or equal to the MCL, or remove the source from use. Chapter 4 includes details on public water systems that violate the MCL requirements.

Monitoring from 2015 through 2019 shows the following:

Regulated inorganics that were most often detected (excluding fluoride and aluminum, which are often added to drinking water supplies for public health benefits) are nitrate, arsenic, lead, and total chromium. Reported lead findings are generally considered to have been associated with lead solder, brass fixtures, or lead service lines and not source water.

Among the industrial organic contaminants most often detected from 2015 through 2019 (excluding disinfection byproducts of water treatment), are tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1,1-trichloroethane, 1,1-dichloroethylene, cis-1,2-

dichloroethylene, carbon tetrachloride, and 1,2-dichloroethane.

Among the pesticides that were most often detected were DBCP, EDB, and 1,2-dichloropropane. A newly regulated pesticide-related contaminant (1,2,3-trichloropropane, 1,2,3-TCP) is also a commonly detected chemical, and where detected, it is greater than its MCL. For pesticides, most detections above MCL occurred in Fresno, Kern, Stanislaus, San Bernardino, and Tulare Counties.

Radioactivity analyses included gross alpha activity, which may be used to trigger further analyses for uranium and radium-226 and radium-228, which reflect natural soil radioactivity. Relatively few detections of tritium and strontium-90 (radionuclides of human origin) have been reported.

A 2013 report to the Legislature pursuant to AB 2222 (Chapter 670, Statutes of 2008) utilized public water system analytical data to provide information on communities whose primary source of drinking water is contaminated groundwater. For data from 2002 to 2010, the most prevalent regulated drinking water contaminants were arsenic, nitrates, gross alpha particle activity, perchlorate, PCE, TCE, uranium, DBCP, fluoride, and carbon tetrachloride. Community water systems relying on contaminated groundwater were most numerous in Los Angeles, Kern, San Bernardino, Tulare, Riverside, Fresno, and Madera Counties. The State Water Board's AB 2222 report is available online (http://www.waterboards.ca.gov/gama/ab2222/docs/ab2222.pdf).

Natural elements such as arsenic, and chromium (to address the more toxic hexavalent form of the element), in drinking water sources and lead and copper in drinking water distribution systems continue to be the focus of regulatory activity, as does perchlorate, which has been regulated since 2007. All regulated contaminants are presented in Appendix 2. The State Water Board's notification levels for other contaminants that have been found to be present in drinking water are presented in Appendix 5. More information about State Water Board's notification levels is available online (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.shtml).

Arsenic, nitrates, and perchlorate are currently the regulated inorganic contaminants most often detected at levels greater than their primary MCL. Manganese, which is regulated by a secondary standard that addresses the acceptability of drinking water relative to aesthetics, is also a common contaminant. A new MCL for hexavalent chromium, was established, effective July 2014, but was withdrawn in 2017 as the result of a superior court decision that the regulation development documents did not adequately discuss the costs and benefits for small public water systems. Hexavalent chromium now continues to be addressed by the MCL for total chromium. Because of its widespread natural occurrence, hexavalent chromium is expected to join those that are detected most often. Among inorganic chemicals often detected are chlorite and bromate, which can be present as byproducts from water disinfection.

Of the radiological contaminants, uranium and radium are common naturally occurring radionuclides. Gross alpha activity and gross beta activity are used as screening measurements; exceeding standards for these constituents can prompt additional monitoring for the causes of the excess radioactivity.

The most commonly detected organic contaminants are TCE and PCE, and the banned nematocide DBCP, as well as disinfection byproducts such as the trihalomethanes and haloacetic acids. Other contaminants of more recent concern are 1,2,3-trichloropropane (1,2,3-TCP), which in 2017 became a regulated contaminant, and the as yet unregulated 1,4-dioxane and N-nitrosodimethylamine (NDMA).

There are approximately 90 contaminants that are currently regulated for drinking water by the State Water Board and another 30 with notification levels. Technical support documents associated with each contaminant's public health goal (PHG) have been developed by OEHHA (https://oehha.ca.gov/water/public-health-goals-phgs). Another 30 chemicals that have been found in or may pose a risk to drinking water have advisory levels that require notification under certain circumstances; they are not formally regulated. Information on those chemicals and their advisory notification levels is available at the State Water Board website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.html).

Additional information is available from the State Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) program, which has published fact sheets on many of these chemicals that include statewide maps showing the locations of contaminated wells, based on its water quality database. Those fact sheets and maps are available at: http://www.waterboards.ca.gov/water_issues/programs/gama/coc.shtml.

This chapter includes information on constituents detected at public water system sources. A detection greater than the MCL does not necessarily indicate non-compliance with the standard, since other detections may be lower than that level; nor does it indicate that such water is being served, since it may be blended, treated, or not used. Violations of MCL are discussed in Chapter 4.

On occasion, well-documented drinking water contaminants appear in new situations. For example, in the aftermath of the recent devastating fires, benzene in Santa Rosa (2017) and benzene and other volatile organic chemicals (VOC) in Paradise (2018) were found to be problematic in the communities' remaining distribution systems. For more, see subsection 3.3.2, Distribution Systems.

3.2.1.2.1 Inorganic Contaminants

Specific contaminants of concern are discussed below.

Arsenic

Due to concerns about the potential for cancer-related health risks and non-cancer effects associated with exposures to this natural element (which also has some industrial uses), the federal MCL was reduced from 50 ppb to 10 ppb in 2006 and the state MCL to 10 ppb in 2008. Because arsenic is present in groundwater supplies throughout the state, reducing the MCL greatly increased the number of water systems that have exceeded the state and federal MCL. From 2015 through 2018, 4,460 active drinking water sources were reported to have arsenic present at concentrations greater than 2 µg/L, the detection limit for purposes of reporting (DLR). Detections greater than the 10-ppb MCL were reported for 960 sources.

Nitrate/Nitrite

Nitrates historically have been considered significant contaminants of drinking water. They can be present because of human activities, for example in rural areas from septage and from fertilizer application in agriculture or from wastes in concentrated animal feeding operations such as dairies or feedlots. Focus has been on controlling the release of nitrates to the environment from such human activities. The MCL for nitrate is 10 ppm as nitrogen; the MCL for nitrite is 1 ppm as nitrogen; and the MCL for nitrate and nitrite combined is 10 ppm as nitrogen. Results from 2015 through 2018 show over 910 sources reporting detections of forms of nitrate that exceeded their MCL. Counties with the greatest number of sources reporting nitrate detections were Kern, Los Angeles, Riverside, San Bernardino, and Tulare. For more information, see the State Water Board's website on nitrate (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Nitrate.shtml).

A 2012 report from researchers at the University of California at Davis, pursuant to Chapter 1, Statutes of 2008 (SB X2 1) presented extensive information on nitrates in the Tulare Lake Basin and Salinas Valley. This report, *Addressing Nitrate in California's Drinking Water*, along with a 2017 update entitled *Nitrogen Loading to Groundwater in the Central Valley*, are available at: http://groundwaternitrate.ucdavis.edu.

The State Water Board's Report to the Legislature, *Recommendations Addressing Nitrate in Groundwater* is online (http://www.waterboards.ca.gov/water_issues/programs/nitrate_project/docs/nitrate_rpt.pdf).

Lead and Copper

Lead exposures can result in neurological, reproductive, and developmental effects. Copper is an essential nutrient, but at elevated levels can result in gastrointestinal distress. The source of most lead and copper in water supplies tends to be the pipes, fixtures, and associated hardware from which lead can leach. In 1991, USEPA adopted the Lead and

Copper Rule (LCR). The LCR changed the approach to regulating lead and copper in drinking water to regulatory action levels, for which compliance is measured at the water taps of customers and determined by statistical measures. Because the most likely sources of lead and copper exposure are associated with water distribution systems, this approach is reasonable for the protection of public health. In addition, there have been other changes in the production of plumbing fixtures to reduce the presence of lead and to minimize its leaching into water (for example, from changes in the Building Code and from enforcement actions resulting from the Safe Drinking Water and Toxic Enforcement Act of 1986, Proposition 65).

Since the 2015 Safe Drinking Water Plan, there has been considerable attention given to lead in drinking water. Much of the concern resulted from the experience of Flint, Michigan, in which a change in water supply in 2014 without attention to the change in the new water supply's corrosiveness and inadequate water treatment resulted in considerable release of lead from the lead pipes in the community, and high level of lead exposures to water consumers.

Although current law prohibits the use of any pipe, pipe fittings, or other related plumbing materials that are not lead-free in the installation or repair of public water system or a facility providing drinking water, there may nonetheless be instances when lead materials exist in pipes and associated materials, particularly in older systems. As a result, and prompted by the Flint, MI experience, there were several actions taken in California:

- There is now a requirement for testing of lead in drinking water in California's K-12 public schools. Chapter 746, Statutes of 2017, (AB 746), (Health & Safety Code Section 116277) requires testing to be done at all K-12 public schools that were constructed before January 1, 2010. Public schools may request assistance from their public water systems to conduct water sampling for lead, and to provide technical expertise when elevated lead levels are found. Testing was to be completed by July 1, 2019. For more information, see the State Water Board's website on lead sampling in schools (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/leadsamplinginschools.html).
- Similarly, there is now a requirement for testing of lead in drinking water in child day care facilities. Chapter 676, Statutes of 2018, (AB 2370), (Health and Safety Code Section 1596.7996, et seq.) requires drinking water testing by each licensed child day care center that is in a building constructed prior to January 1, 2010. Testing is to be completed no later than January 1, 2023, and every five years after the initial sampling date. AB 2370 also includes posting and notification requirements, as well as steps to be taken if lead levels are elevated (specifically cease use and obtain potable water).

- Community water systems were required to provide an inventory of known partial or total lead user service lines in their distribution system, as well as those with unidentified materials used in construction Chapter 731, Statutes of 2016 (SB 1398) and Chapter 238, Statutes of 2017 (SB 427). The inventory was to be completed by July 1, 2018. For more information, see the State Water Board's website on lead service line inventory (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/lead_service_line_inventory_pws.html).
- Community water systems were required to provide a timeline for replacement of known lead user service lines, as well as those with unidentified materials. The timeline had a completion date of July 1, 2020.

Related to the school testing requirements mentioned above, as well as those for compliance with the Lead and Copper Rule requirements, the State Water Board's DDW established in 2018 a new method to electronically submit lead and copper analytical data via a "Lab-to-State Portal." For more information, see the State Water Board's website on lab to state portal (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/lts_portal_info.html)

Manganese

Manganese is a naturally occurring element and is regulated via a secondary MCL. Secondary MCL address taste, odor, and appearance, and unlike federal secondary standards, are enforceable in California. Manganese, and its natural but non-toxic co-contaminant iron, can cause aesthetic problems including to taste and color. Manganese is not considered to pose a health risk at low levels and is an essential nutrient. However, at very high levels, it has the potential to cause neurological effects. In 2003 a notification level of 500 ppb was established, ten times the secondary MCL in order to address health concerns that may be associated with high levels of manganese exposure, and because non-transient, non-community water systems (NTNCWS) such as schools are not required to comply with state secondary MCL. Water systems that serve water above the notification level are required to notify their county boards of supervisors or city councils that their customers are receiving this water. Results from 2015 through 2018 show that 181 sources reported a detection above the 500-ppb notification level. Because of concerns about possible neurological effects of high levels of manganese, it is appropriate to consider additional advisory or regulatory actions, particularly as they might relate to the protection of young children in the home and school environment. For more information, see the State Water Board's website on manganese (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Manganese.shtml).

Hexavalent Chromium

This form of chromium is the more toxic, carcinogenic form (trivalent chromium is a required nutrient). Total chromium has been regulated in drinking water supplies since the 1970s to protect against adverse health effects associated with the hexavalent form. Hexavalent chromium has been known to be carcinogenic in people when inhaled, but its potential for carcinogenicity when ingested was not supported scientifically until 2007 when the National Toxicology Program reported the results of long-term laboratory animal studies that showed ingested hexavalent chromium can result in cancer.

To address hexavalent chromium's presence in drinking water, a primary drinking water standard of 10 ppb was adopted in July 2014 for hexavalent chromium. This standard, as mentioned above, was withdrawn in 2017. The State Water Board will propose a new MCL for hexavalent chromium, as required by statute. This will likely occur in 2021.

Hexavalent chromium has been found in drinking water supplies, both as a naturally occurring contaminant and as an industrial contaminant. From 2015 through 2018, 2930 sources were reported to have detections greater than the 1.0-ppb DLR, with the greatest number in the counties of Fresno, Los Angeles, Riverside, Sacramento, and San Bernardino. From the same time period, 2070 sources reported a detection greater than 10 ppb. The greatest number of detections above 10 ppb were reported in the counties of Los Angeles, Monterey, Riverside, San Bernardino, and Tulare. The GAMA program, based on DDW data, reported hexavalent chromium above 1 ppb in 3,778 out of 8,765 active and standby wells, tested from 2007 – 2017. For more information, see the State Water Board's hexavalent chromium website (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.shtml)

Perchlorate

Over two decades ago (in 1997), perchlorate, used as a propellant in solid rocket fuel, as well as fireworks and munitions, was found to have contaminated groundwater supplies near several aerospace facilities. At high enough levels, perchlorate can interfere with the thyroid gland's ability to take up iodine and to make thyroid hormones, which are required for normal growth and development and for normal metabolism. Inadequate thyroid hormones are a particular concern for developing fetuses and infants. Perchlorate is an example of a contaminant that has been present in groundwater for some time, but at levels that were undetectable at very low concentrations due to limitations of laboratory analytical methods. With laboratory analytical improvements, perchlorate began to be detected at much lower concentrations, and its presence was found to be more widespread in groundwater than previously thought. Perchlorate was also found to be present in the Colorado River, a major source of drinking water in Southern California, resulting from industrial operations in Nevada.

To address this contamination, monitoring was first required for perchlorate in the late 1990s, and in 2007 a perchlorate MCL was adopted. From 2015 through 2018, 305 active sources were reported to have detected perchlorate above its 4-ppb DLR, primarily in the counties of Los Angeles, Riverside, and San Bernardino;174 sources had a detection greater than the 6-ppb MCL.

As part of its periodic reviews of MCL, DDW in 2017 began exploring the feasibility of establishing a lower (more sensitive) DLR for perchlorate which would enable the collection of additional occurrence data that would be needed to revise the current MCL, if appropriate. In October 2020, the State Water Board approved lowering the DLR. For more information, see the State Water Board's perchlorate website (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Perchlorate.shtml).

3.2.1.2.2 Radiological Contaminants

Uranium

A naturally occurring radionuclide that exists in soil, uranium can be found in groundwater. Like other radioactive materials and radiation in general, high enough exposures can result in an elevated lifetime cancer risk. In 2006, regulations were updated for uranium, radium-226 and -228, gross alpha and gross beta particle activity, strontium-90, and tritium. Uranium and the radium isotopes are the predominant radionuclides in drinking water and reflect the natural radioactivity that occurs in soil. Uranium is most commonly detected in groundwater in the foothill areas of the state where the geology is associated with granitic formations. More than 2,200 active sources have been found to have detectable levels of uranium.

Radon

A tasteless, odorless radioactive gaseous element, radon is a decay product of naturally occurring radioactive materials in the earth; it is considered to pose a cancer risk by inhalation. Radon was at one time considered by the USEPA for possible regulation as a drinking water contaminant, even though its primary means of exposure is indoor air from radon gas that percolates from the earth as it decays from primordial radionuclides. Although plans to regulate indoor air quality related to radon by limiting its presence in drinking water were dropped, programs to limit exposure to indoor air radon have been developed. For more information, see the CDPH's website on radon (https://www.cdph.ca.gov/Programs/CEH/DRSEM/Pages/EMB/Radon/Radon.aspx).

3.2.1.2.3 Organic Contaminants

DBCP

Though the agricultural use of the nematocide1,2- dibromo-3-chloropropane (DBCP) has not been allowed since the late 1970s, groundwater continues to be contaminated and water continues to need to be treated to remove this widespread contaminant. The concern about DBCP initially was sterilization of male workers, both in its manufacture and in its agricultural use, and it was subsequently found to pose a cancer risk. DBCP was detected from 2015 through 2018 at a level greater than the DLR in 454 sources primarily in counties of the Fresno, Kern, Madera, Merced, San Bernardino, San Joaquin, Stanislaus, Riverside and Tulare; it was detected at greater than the MCL in 111 of those sources.

EDB

Ethylene dibromide is no longer in use as a pesticide. From 2015 through 2018, EDB was detected at concentrations above its DLR in 13 sources, and at concentrations greater than its MCL in 7 sources.

1,2,3-TCP

In 1999, a 0.005-ppb drinking water notification level was established for 1,2,3-Trichloropropane (1,2,3-TCP), based on cancer risks derived from laboratory animal studies. 1,2,3-TCP has had various industrial uses, and has been found to be present at hazardous waste sites. It is also associated with historic pesticide uses. The notification level for 1,2,3-TCP was established to address its presence at the Burbank Operable Unit — a Southern California Superfund hazardous waste site — and concerns that it might find its way into drinking water supplies. 1,2,3-TCP was also found in several drinking water wells at the same time, primarily in the San Joaquin Valley, reflecting its agricultural linkage.

Subsequently, in the early 2000s water systems were required to monitor for 1,2,3-TCP and several hundred sources reported 1,2,3-TCP detections; the greatest number of sources were in the counties of Fresno, Kern, Los Angeles, Merced, Riverside, San Bernardino and Tulare. The State Water Board adopted a 0.005-ppb MCL for 1,2,3-TCP, effective December 2017**.**

Monitoring results from 2015 through 2018 showed that 591 sources had two or more detections above the 0.005-ppb DLR, mostly in the counties of Fresno, Kern, and Tulare; 654 had a single detection above that concentration.

For more information, see the State Water Board's website on 1,2,3-TCP (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP.shtml).

TCE

An industrial solvent, trichloroethylene (TCE) is a contaminant that can pose a cancer risk. From 2015 through 2018, it was detected above its DLR in 393 sources, with two-thirds of those detections occurring in sources in Los Angeles County. It was detected at levels above its MCL in 154 sources. TCE contamination is widely distributed throughout the state, often present in groundwater associated with hazardous waste sites. Where cleanup has not been completed, it can spread laterally and vertically in contaminated groundwater basins. This is likely to continue because the cleanup of the groundwater contamination is very expensive, time-consuming, and technically challenging.

PCE

An industrial solvent, tetrachloroethylene (PCE) is another contaminant that can pose a cancer risk. From 2015 through 2018, it was detected above its DLR in 475 sources, with 60 percent of those detections occurring in sources in Los Angeles County. It was detected above its MCL in 137 sources. PCE, like TCE, is often present in groundwater associated with hazardous waste sites. Because of its historic use in dry cleaners, there has been urban contamination of groundwater supplies by this contaminant.

MTBE

In the 1990s, Methyl tert-butyl ether (MTBE) was found to have contaminated groundwater and certain surface water sources that allow gasoline-powered watercraft. MTBE was used as a gasoline oxygenate. Leaks from underground gasoline storage tanks caused dozens of drinking water supplies to become contaminated; its use as a gasoline additive was eventually prohibited. California established a 5-ppb secondary MCL in 1999 to address its taste and odor, and a 13-ppb primary MCL was established in 2000 to address its potential carcinogenicity. To address MTBE contamination from leaking underground gasoline storage tanks, the Drinking Water Treatment and Research Fund was established (Health and Safety Code Section 116367, Chapter 997, Statutes of 1998 (SB 2198)) to help affected water systems. This fund was accessible to affected water systems through 2006. Detections of MTBE have decreased significantly over the past decades, reflecting its cessation of use as a gasoline additive, as well as cleanup activities. From 2015 through 2018, there were 5 sources that reported MTBE detections that were greater than the DLR; each of these 5 sources also had a detection that exceeded the MCL.

For more information, see the State Water Board's website on MTBE (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MTBE.shtml).

1,4-Dioxane

1,4-Dioxane has been used as a solvent and as a stabilizer for solvents, in particular, 1,1,1-trichloroethane (TCA), and in a number of industrial and commercial applications. In 1998, a drinking water notification level was established for 1,4-dioxane of 3 ppb, and in 2010 revised it downwards to 1 ppb to take into account revisions by USEPA of the cancer risk estimate, based on laboratory animal studies. From 2015-2019, 1,4-dioxane was detected at levels greater than its 1-ppb notification level in 162 sources, mostly in the counties of Los Angeles (139 sources) and Orange (21). In early 2019, DDW requested a public health goal (PHG) from OEHHA—a PHG for 1,4-dioxane is needed before DDW can develop a proposal for a primary drinking water standard. A draft PHG is expected in 2021. For more information, see the State Water Board's website on 1,4-dioxane (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/14-Dioxane.shtml).

NDMA

In 1998, N-Nitrosodimethylamine (NDMA) was found to be present in several drinking water wells that were the result of industrial contamination. These findings prompted a notification level of 0.01 ppb for NDMA to be established, based on concerns about its carcinogenic risk. In 2000, it was found to be a contaminant present in monitoring wells associated with a groundwater recharge project in Orange County. In addition, NDMA was found to be produced in water treatment; therefore, it can be considered a disinfection byproduct in certain water treatment situations. However, because NDMA and other nitrosamines have been shown to produce cancer in laboratory animal testing, it is important to limit exposure to NDMA in drinking water. In 2006, OEHHA published a final PHG for NDMA of 0.003 ppb. From 2015-2018, NDMA has been reported to be present at greater than its 0.01-ppb notification level in 14 sources, all in Los Angeles County. For more information, see the State Water Board's website on NDMA (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NDMA.shtml).

PFOA/PFOS

Perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) have been found to be drinking water contaminants. They have been used extensively in consumer products such as carpets, clothing, fabrics for furniture, paper packaging for food, and other materials (for example cookware) designed to be waterproof, stain-resistant or non-stick. In addition, they have been used in fire-retarding foam and various industrial processes. Six perfluorinated compounds, including PFOA and PFOS, were identified in 2012 by USEPA as unregulated contaminants requiring monitoring. In 2016, USEPA issued a 70-parts per trillion (ppt) lifetime health advisory for PFOA and PFOS in drinking water, and advised water systems to notify their customers when the advisory level is exceeded, including information on the increased risk to health, especially for susceptible populations. Subsequently, in 2018 DDW established notification levels at concentrations of 14 ppt for PFOA (based on its liver toxicity, as well as cancer risk) and 13 ppt for PFOS (based on its immunotoxicity), based on recommendations from OEHHA. In August 2019, DDW revised the notification levels to 6.5 ppt for PFOS and 5.1 ppt for PFOA. The single health advisory response level (for the combined values of PFOS and PFOA) remained at 70 ppt. On February 6, 2020, DDW issued updated drinking water response levels of 10 ppt for PFOA and 40 ppt for PFOS based on a running four-quarter average.

While PFOA and PFOS are not regulated contaminates, DDW has issued monitoring orders to investigate the impact on drinking water sources. Monitoring orders were first issued in 2019 for groundwater sources: 1) near airports which used aqueous film forming foam (AFFF) to extinguish fires, 2) near landfills, and 3) near Unregulated Contaminant Monitoring Rule (UCMR) detections. In 2020 DDW issued new monitoring orders to water systems which were near sources with detections in the 2019 monitoring orders.

For more information, see the State Water Board's website on PFOA and PFOS (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html).

3.2.1.3 Constituents of Emerging Concern

Constituents of Emerging Concern (CEC) are constituents that are or may present in water supplies. Often, they occur in wastewater from industry or households, for example, and, therefore, may reach surface water or groundwater supplies of drinking water. These constituents include pharmaceuticals, personal care products, household products, hormones and others, as well as their breakdown products. Some are considered to be endocrine disrupting constituents, in that they may mimic the action of hormones, particularly female and male sex hormones.

CEC have received considerable attention in the past decade owing to possible health concerns related to their presence in wastewater and in drinking water supplies. As a result, the State Water Board's statewide Recycled Water Policy establishes CEC monitoring requirements. In 2017, the State Water Board re-convened a Science Advisory Panel to develop a list of CEC that permit holders are required to address in their monitoring program; in 2018 the panel released its report, "Monitoring Strategies for Chemicals of Emerging Concern in Recycled Water - Recommendations of a Scientific Advisory Panel." More information about these CEC and the Panel report are available on the State Water Board's Recycled Water Policy website (http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/).

The Panel applied a risk-based framework to identify CEC for monitoring in recycled water for potable applications (groundwater augmentation and reservoir water augmentation). The framework includes consideration of the presence of CEC in recycled water, the concentrations found therein, and the potential for adverse health effects in people were that water to be ingested as drinking water. The Panel recommended monitoring the following constituents in recycled water for groundwater recharge projects: indicator compounds and surrogates for CEC (reflecting the adequacy of wastewater treatment): health-based CEC: 1,4-dioxane, NDMA, n-nitrosomorpholine (NMOR), PFOA, and PFOS; and performance indicator CEC: iohexol, gemfibrozil, sulfamethoxazole, and sucralose. The Panel recommended monitoring the following constituents in recycled water for groundwater augmentation projects using injection and for reservoir water augmentation: Indicator compounds and surrogates for CEC (reflecting the adequacy of wastewater treatment); health-based CEC, 1,4-dioxane, NDMA, NMOR, PFOA, and PFOS; and performance indicator CEC, NDMA, sulfamethoxazole, and sucralose.

The Panel also recommended using the bioanalytical screening tools estrogen receptor-α (ER-α) and aryl hydrocarbon receptor (AhR) to evaluate the presence of estrogenic and dioxin-like CEC, respectively, in potable recycled water.

In December 2018, based on the Panel's report, the State Water Board amended the Recycled Water Policy to include monitoring requirements for CEC in recycled water used for groundwater recharge and reservoir augmentation. The policy became effective in April 2019.

The replenishment or recharge of groundwater basins with recycled water continues to involve more basins and will increase, in terms of percent of the contribution of wastewater, in existing projects. Contamination of a groundwater basin by chemical contaminants (NDMA, 1,4-dioxane) in wastewater has already occurred (in the late 1990s in an Orange County water recycling project), which prompted new attention to wastewater treatment and industrial source control. Monitoring will determine if similar incidents will occur in newly recharged basins or in existing basins using more recycled water. Improvements in the design and construction of membranes used as part of the treatment process may reduce the likelihood of such occurrences. The State Water Board's Recycled Water Policy requires groundwater monitoring for CEC.

Even though the Water Boards have addressed CEC for groundwater recharge, CEC from wastewater are also present in surface water sources into which wastewater is discharged. The State Water Board is currently partnering with the Ocean Protection Council to reconvene the Science Advisory Panel to update its recommendations pertinent to CEC in marine, freshwater, and estuarine ecosystems, which were published in its 2012 report, Monitoring Strategies for Chemicals of Emerging Concerns in California's Ecosystems, (https://www.waterboards.ca.gov/water_issues/programs/swamp/cec_aquatic/docs/cec_ecosystems_rpt.pdf). The Panel's updated report is anticipated to be released in 2021. Although the focus of that report is on ocean protection, the CEC of concern to surface waters, in addition to those mentioned above for reservoir augmentation, will be of interest to those concerned with drinking water source protection.

As the state's population grows, the volume of treated wastewater from municipal sewage treatment plants can be expected to increase. Since no increase is anticipated in the volume of natural water supply from rainfall, the percentage of treated wastewater in the receiving water bodies (discharge-receiving water bodies) will likely increase. A point may be reached when the percentage of wastewater is high enough that the approval of the recipient stream as a source of drinking water will be questioned, especially if CEC are detected at higher concentrations. DDW, the Regional Water Boards and DWQ will continue to coordinate to ensure that no losses of drinking water supplies occur as a result.

Use of recycled water for irrigation will continue to increase in the future as it has been for the past four decades and is addressed in the State Water Board's Recycled Water Policy.

Microplastics, microbeads, and microfibers.

Beyond concerns about the impacts of plastics on the environment at large, very small particles of plastics and fibers are also being recognized as potential concerns in wastewater and subsequently in drinking water. Legislation recently passed and signed into law (Chapter 902, Statutes of 2018 (SB 1422)) requires the State Water Board to define microplastics in drinking water by 2020; this definition was established in July 2020. Further, the law requires the State Water Board to adopt analytical methods for microplastics by 2021 to be used subsequently in four years of testing; and to consider establishing an advisory notification level, if appropriate.

Related to this, it will be appropriate to consider the presence of microplastics in the environment, particularly in source control with regard to their potential impact on water recycling projects, which will likely lead to increased attention to industrial source control activities. Since microplastics also result from domestic sources, a public education program is appropriate to encourage, where possible, the minimization of these materials into the domestic waste stream.

For more information, see the State Water Board's website on microplastics (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/microplastics.html).

3.2.2 Wastewater

Many wastewater treatment plants discharge treated wastewater into surface water bodies, such as rivers. Many other wastewater treatment plants discharge treated wastewater into groundwater. There may be health concerns about the use of water supplies that receive such discharges for drinking water unless the wastewater treatment is adequate to protect public health. The Regional Water Boards limit such discharges for the protection of public health and the environment, through permits on wastewater treatment plants and through industrial source control limits on chemicals that are released into sewers for subsequent wastewater treatment.

As the state's population grows, there are commensurate increases in the volume of waste discharges from industries and municipal sewage. These discharges, except along the coast, are into rivers and streams (surface waters) or groundwater used as drinking water supplies. In the past, those discharges have been minor contributors to the drinking water supply (generally less than five percent in most supplies); however, the increase in the population is increasing the percentage of sewage in drinking water supplies.

Wastewater must be highly treated to be used in indirect potable reuse projects that supplement groundwater and surface water drinking water supplies. To assist in ensuring the availability of such wastewater, Regional Water Boards' industrial source control programs have a crucial role in protecting public health. By making sure that industrial and commercial operations comply with their allowable permitted releases and that they do not inadvertently or intentionally introduce new contaminants into their waste streams, the Regional Water Boards' regulatory activities can help reduce the uncertainties associated with the chemical inventory of the wastewater.

When water supplies are not affected by wastewater or other human activities, the chance for contamination is diminished. The water supply from Hetch Hetchy that San Francisco uses is an example of a relatively pristine surface water supply that is not required to be filtered. However, such pristine sources are relatively rare.

3.2.3 Water Security

Recent attention has been directed toward addressing threats from the intentional release of materials into drinking water supplies, for criminal or anti-government (terrorist) purposes. Chapter 11 (Drinking Water Security, Emergency Preparedness, State Water Board Emergency Response and Water System Resiliency) addresses the intentional release of chemicals and other agents into public water supplies.

3.2.4 Other Threats to Surface Water Supplies

Algae and algal toxins: Some surface water sources are affected by algae and algal toxins, which affect the quality of drinking water supplies and can also pose health risks. Poor circulation and mixing, high temperatures, and nutrients from runoff can contribute to algal growth.

The public health concern about algal toxins, particularly cyanobacteria (blue-green algae) has been generally related to recreational exposures (swimming), although some cyanotoxin exposures have caused fish kills and deaths of pets and livestock. California's OEHHA in 2012, for example, evaluated health concerns about recreational exposures to such toxins in response to a request from the State Water Board.

In coastal environments marine algal toxins can affect the suitability of shellfish for harvest and consumption.

For drinking water supplies, the likelihood of exposure to algal toxins is low, since most public water systems strive to minimize algal growth in order to meet drinking water standards that address taste and odor, and to avoid problems of consumers finding their water unacceptable for use. Nonetheless, drought and concerns about climate change make likely the possibility of increased cyanobacteria blooms and the threat of their toxins to surface water bodies used to supply drinking water.

USEPA added cyanotoxins (anatoxin-a, microcystin-LR, and cylindrospermopsin were specifically mentioned to its Candidate Contaminants List 3 (CCL3) in 2011. Their presence on CCL3 indicates a need for additional information on occurrence in drinking water supplies and their potential to cause adverse health effects. Information on CCL3 is here: http://water.epa.gov/scitech/drinkingwater/dws/ccl/ccl3.cfm. USEPA listed cyanotoxins in CCL4 in 2016, adding that the group includes, but is not limited to, the three mentioned above plus saxitoxin (https://www.epa.gov/ccl/chemical-contaminants-ccl-4).USEPA in 2015 developed advisory levels for certain cyanotoxins to address their potential neurotoxic and other adverse health effects. (https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisory-documents-cyanobacterial-toxins)

In 2016, 10 cyanotoxins were added the Fourth Unregulated Contaminant Monitoring Rule (https://www.epa.gov/dwucmr/fourth-unregulated-contaminant-monitoring-rule). More information is available at the following websites:

- State Water Board's website on Cyanobacteria and cyanotoxins in drinking water (https://www.waterboards.ca.gov/drinking_water/programs/habs/)
- California's My Water Quality website on Harmful Algal Blooms (https://mywaterquality.ca.gov/habs/)

Invasive Fish Eradication Projects: The 2007 the Department of Fish and Game (now the Department of Fish and Wildlife) Northern Pike Eradication Program used rotenone in a drinking water supply to kill an invasive species in its for Lake Davis. Concerns about the effect of the poison on the use of Lake Davis as a drinking water supply resulted in considerable local concern among the community, and required extensive monitoring of the pesticide and its degradation products in water and sediment samples until levels were below detectability. Legislation was subsequently enacted that prohibits the Department of Fish and Wildlife from introducing a poison to a drinking water supply for purposes of fisheries management unless the State Water Board determines that the activity will not have a permanent adverse impact on the quality of the drinking water supply or wells connected to the drinking water supply.

Accidental Releases: Surface water sources can also be subject to accidents involving chemical releases. An example is the 1991 railroad accident at the Cantara Loop on the Sacramento River that resulted in the release of thousands of gallons of the fumigant pesticide metam sodium from a tank car into the Sacramento River and the contamination of the river and Shasta Lake. This spill not only threatened drinking water supplies but resulted in concerns about the public health and ecological effects of chemical exposures.

Industrial Releases: Groundwater contamination by industrial and agricultural activities is well known. In addition to examples discussed above, there can be exchange between surface water and groundwater contaminants. For example, California's past surface water contamination of the Colorado River by perchlorate was the result of groundwater contamination at a perchlorate manufacturing facility in Nevada, which came to the surface via the Las Vegas Wash to the Colorado River. This contamination was significant to California not only because the Colorado River provides drinking water to many Southern

Californians, but also because Colorado River water is used to recharge groundwater supplies.

Surface Water Augmentation Projects: Wastewater recycling projects that augment surface water supplies have the potential of introducing contaminants into water bodies used for drinking water. The susceptibility of surface water supplies to such contamination has resulted in stringent regulatory requirements for indirect potable reuse projects.

3.2.5 Other Threats to Groundwater Supplies

Natural Geologic Formations: The geology of the state contributes to a number of contaminants in drinking water supplies. Chemicals such as arsenic, chromium (particularly hexavalent chromium), cadmium, and radionuclides like uranium are examples of regulated chemicals that have natural origins. Unregulated contaminants of natural origin, for which the State Water Board has established notification levels, include boron and vanadium.

Industrial and Agricultural Activities: Groundwater contamination has occurred historically in industrial and agricultural areas throughout the state and has resulted in widespread groundwater contamination, as has been described previously.

Groundwater Recharge Projects: Groundwater recharge projects that use recycled water, either via surface application (spreading) of the recycled water or via subsurface application (injection), have the potential to introduce contaminants into aquifers used for drinking water. The susceptibility of groundwater supplies to such contamination has resulted in stringent regulatory requirements on indirect potable reuse projects that involve aquifer replenishment.

Hydraulic Fracturing: Various oil and natural gas well stimulation techniques including hydraulic fracturing (or “fracking”) are used in California to increase oil and natural gas production from “tight” (low permeability) geological formations such as diatomite or shale.

Concerns have arisen both in the state and nationally about the potential for groundwater contamination from hydraulic fracturing and other well stimulation activities. These concerns relate to the quantities of water and chemicals used to fracture the geologic formations that release oil and natural gas and the potential for this activity to contaminate groundwater resources. Most oil and gas production zones are located in deep geologic formations; however, injected fluids could impact groundwater resources as a result of improperly constructed wells or fractures that create a conduit to a zone that contains groundwater that has a beneficial use such as drinking water supply.

Pursuant to Chapter 313, Statutes of 2013 (SB 4), the California Water Code (section 10783) was amended to require the State Water Board to develop model groundwater monitoring criteria in areas of oil and gas well stimulation (Model Criteria). The Model Criteria was adopted in 2015 by the State Water Board and requires:

- Area-specific groundwater monitoring be conducted by oilfield operators when a well to undergo stimulation treatment penetrates protected water;
- Property owner notification and sampling of groundwater or surface waters within 1,500 feet of any proposed well stimulation; and
- Regional groundwater monitoring to assess baseline groundwater quality in areas of oil and gas production and evaluate any potential effects that well stimulation and oilfield activities may have on groundwater quality.

The Water Boards have overseen groundwater monitoring in areas of oil and gas well stimulation since 2015. As of October 2018, Water Boards staff oversee 13 area-specific groundwater monitoring programs in Kern County, the only area where hydraulic fracturing has occurred since 2015. Adjacent property owners have been notified prior to each hydraulic fracturing event; however, none of the property owners have requested sampling.

The Water Boards also collaborate with the USGS to implement the Regional Groundwater Monitoring Program. Since 2015, the USGS has collected data from oilfields located in Kern, Santa Barbara, Ventura, and Los Angeles Counties. The results of these studies are included in data releases, articles, and reports that are publicly available on the State Water Board Oil and Gas Monitoring Program website, at:https://www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/ and the USGS California Oil, Gas, and Groundwater website, at https://webapps.usgs.gov/cogg/

3.2.6 Addressing Threats to Drinking Water Supplies

3.2.6.1 Source Water Assessment and Protection Programs

The State Water Board has a Drinking Water Source Assessment and Protection (DWSAP) program. The 1996 reauthorization of the federal SDWA included a requirement for states to assess all groundwater and surface water sources. A source water assessment is an inventory of possible contaminating activities that may threaten the quality of the source. If possible contaminating activities present a threat to the source, water systems are encouraged to protect their water sources from contamination through the establishment and implementation of a source water protection program. The results of the source water assessment must be included in the water system's annual Consumer Confidence Report. Any new drinking water sources must include an assessment as part of DDW's permit process. For more information, see the State Water Board's website on DWSAP (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/DWSAP.shtml).

The 2014 transfer of DDW from the Department of Public Health provided the State Water

Board an opportunity to better integrate surface water and groundwater protection efforts to protect drinking water supplies. These efforts include:

1. the Regional Water Boards' greater emphasis on drinking water source water protection through salt and nutrient management planning and regulation and enforcement of nitrate discharges from agriculture and dairies;
2. the State Water Board's Groundwater Ambient Monitoring and Assessment Program;
3. the Regional Water Boards' Irrigated Lands Regulatory Programs to monitor groundwater in order to characterize potential impacts to drinking water supplies;
4. the State Water Board integrating DDW's drinking water monitoring data to improve source water protection efforts. For example, DDW has used public water system well location information to identify wells that are vulnerable to contamination from wastewater injection wells used by the oil and gas exploration industry.

3.2.6.2 Limits on Industrial Releases and Restoration of Drinking Water Supplies

Due to the widespread contamination of several groundwater basins, the Water Boards have been diligent in controlling discharges of wastes to prevent further contamination of groundwater basins. The regulation of wastewater discharges from larger facilities into surface water supplies includes requirements for industrial source control, whereby industries must limit chemical releases into wastewater collection systems. Additionally, Regional Water Board staff are actively identifying historic industrial and illegal discharges that have contributed to groundwater basin contamination. Identification and cleanup of these illegal discharges will contribute to groundwater basin restoration in the long term.

The Water Boards' Cleanup Programs serve to restore groundwater beneficial uses and prevent further impacts to groundwater basins used for drinking water. The Water Boards' Cleanup Programs include the Site Cleanup, Department of Defense, and Underground Storage Tank Cleanup Programs, which regulate and oversee the investigation and cleanup of sites where recent or historical unauthorized releases of pollutants to the environment, including soil, groundwater, surface water, and sediment, have occurred. These sites have already or have the potential to impact drinking water supplies. Sites in the programs are varied and include, but are not limited to, pesticide and fertilizer facilities, rail yards, ports, equipment supply facilities, metals facilities, industrial manufacturing and maintenance sites, dry cleaners, gasoline stations, bulk transfer facilities, refineries, and some brownfields. The types of pollutants encountered at the sites are plentiful and diverse and include solvents, pesticides, heavy metals, and fuel constituents to name a few.

3.2.6.3 Limits on Household Chemical Releases into Drinking Water Supplies

Household hazardous substances, personal care products, and prescription pharmaceuticals are examples of materials that can be discharged into wastewater collection systems and subsequently discharged into surface water bodies. Many are also referred to as CEC, which are discussed elsewhere.

Regional Water Boards cannot feasibly require or enforce source control or household discharges. However, some progress has been made in limiting the presence of pharmaceuticals released from households into wastewater and subsequently into water used for drinking.

A number of communities have instituted public education programs or other programs to collect unused drugs and to keep them from being flushed down the toilet. For example, Alameda County passed an ordinance in July 2012 requiring drug manufacturers and producers that sell, offer for sale, or distribute certain prescription drugs in the county to participate in a program that includes a process for the collection and disposal of unwanted products from residential prescription drug consumers.

3.2.6.4 Requirements for Reducing Nitrate Contamination in Groundwater and Surface Water

In February 2018 the State Water Board adopted an order revising agricultural requirements for the Eastern San Joaquin River Watershed to reduce nitrate contamination of groundwater and surface water. The order protects communities that rely on groundwater for drinking water supply. It establishes a model for all 9 Regional Water Boards to follow in their subsequent orders to reduce pollutants for irrigated agriculture around the state. The order directs the Regional Water Boards to revise their agricultural orders to incorporate testing of drinking water quality for on-farm wells, and to address the long-term goal of improving groundwater and surface water quality through monitoring and controlling agricultural practices, specifically nitrogen management. It requires reporting of nitrogen application to crops from fertilizers, organic soil amendments and in irrigation water as well as data on nitrogen removed when crops are harvested and taken from the fields.

3.3 THREATS RELATED TO DRINKING WATER SYSTEM OPERATIONS

3.3.1 Disinfection and Disinfection Byproducts

With very few exceptions, all surface waters must be filtered and disinfected to address the microorganisms present in surface waters to make it safe for drinking. Water treatment processes are discussed further in Chapter 7. For surface water supplies, microorganisms and disinfection byproducts (DBP) have been and continue to be contaminants that must be dealt with by public water system.

Disinfection is the most important barrier to the spread of infectious disease from waterborne pathogens. Historically chlorine was the disinfectant of choice for surface water sources. However, in the 1970s it was discovered that chlorine reacts with natural organic matter to form DBP that have potential long-term health effects. Surface water contains natural organic compounds from vegetation that may fall into or otherwise be present in water supplies, or from algae that may grow in sun-lit water. To prevent the formation of DBP, water systems must take steps to reduce organic material in surface water sources, and/or change the method or chemicals used for disinfection.

Beginning in 1989 and continuing to the present, USEPA promulgated several regulations that apply to certain public water systems that use surface water. These regulations were all subsequently adopted by the state. They include the Surface Water Treatment Rule (SWTR), Interim Enhanced Surface Water Treatment Rule (IESWTR), Long Term (LT) 1 Surface Water Treatment Rule (LT1SWTR), LT 2 Surface Water Treatment Rule (LT2SWTR), and the Filter Backwash Recycling Rule. In 1995, the *Cryptosporidium* Plan, was released to address risks associated with this parasite. Subsequently, regulations for *Cryptosporidium* and *Giardia* were included in the surface water treatment rules mentioned above. Additional requirements and regulations to minimize the presence of DBP have been put into place, including the Stage 1 Disinfection and Disinfection Byproducts Rule in 1998 and the Stage 2 Disinfection and Disinfection Byproducts Rule in 2006.

The nitrosamine NDMA is currently unregulated, though it and other nitrosamines have notification levels. It has been found to result from water chlorination and can be present in drinking water and in wastewater. In this regard, the production of NDMA can be considered a disinfection byproduct. At high enough levels, it can be of concern for drinking water and for wastewater that is destined for use in a recycled water project involving the augmentation of drinking water supplies.

3.3.2 Distribution Systems

Public water system distribution systems consist of water pipes, pumps, storage facilities, and other appurtenances to meet distribution needs. The maintenance and operation of the distribution system are critical to meet the demands for water, including during natural disasters such as earthquakes, floods, fires, power outages, etc.

Adequate storage facilities and standby power helps water systems during disasters. Some water systems have made efforts to prepare for such disasters, but most water systems, especially small water systems, have not. Recently, mutual aid organizations have been formed for some small water systems that need help. An inventory of standby equipment is maintained to assist those water systems.

All water systems must properly operate and maintain their distribution facilities in order to provide customers with drinking water of good quality and at an adequate pressure under all conditions, including during emergencies or natural disasters. Most of the distribution system facilities were constructed many decades ago. In California, based on the USEPA’s 2018 Infrastructure Needs Assessment, the estimated cost to bring distribution systems up to date is over $51.03 billion.

In the 2015 Plan, for regulating surface water augmentation, it was noted that there were some water systems that continued to have uncovered distribution reservoirs, which are susceptible to contamination of treated water from runoff and airborne contaminants, and vandalism. These sources were not acceptable according to the 2008 regulations or the "California Waterworks Standards." Nor did they meet subsequent USEPA requirements for open distribution reservoirs. Of the seven reservoirs that were uncovered as of late 2015 and still in use, four are now covered or are completing cover installation, two will be removed from service after consolidation with another system in 2023, and one is installing ultraviolet and chlorine treatment at the reservoir outlet.

Most water systems use storage reservoirs to handle hourly, daily, and seasonal fluctuations in water demands. During periods of low water demand, especially during the winter months, water can be stored in the reservoirs for several days and, in some cases, weeks. This can cause the water to become stale. If the water system uses chloramines for disinfection, the stale water could result in the breakdown of chloramines, through nitrification. This loss of disinfectant residual leads to bacteriological problems in water quality.

Water pipes are subject to contamination if the pipes develop leaks, such as through deterioration. Depending on the water pressure, the openings in the pipe may allow contaminants in the surrounding soil to seep in and contaminate the water inside the pipe. In addition, during repairs the water could become contaminated if proper procedures are not carefully followed. Adequate disinfection is necessary after repairs to ensure that the water in the pipe is safe for drinking.

Water pipes in the distribution systems are also subject to contamination from source water quality deposits over time. For example, sources with elevated levels of manganese will deposit manganese in the distribution pipes, which can be released when flushing occurs. Most monitoring occurs at the source and the full extent of water quality in the distribution system is unknown.

Besides the potential for contaminants entering the distribution through leaking pipes, the loss of water from leaking pipes is also of concern. Water system operators must be aware of water losses and address them in order to ensure an adequate supply for their customers. The State Water Board's Water Loss Control Portal has access to information about the development of water loss performance standards and other related information. For more information, see the State Water Board's website on the Water Loss Control Portal (https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/water_loss_control.html)

Water loss can be more easily determined when a meter exist at the service connection. Annually public water systems submit a report that quantifies the number of metered and unmetered service connections; however, in the DDW's database there are still a number of systems which are not known to either have a meter or not. Currently only systems with greater than 10,000 service connections are required to install meters at service connections. Based on the information from the DDW database, on average, large systems are more likely to have meters at service connections. On average, about 80 percent of systems serving more than 10,000 service connections are metered, and only 7 percent of systems serving less than 200 service connections are metered. Furthermore, by having meters installed at service connections, water systems would have more information which can be used to better manage the water system.

It is essential to maintain a disinfectant residual in the distribution system to control microbial growth inside distribution system piping and reservoirs. As normal disinfection does not sterilize the water, there will still be some microbiological organisms present in the water supply that can be controlled by the disinfectant residual. In addition, a disinfectant residual will prevent contamination that may occur if microbiological organisms are introduced into the distribution system via leaks, vents, or other openings.

Connections can be made that expose the distribution system to contaminants or pollutants that may cause the water supply to be unsafe for drinking. "Cross connection" occurs when a connection is made between the drinking water and another source of water that is not safe. An example of a cross connection is when a container of a chemical is connected to the drinking water through a pipe or a hose. If the drinking water system loses pressure or a vacuum occurs, the chemical can be sucked into the drinking water system. Another example is when the homeowner leaves a garden hose flowing and submerged in a pond or pool of water. If the drinking water system experiences a loss of pressure or a vacuum is created, the water in the pond or pool can be sucked into the drinking water system. To prevent such events, California requires every water system to have a cross connection control program, including an ordinance or rules of service.

Water system owners and operators must be diligent in inspecting and monitoring their facilities on a frequent basis. At any time, the facilities may be targets of vandals or terrorists. Several acts of vandalism and/or terrorism have occurred in California. Several water systems inspect their facilities more than once a day. Some systems have installed cameras and intrusion alarm systems.

Wildfires and Resulting Distribution System Contamination

Since the 2015 Plan, a newly discovered type of wildfire-related distribution system contamination has affected some water systems. In addition to incurring large-scale physical damage, in 2017, the City of Santa Rosa discovered benzene and other volatile organic chemicals (VOC) in its distribution water pipes. Loss of pressure (depressurization) and significant structure loss during the wildfire appeared to be key factors resulting in the VOC contamination. In subsequent fires, other water systems that experienced similar conditions were tested for VOC contamination, and it was found again in 2018 in Paradise. Extensive investigation took place in both cases. Based on available data, contamination is believed to occur from: 1) pyrolysis and heating of plastic and synthetic pipe materials, and 2) smoke and combustion byproducts entering the distribution lines when they depressurize during the fire.

The highest levels of VOC contamination have been found in service laterals to burned structures, but in some cases lower levels of contamination have affected water mains. Service line contamination has typically averaged a few times to tens of times greater than the California maximum contaminant limit (MCL) for benzene (the California MCL for benzene is 1 ug/L, while the federal MCL is 5 ug/L). In a few extreme cases, benzene has been detected at hundreds to thousands of times the MCL. While other VOC have been detected, benzene has served as an indicator for this type of contamination because of its comparatively low MCL. Other VOC appear to present either with benzene or below their respective MCL. As wildland-urban interfacing wildfires continue to increase in severity and size, this type of distribution system contamination is expected to occur routinely. Government agencies and academia are engaged in a number of research efforts to further study causes and best practices for remediation.

DDW has created some guidance for water systems which have been impacted by large wildfires. Additionally, public notice templates have been developed to be used when needed. DDW is continuing to develop knowledge on when contamination occurs and how to best mitigate the impact.

3.3.3 Operation and Maintenance

The benefits of good operation and ongoing maintenance are critical components of providing safe drinking water. Some shortfalls in operations and maintenance can be attributed to a scarcity of funds. Other problems that occur in water systems result from operator errors. These are caused by poor or no training, inadequate staffing, lack of proper guidance from supervisors, or few or no practice sessions.

To address these issues, in 2001 USEPA required states to establish certification programs for operators of water treatment and water distribution facilities. While California has long had a water treatment certification program, it did not previously certify or require certified distribution operators. The State Water Board now has a comprehensive program, funded by application and renewal fees, to certify treatment and distribution operators. Over the past decade the number of operators has grown significantly from about 23,000 to 35,000 active certified operators.

Small economically disadvantaged water systems have greater difficulty in obtaining and keeping certified operators than do larger systems. The larger water systems can pay higher salaries than small water systems, and many small water systems are located in isolated rural areas where the availability of certified operators is limited. In the past, USEPA provided one-time federal funds through the Expense Reimbursement Grant Fund to pay operators from small water systems for classes and certification; however, these funds have been exhausted. Methods were investigated to continue this program with set-aside funds from the DWSRF, but that approach was hampered by the state's contracting and fiscal requirements. There is a surplus from the revenue that is derived from operator application and renewal fees. This surplus, which is contained in the operation certification Surplus Money Investment Fund, could also be used to support operator education and training.

The availability of classes also depends on location. In rural areas, especially in Northern California, there is generally a lack of classes that an operator can attend in person. Consequently, many small water systems will continue to be challenged to cover such training and certification costs.

3.4 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

More than 98 percent of the population served by public water systems receives drinking water that meets federal and state drinking water standards. The chemical, radiological, and microbiological contaminants are effectively being removed through treatment.

Small water systems, as discussed in Chapter 4, are more likely than larger systems to be out of compliance with drinking water standards. They are also more likely to be out of compliance with reporting requirements and with provisions of their permits.

In addition, consumers of drinking water from state small systems (those with fewer consumers than public water systems are not subject to public water system requirements for compliance and continued monitoring), and from transient non-community systems (which perform monitoring for a limited number of constituents), do not receive the public health benefits of extensive monitoring and compliance requirements. Further, groundwater sources that are used by state small systems and transient non-community systems (as well as private homeowners) are often shallow aquifers with concomitant poorer water quality than deeper aquifers.

As mentioned earlier, this Plan does not take into account the state's residents who are not served by a public water system. With the SAFER program, the State Water Board has a means to begin to address the needs of residents who are not served by a public water system. The State Water Board is committed to pursuing solutions to ensure that all Californian's receive affordable, safe, and reliable drinking water and will continue to partner with local agencies to ensure this goal is achieved.

In the past several decades, many new contaminants have been identified, the majority of which have been effectively regulated or are in the process of being regulated. Monitoring for certain unregulated contaminants (see Appendix 4) has provided information on the extent of their presence in drinking water supplies. Some CEC may require consideration for regulatory action although, because of their low concentrations in drinking water sources, it is unclear whether these pose a health risk. Water quality monitoring for the myriad of regulated contaminants has become costly, which has resulted in an economic burden on many small water systems.

California depends on a combination of surface water and groundwater to meet its drinking water needs. Pollution threats such as wastewater discharges and agricultural practices can impact the quality of these sources. Fortunately, strong regulatory efforts along with greater emphasis on drinking water source protection activities have lessened the impact from these threats. However, with California's increasing population and the effects of climate change on water resource reliability, new sources of drinking water will be needed. Sources derived from high-quality recycled wastewater and desalination will likely become more prevalent.

The operation and maintenance of water systems has a significant impact on the quality of drinking water delivered to the public. Larger water systems have the financial capacity to operate sophisticated treatment facilities and to provide for a well-trained and technically competent workforce of water system operators. However, small water systems, particularly those that have technically challenging treatment facilities have a difficult time paying the operating costs and acquiring and retaining water system operators with the expertise to operate such facilities. In addition, covering the cost of training operators is a challenge to small water systems.

Recommendations

3-1 The State Water Board will continue to encourage large water systems to assist small systems with technical knowledge and implementation, for example optimizing water treatment systems.

3-2 The State Water Board will continue to explore ways to facilitate operator education opportunities particularly for small water system operators and will increase outreach to recruit new operators through high schools, veterans' affairs groups, by providing internships, and other training initiatives.

3-3 The State Water Board will continue to encourage vulnerable water systems, particularly those that rely on only a single groundwater source, to study and improve their reliability. Increase existing community water systems source capacity requirements to include a minimum of two sources, either through an intertie to another water system or an additional well source and ensure backup power supply

3-4 To ensure the health and safety of consumers of drinking water from state small water systems, the State Water Board recommends an initial sanitary survey followed by repeat sanitary surveys every five years. In addition, an annual Consumer Confidence Reports should be issued by state small water systems.

3-5 To ensure the health and safety of customers of state small water systems and consumers of their drinking water, the State Water Board intends to explore amending the existing bacteriological quality regulations for such systems to require them to collect and analyze water samples for compliance with bacteriological standards, consistent with 22 CCR section 64423, et seq.

3-6 The State Water Board will explore amending its regulations to require both state small water systems and transient non-community water systems to monitoring and comply with the same monitoring requirements for non-transient non-community water systems. Specifically, nitrate/nitrite, perchlorate and other inorganic chemicals, radionuclides and organic chemical contaminants, consistent with Title 22 CCR section 64432, et seq., section 64442, et seq., and section 64444, et seq., respectively.

3-7 To address the potential after-effects of large fires on public water systems' distribution systems with regard to benzene and other VOC contamination, the State Water Board support research on the origins of such contamination, including the effects of fire on pipes and other associated materials, and on ways to prevent an affected distribution system from losing pressure during a fire and being subsequently contaminated.

3-8 To address and to enable conservation of treated drinking water, to provide information to drinking water consumers, and to improve the management of water systems, the State Water Board recommends legislation require all drinking water systems including state small water systems to install water meters on all service connections in their service area.

3-9 To further address conservation of treated drinking water, the State Water Board will require all drinking water systems, including state small water systems, to document at least quarterly the quantity of drinking water they produce or otherwise delivered to customers, the quantity received by customers (based on customers' water meters), and the quantity estimated to be lost by broken or leaky conveyance and distribution systems. Such documentation shall be provided to the State Water Board annually.

3-10 To provide information that will address drought-related and over-drafting stresses on groundwater sources used as drinking water, at least monthly monitoring of both static and pumping water levels by public water systems, including state small water systems, should be conducted. The results of water level monitoring should be submitted to the State Water Board on a schedule developed that is proportionate to the risk level.

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My Water Quality website (https://mywaterquality.ca.gov/safe_to_drink/)

State Water Board Drinking Water Watch website (https://sdwis.waterboards.ca.gov/PDWW/)

State Water Board Sustainable Groundwater Management Act website (https://www.waterboards.ca.gov/water_issues/programs/sgma/)

State Water Board Recycled Water Information website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RecycledWater.html)

State Water Board's "Investigation on the Feasibility of Developing Uniform Water

Recycling Criteria for Direct Potable Reuse" December 2016 (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/rw_dpr_criteria/final_report.pdf)

State Water Board's "A Proposed Framework for Regulating Direct Potable Reuse in California" April 2018 (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/direct_potable_reuse/dprframewk.pdf).

State Water Board's "A Proposed Framework for Regulating Direct Potable Reuse in California" Second Edition August 2019 (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/direct_potable_reuse/dprframewkseced.pdf)

State Water Board's Groundwater Information Accessibility and Identification of Communities Reliant on Contaminated Groundwater–AB 2222 Report (https://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/docs/ab2222.pdf)

State Water Board GAMA Resources website (https://www.waterboards.ca.gov/water_issues/programs/gama/resources.html#coc)

State Water Board Drinking Water Notification Level website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.html)

State Water Board Nitrates and Nitrites in Drinking Water website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Nitrate.html)

State Water Board's "Recommendations Addressing Nitrate in Groundwater" (http://www.waterboards.ca.gov/water_issues/programs/nitrate_project/docs/nitrate_rpt.pdf)

State Water Board Lead Sampling of Drinking Water in California Schools website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/leadsamplinginschools.html)

State Water Board Lead Service Line Inventory Requirement for Public Water Systems website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/lead_service_line_inventory_pws.html)

State Water Board Lab-To-State Portal Information website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/lts_portal_info.html)

State Water Board Drinking Water Notification Level for Manganese website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Manganese.html)

State Water Board GAMA Groundwater Information Sheet Hexavalent Chromium (https://www.waterboards.ca.gov/water_issues/programs/gama/docs/coc_hexchromcr6.pdf)

State Water Board Chromium-6 Drinking Water website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.html)

State Water Board Perchlorate in Drinking Water website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Perchlorate.html)

State Water Board 1,2,3,-Trichloropropane (1,2,3 - TCP) website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP.html)

State Water Board MTBE: Regulations and Drinking Water website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MTBE.html)

State Water Board 1,4-Dioxane website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/14-Dioxane.html)

State Water Board NDMA and Other Nitrosamines - Drinking Water Issues website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NDMA.html)

State Water Board Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS) website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/PFOA_PFOS.html)

State Water Board Recycled Water Policy website (https://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/)

State Water Resources Microplastics website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/microplastics.html)

State Water Board Cyanobacteria and Cyanotoxins in Drinking Water website (https://www.waterboards.ca.gov/drinking_water/programs/habs/)

State Water Board Oil and Gas Monitoring Program website, (https://www.waterboards.ca.gov/water_issues/programs/groundwater/sb4/)

State Water Board Drinking Water Source Assessment and Protection (DWSAP) Program website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/DWSAP.html)

State Water Board Water Loss Control website (https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/water_loss_control.html)

My Water Quality website (https://mywaterquality.ca.gov/safe_to_drink/)

My Water Quality California Harmful Algal Blooms (HABs) Portal

(https://mywaterquality.ca.gov/habs/)

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CDPH Indoor Radon Program website (https://www.cdph.ca.gov/Programs/CEH/DRSEM/Pages/EMB/Radon/Radon.aspx)

USEPA Contaminant Candidate List 3 – CCL 3 website (https://www.epa.gov/ccl/contaminant-candidate-list-3-ccl-3)

USEPA Contaminant Candidate List 4 – CCL 4 website (https://www.epa.gov/ccl/chemical-contaminants-ccl-4)

USEPA Drinking Water Health Advisory Documents for Cyanobacterial Toxins (https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisory-documents-cyanobacterial-toxins)

USEPA Fourth Unregulated Contaminant Monitoring Rule website (https://www.epa.gov/dwucmr/fourth-unregulated-contaminant-monitoring-rule)

USGS California Oil, Gas, and Groundwater website (https://webapps.usgs.gov/cogg/)

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CHAPTER 4 WATER QUALITY ISSUES AFFECTING PWS SERVING FEWER THAN 10,000 SERVICE CONNECTIONS

Public water systems (PWS) are required to monitor their source water for a range of constituents in accordance with regulations developed under the Safe Drinking Water Act. Under the Safe Drinking Water Act, public water systems are required to respond to violations and potential violations of drinking water standards in accordance with regulatory requirements. The required response may include follow-up sampling, investigation, corrective action and notification of the public to drinking water quality violations.

All public water systems must comply with the primary drinking water standards that are applicable to their category of water system. Both community and non-transient non-community water systems must meet all primary drinking water standards. transient non-community water systems must comply with primary standards for microbiological, surface water treatment and nitrate but are exempt from monitoring for the broader range of primary drinking water standards. The basis for the less extensive source monitoring requirements for transient non-community systems is the low risk of chronic exposure to the general public since the vast majority of users visit the location a limited number of days per year.

The State Water Board publishes a summary of the violations incurred statewide in each calendar year known as the Annual Compliance Report (ACR). These reports are available at: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Publications.html The 2019 ACR is included as Appendix G to this report. The base information in this chapter is drawn largely from the 2019 ACR with added summaries and discussion based on larger data sets from previous years ACR.

This chapter describes water quality issues based on violations of primary drinking water standards from the reporting years since the 2015 Plan, which included data from 2015 thru 2019. There are a few broad considerations that are important to keep in mind:

1. Many communities rely on contaminated groundwater sources as detailed in the 2013 report to the Legislature entitled "Communities that Rely on Contaminated Groundwater Sources." This report was prepared pursuant to AB 2222 and is available at: https://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/
2. Many of the communities identified in the AB 2222 Report are economically disadvantaged and have experienced ongoing violations of drinking water standards as a result of the contamination.
3. The AB 2222 Report focused on the San Joaquin Valley though groundwater contamination of various scales and severities faced by many communities statewide.

4. Many very large systems rely on surface water sources which require extensive treatment but are not subject to the local and regional groundwater quality issues faced by systems which rely on groundwater. Often these systems must pay special attention to the challenges of meeting drinking water standards within the distribution system including compliance with Disinfectant Byproduct Standards.

Table 4-1 below provides a description of the water quality issues presently affecting community, non-transient non-community, and transient non-community water systems based on water sources and types of contaminants including microbial, chemical (organic and inorganic), and radiological.

Table 4-1 Number of Public Water Systems by Type and Size as of November 2020

System Type	Size (Service Connections)	Number of Systems
Large Community Water Systems	More than 10,000	223
Medium Community Water Systems	1,000 to 9,999	450
Intermediate Community Water Systems	200 to 999	407
Small Community Water Systems	Fewer than 200	1,804
Non-Transient Non-Community	Not Applicable	1,497
Transient Non-Community	Not Applicable	2,988

4.1 SURFACE WATER

4.1.1 Microbiological

Over the last three decades, a greater emphasis has been placed on improving treatment of surface waters to provide greater assurance that bacterial, parasitic, and viral pathogens are effectively removed, and to address new microbiological threats, specifically *Cryptosporidium*. USEPA has adopted several regulations that apply to certain PWS that use surface water. These regulations were all subsequently adopted by the state. They include the Surface Water Treatment Rule (SWTR), Interim Enhanced Surface Water Treatment Rule (IESWTR), Long Term (LT) 1 Surface Water Treatment Rule (LT1SWTR), LT 2 Surface Water Treatment Rule (LT2SWTR), and the Filter Backwash Recycling Rule.

The LT1SWTR is directed at PWS serving fewer than 10,000 people, while the LT2SWTR affects all PWS that use surface water. The effect of these rules has been to significantly reduce the risk of waterborne infectious disease transmission. This is evidenced by the lack of waterborne infectious disease outbreaks associated with PWS that use surface water sources in California.

Table 4-2: SWTR violations for years 2015-2019

System Size	**2015**	**2016**	**2017**	**2018**	**2019**	**Total Number of violations**
Large Community Water Systems	7	0	0	0	0	**7**
Medium Community Water Systems	4	0	1	1	0	**6**
Intermediate Community Systems	3	3	1	2	0	**9**
Small Community Water Systems	96	80	33	15	14	**238**
Non-Transient Non-Community	17	17	18	3	1	**56**
Transient Non-Community	5	5	2	0	2	**14**
Total Number of violations	**132**	**105**	**55**	**21**	**17**	**330**

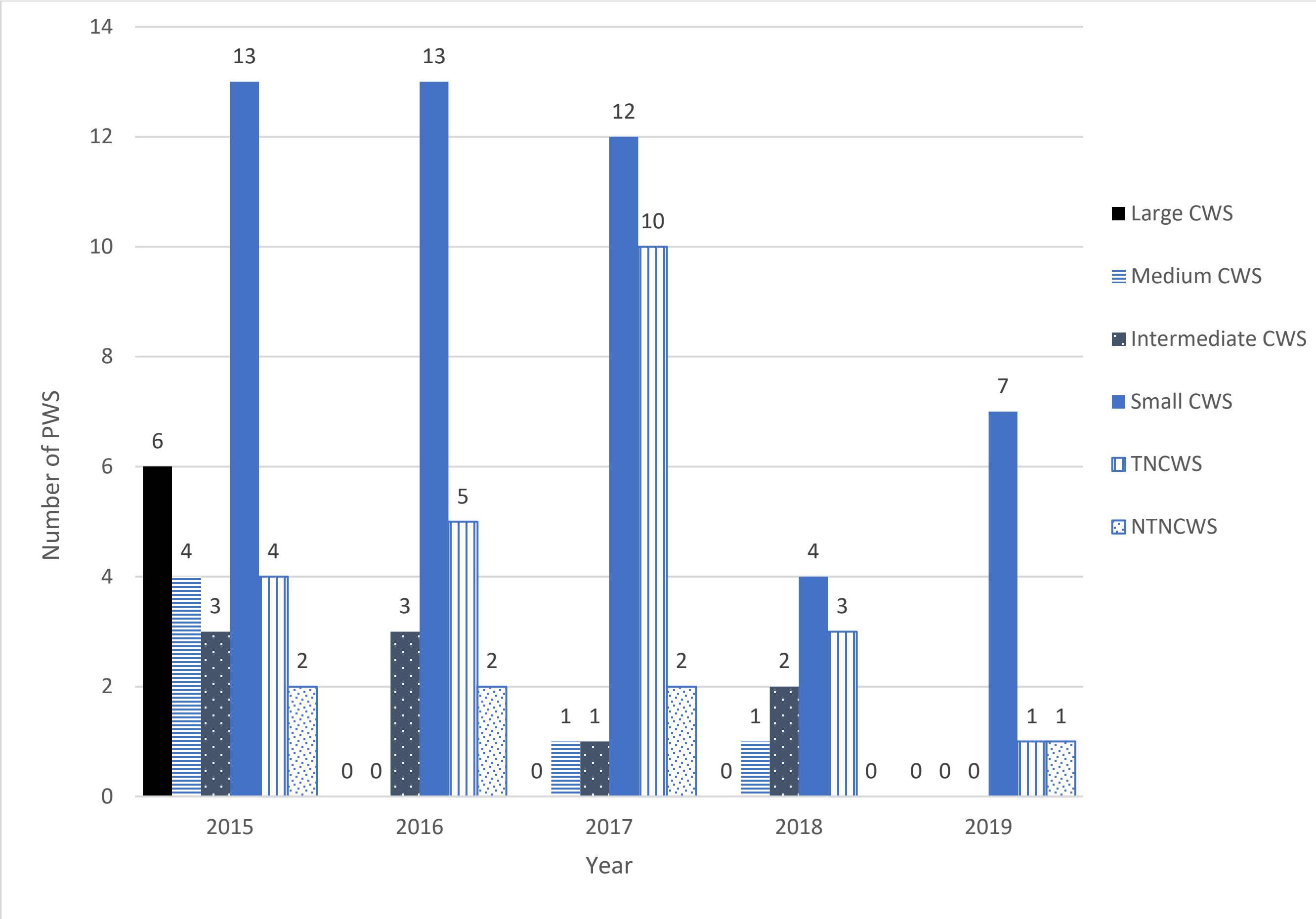

Figure 4-1 - Number of PWS with SWTR violations for years 2015-2019

Table 4-2 shows the number of community, transient non-community, and non-transient non-community water systems that were in violation of these surface water treatment rules for each year from 2015 to 2019. For the purposes of this table, violations are failures of the various treatment techniques required by the surface water treatment rules. To summarize, between 2015-2019 a total of 81 PWS were in violation of the surface water treatment rules. Almost 95 percent of the violations were by small community (<200 service connections), non-transient non-community, or transient non-community. 36 Small community systems had a total of 238 violations, while 18 transient non-community systems had a total of 56 violations and 6 non-transient non-community systems had a total of 14 violations.

Due to the acute public health risk, when a PWS does violate a surface water treatment rule, the Division of Drinking Water takes immediate action and issues an enforcement document. The enforcement document details what actions the PWS needs to complete to return to compliance and public notice to the consumers. Additionally, the Division of Drinking Water provides extra oversight and helps the PWS with obtaining resources, for example funding, to correct the issue.

Case Study / Example

Las Cumbres Mutual Water Company (MWC) is a small community that violated the surface water treatment rules 46 times between 2015 to 2016 by utilizing unapproved surface water treatment. In September 2017 Las Cumbres MWC, funded with money from Proposition 50, finished the construction of an approved surface water treatment plant. The initial design utilized slow sand filters but due to iron bacteria in the source water, pre-chlorination was required to prevent premature clogging of the sand filters. The chlorine pre-treatment prevented the schmutzdecke formation on the slow sand filters, which was essential for approval. The design was later modified to include cartridge filters, an approved alternative filtration technology, installed downstream of the sand filters. Las Cumbres MWC has not violated the SWTR since operations began at the new treatment plant.

4.1.2 Chemicals

Surface waters in California continue to be free from organic and inorganic chemicals that exceed MCL. The principal chemicals that affect surface waters are naturally occurring organic chemicals and, in some situations, bromide that are precursor materials in the formation of disinfection by products.

The Colorado River contamination by perchlorate from a Nevada facility, however (discussed in Chapter 3), shows that chemical contaminants may be problematic for surface water supplies of drinking water in some situations. Chemicals used in industry, though limited in their release because of industrial source control measures and wastewater treatment, may nonetheless be present at low levels in receiving surface waters. In addition, constituents of emerging concern (CEC), such as pharmaceuticals and personal health care products, are being detected at low levels in surface waters that receive wastewater discharges. The public health significance of the low levels of these many chemicals is unclear, but their presence demonstrates the vulnerability of drinking water supplies to contamination.

4.2 GROUNDWATER

4.2.1 Inorganic Chemicals

Inorganic chemicals are often naturally present. Minerals present in the soil become dissolved in the groundwater. In general, naturally occurring contaminants are detected statewide, while anthropogenic contaminants tend to be detected in particular regions of the state. For example, arsenic (naturally occurring) is detected in a wide distribution of community water system wells across the state (see Figure 4-3 below). In contrast, nitrate at concentrations above the MCL is anthropogenic and is predominantly detected above the MCL in areas of the state with current or historical agricultural activity (See Figure 4-4 below).

Table 4-3: Inorganic MCL violations for years 2015-2019

System size	2015	2016	2017	2018	2019	Total Number of violations
Large Community Water Systems	14	4	2	0	0	**20**
Medium Community Water Systems	46	30	27	24	12	**139**
Intermediate Community Systems	50	53	65	51	39	**258**
Small Community Water Systems	405	428	401	359	309	**1902**
Non-Transient Non-Community	253	288	295	267	247	**1350**
Transient Non-Community[1]	62	89	121	104	89	**465**
Total Number of violations	**830**	**892**	**911**	**805**	**696**	**4134**

1 – Transient Non-Community water systems only need to comply with the inorganic MCL for nitrate and nitrite.

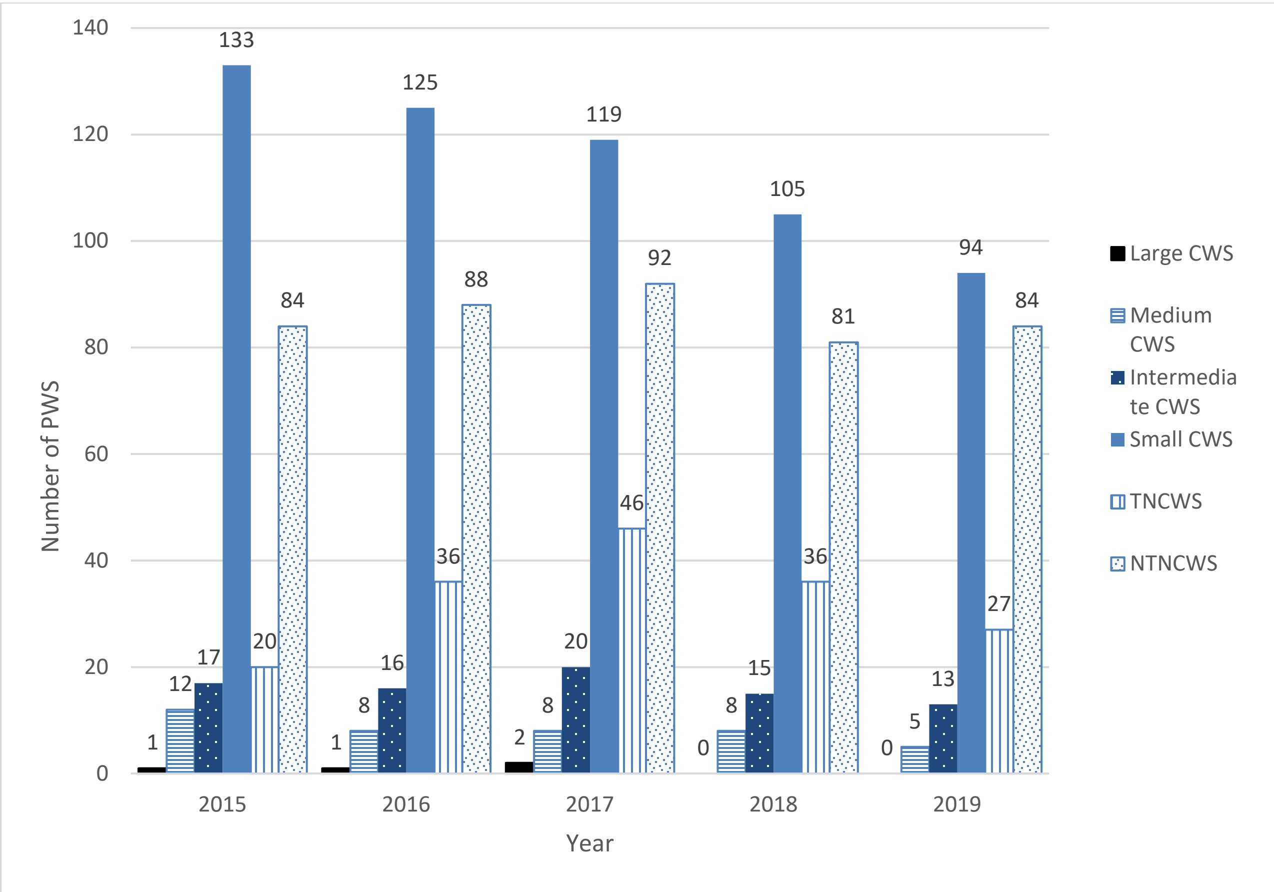

Figure 4-2 - Number of PWS with inorganic MCL violations for years 2015-2019

Almost 50 percent of the inorganic MCL violations are exceedances of the arsenic MCL. In 1993, the MCL for arsenic was established at a concentration of 50 micrograms per liter (µg/L). In 2001, USEPA lowered the MCL for arsenic from 50 µg/L to 10 µg/L and the state subsequently adopted the same 10 µg/L MCL. The reduction in the standard triggered a large increase in MCL violations for arsenic.

Table 4-4 : Arsenic MCL violations for years 2015-2019

System size	**2015**	**2016**	**2017**	**2018**	**2019**	**Total Number of violations**
Large Community Water Systems	0	0	0	0	0	**0**

System size	2015	2016	2017	2018	2019	Total Number of violations
Medium Community Water Systems	27	21	23	22	12	**105**
Intermediate Community Systems	43	38	40	33	20	**174**
Small Community Water Systems	250	242	239	194	162	**1087**
Non-Transient Non-Community	135	131	134	111	105	**616**
Total Number of violations	**455**	**432**	**436**	**360**	**299**	**1982**

Table 4-4 shows the number of systems in violation of the arsenic MCL from 2015-2019. Arsenic continues to be a major groundwater quality issue, principally affecting small community and non-transient non-community water systems. Small community water systems account for over half the violations, while non-transient non-community water systems account for about a third of them. Exceedance of the arsenic MCL affects many of counties across the state (shown in Figure 4-3).

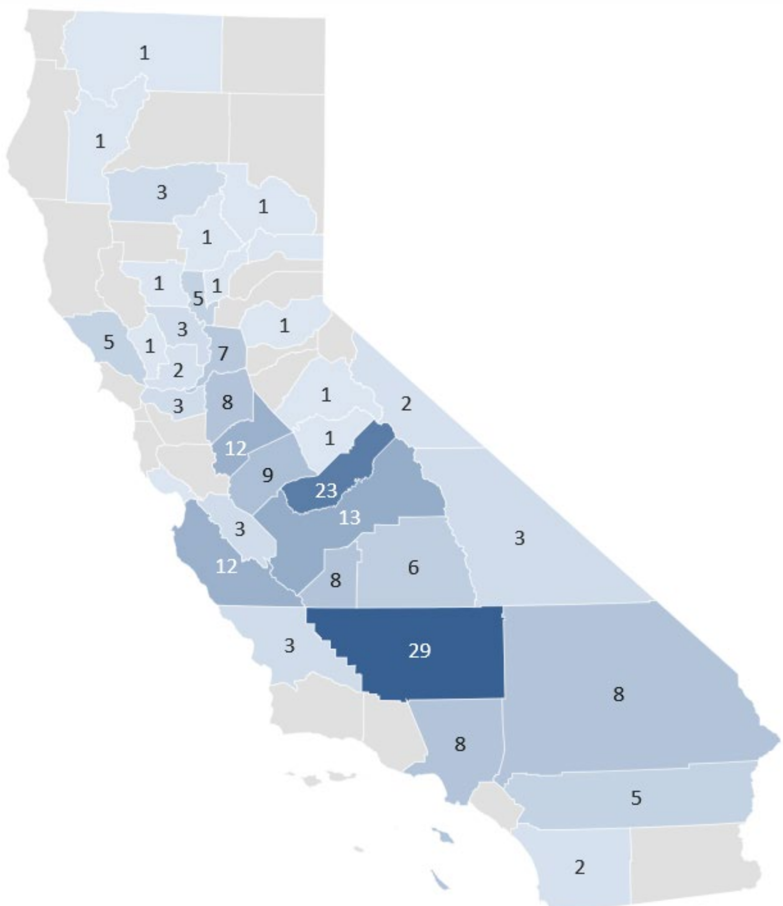

Figure 4-3 - Number of PWS with Arsenic MCL violations for years 2015-2019

The second most significant groundwater quality issue affecting PWS serving fewer than 10,000 service connections is nitrates. Nitrates have historically been a major groundwater contaminant. The use of nitrogen fertilizers and large dairy operations and cattle feeding facilities, and to a lesser extent individual sewage disposal practices, have been the principal sources of the contamination.

Table 4-5 : Nitrate MCL violations for years 2015-2019

System Size	**2015**	**2016**	**2017**	**2018**	**2019**	**Total Number of violations**
Large Community Water Systems	0	0	1	1	0	**2**
Medium Community Water Systems	0	0	1	2	0	**3**
Intermediate Community Systems	1	4	5	3	6	**19**
Small Community Water Systems	89	116	110	112	120	**547**
Non-Transient Non-Community	66	107	117	115	117	**435**
Transient Non-Community	49	85	109	103	89	**522**
Total Number of violations	**205**	**312**	**343**	**336**	**332**	**1528**

Table 4-5 summarizes the MCL violations for nitrate for 2015-2019. Nitrate violations are predominately in the Central Valley (mainly in Tulare, Kern, Stanislaus, and Merced Counties), and the Salinas Valley in Monterey County (see Figure 4-4 below). Approximately one-third of the water systems affected are small community; transient non-community and non-transient non-community showed about the same number of violations. These findings are consistent with findings contained in the February 2013 Report to the Legislature by the State Water Board, "Recommendations Addressing Nitrate in Groundwater," available at: https://www.waterboards.ca.gov/water_issues/programs/nitrate_project/index.html.

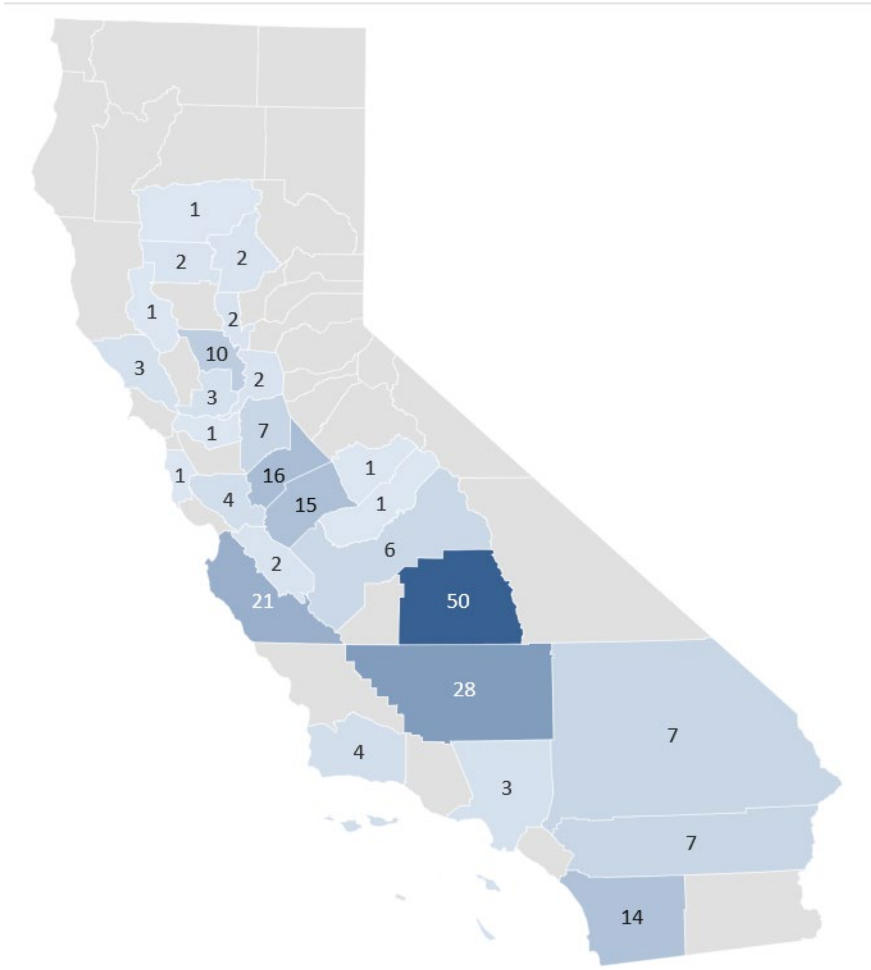

Figure 4-4 - Number of PWS with Nitrate MCL violations for years 2015-2019

Perchlorate is another inorganic contaminant that has been regulated with a California MCL since 2007. Principally a groundwater contaminant associated with munitions, rocket fuel, and fireworks, it was also found to be present in the Colorado River, a source of drinking water for many Californians, because of releases from a facility in Nevada. It may also be naturally present in low concentrations in groundwater. Perchlorate MCL violations are relatively not common; for example, violations occurred only in 35 PWS (1 medium community, 19 small community, and 15 non-transient non-community) between 2015-2019.

Hexavalent chromium occurs in groundwater as a natural constituent, as well as a contaminant from industrial disposal practices. It is regulated under California's total chromium MCL of 50 ppb, as well as the less stringent federal MCL of 100 ppb. It was also regulated with a 10-ppb California-specific MCL for a relatively short period of time from July 1, 2014-September 11, 2017. The MCL was rescinded by the State Water Board following a court order to revisit the standard after a better evaluation of the costs to small water systems.

Table 4-6 : Hexavalent Chromium MCL violations for years 2015-2017

System Size	**2015**	**2016**	**2017**	**Total Number of violations**
Large Community Water Systems	14	4	1	**19**
Medium Community Water Systems	15	7	2	**24**
Intermediate Community Systems	6	4	2	**12**
Small Community Water Systems	41	26	8	**75**
Non-Transient Non-Community	26	12	2	**40**
Total Number of violations	**102**	**53**	**15**	**170**

Hexavalent chromium MCL violations are presented in Table 4-6; they show 44 percent of the violations that occurred were by small community water systems, and another 24 percent were in non-transient non-community water systems.

A new California-specific MCL for hexavalent chromium is likely to be established by the State Water Board in 2021. Until that time, the contaminant continues to be regulated under the state's MCL for total chromium.

For more information, see the State Water Board's hexavalent chromium website (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.shtml)

4.2.2 Organic Chemicals

Agricultural chemical pesticides such as dibromochloropropane (DBCP) and volatile organic chemicals such as the chlorinated solvents trichloroethylene (TCE) and tetrachloroethylene (PCE) have been the most common organic chemicals found to exceed MCL. Another organic chemical, 1,2,3-trichloropropane (1,2,3-TCP), a byproduct of an agricultural pesticide and an industrial solvent, has been found to exceed MCL, as well, though its MCL was adopted in late 2017.

In the past two decades tremendous strides have been made to mitigate problems associated with organic contamination. Between 2015 and 2019, three small community water systems and one non-transient non-community water system exceeded a volatile organic chemical (VOC) MCL. Between 2015 and 2019, PWS have only exceeded synthetic organic chemical (SOC) MCL for DBCP and 1,2,3-TCP.

Table 4-7: DBCP MCL violations for years 2015-2019

System Size	2015	2016	2017	2018	2019	Total Number of violations
Large Community Water Systems	0	0	0	0	0	**0**
Medium Community Water Systems	1	0	0	0	0	**1**
Intermediate Community Systems	0	0	0	0	0	**0**
Small Community Water Systems	1	2	0	0	0	**3**
Non-Transient Non-Community	18	5	6	3	5	**37**
Total Number of violations	**20**	**7**	**6**	**3**	**5**	**41**

Table 4-7 shows the number of community and non-transient non-community water systems that were in violation DBCP MCL for each year from 2015 to 2019. 90 percent of the DBCP MCL violations occurred in non-transient non-community systems.

Table 4-8: 1,2,3-TCP MCL violations for years 2018-2019

System Size	2018	2019	Total Number of violations
Large Community Water Systems	91	92	**183**
Medium Community Water Systems	36	43	**79**
Intermediate Community Systems	55	52	**107**
Small Community Water Systems	70	73	**143**
Non-Transient Non-Community	239	262	**501**
Total Number of violations	**491**	**522**	**1013**

1,2,3-TCP, the more recent California-regulated contaminant, appears to be problematic for PWS serving fewer than 10,000 service connections. Although state-wide monitoring for MCL compliance was only required once the MCL became effective in December 2017, data from 2018-2019 show that MCL violations occurred in 162 PWS. Table 4-8 shows the number of community and non-transient non-community water systems that were in violation 1,2,3-TCP MCL for 2018 and 2019. The greatest number of violations of the 1,2,3-TCP MCL occurred in several counties in the Central Valley including Fresno, Kern, Tulare, Merced, San Joaquin, and Stanislaus, shown in Figure 4-5 below. This contamination is most likely due to agricultural pesticide use. Violations by smaller numbers in other counties may either be from agricultural pesticide use or from the use and disposal of certain industrial solvents. The findings of these chemicals in parts of Los Angeles County are generally attributed to industrial sources. About 18 percent of the violations occurred in large community systems (>10,000 service connections), 15 percent occurred in small community systems (< 200 service connections), and about 50 percent occurred in non-transient non-community systems.

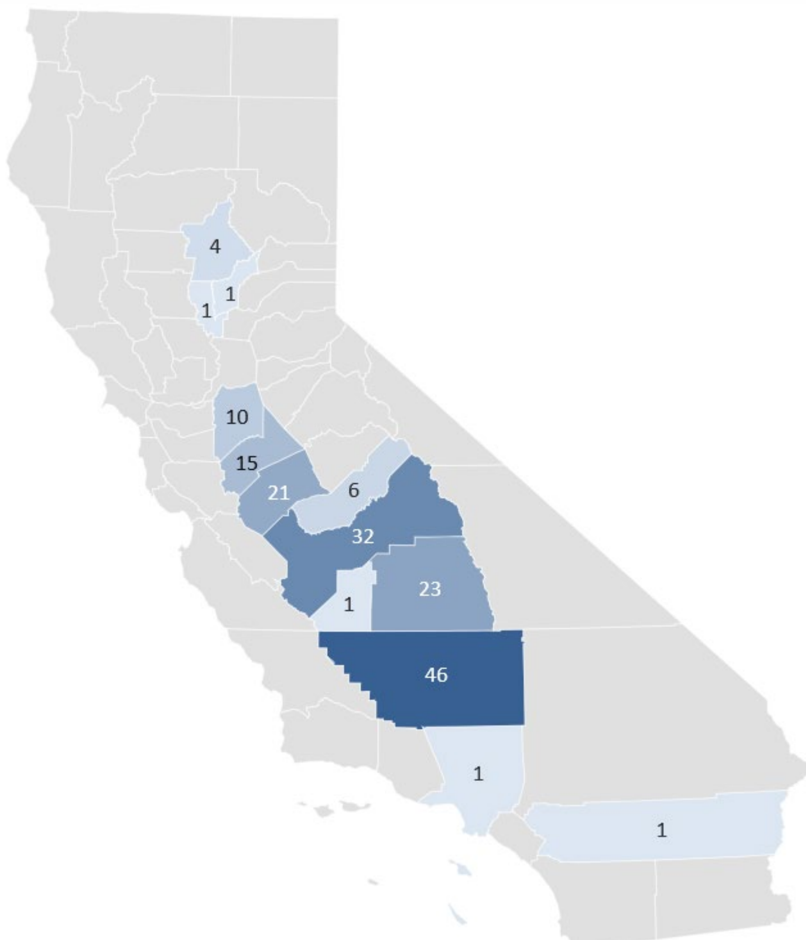

Figure 4-5 - Number of PWS with 1,2,3-TCP violations for years 2018-2019

Case Study / Example

One of the systems that has repeatedly violated the 1,2,3-TCP MCL is the Athal Mutual Water Company (MWC). Athal MWC is a small community water system with a single groundwater well located in Kern County approximately five miles Southeast of Bakersfield. Athal MWC is considering three possible solutions to mitigate the 1,2,3-TCP issue including: 1) drill a new groundwater well, 2) treat the existing well with granular activated carbon, or 3) consolidate with a nearby medium community water system (Lamont Public Utility District). The challenge with drilling a new well is the fact that most of the sources in the area are impacted by 1,2,3-TCP and/ or arsenic and treatment requires additional financial and technical resources. The most sustainable solution is consolidating with the Lamont Public Utility District as the larger customer base results in a more financially and technically resilient water system better able to meet current and future challenges.

For more information, see the State Water Board's website on 1,2,3-TCP (http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP.shtml).

4.2.3 Radionuclides

Regulations adopted for radionuclides over the last two decades include an MCL for uranium, which was initially promulgated in California and subsequently by USEPA.

Table 4-9: Radionuclide MCL violations for years 2015-2019

System Size	2015	2016	2017	2018	2019	Total Number of violations
Large Community Water Systems	1	0	0	0	0	**1**
Medium Community Water Systems	4	4	4	4	1	**17**
Intermediate Community Systems	13	13	14	8	8	**56**
Small Community Water Systems	69	76	73	86	93	**397**
Non-Transient Non-Community	10	24	35	40	34	**143**
Total Number of violations	**97**	**117**	**126**	**138**	**136**	**614**

Table 4-9 summarizes the radionuclide MCL violations for 2015-2019. All the MCL violations were for the MCL exceedance of uranium. Of the 66 PWS with MCL violations, 65 percent occurred in small community water systems. There was only one community water system serving more than 10,000 service connections that exceeded a radionuclide MCL. The preponderance of these PWS were located in the foothills of the Central Valley where the geology (granitic formations) is consistent with the presence of radionuclides in groundwater. See Figure 4-6.

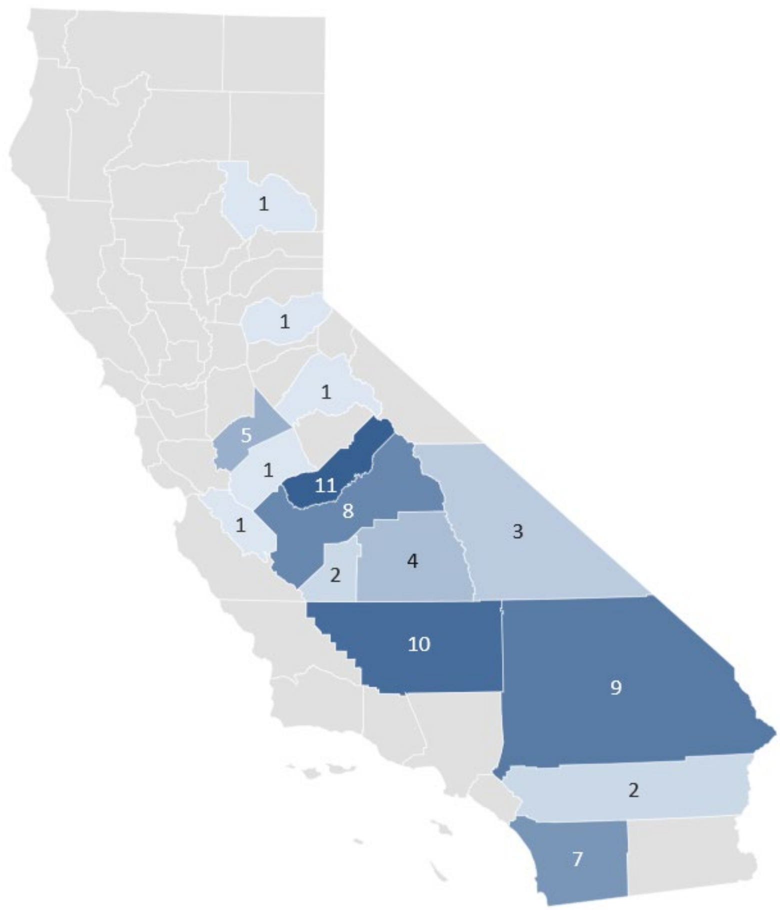

Figure 4-6 - Number of PWS with Uranium MCL violations for years 2015-2019

4.2.4 Microbiological

All PWS that use groundwater, such as wells or springs, must comply with the Groundwater Rule (GWR) to reduce the occurrence of disease associated with microorganisms in drinking water derived from groundwater. The GWR established a risk-based approach to target ground water systems that are vulnerable to fecal contamination. Ground water systems that are identified as being at risk of fecal contamination must take corrective action to reduce potential illness from exposure to microbial pathogens.

Special monitoring of the groundwater source for a fecal indicator microorganism must be conducted whenever a sample collected in the water distribution system pursuant to the total coliform rule or revised total coliform rule is positive for total coliform (triggered source monitoring). California has chosen to use E. coli monitoring as the indicator of fecal contamination.

Between 2015 and 2019, 6 PWS failed to provide the required level of virus inactivation treatment resulting in 12 violations of the GWR.

4.3 DISTRIBUTION SYSTEM

4.3.1 Compliance with Microbial Standards

Microbial contaminants continue to be the primary concern for PWS and health officials because of the potential for waterborne illness. Furthermore, conditions in the distribution system can quickly change, for example a water main break which may allow pathogens to be introduced to the water supply. Regular microbial monitoring helps to identify any problems that arise. PWS are required to routinely collect water samples from distribution systems for bacteriological examination, on a schedule based on the size of the PWS. Coliform bacteria are used as the indicator to determine if drinking water is free of contamination from human waste. The coliform group is accepted as the indicator organism since they are the most prevalent bacteria in the environment. Analytical methods used to determine the presence or absence of these organisms are the easiest and least expensive to use.

There are two types of violations of drinking water standards associated with coliform organisms, also known as the Total Coliform Rule (TCR): 1) an acute violation, which indicates a PWS has detected fecal coliform or *E. coli* bacteria in the drinking water being delivered to customers; and 2) a nonacute violation which indicates a PWS detected total coliform bacteria in a specific number of samples of drinking water being delivered to customers within a specific timeframe (most commonly a month). An acute violation will result in immediate action including a notice to consumers to boil the water before drinking or use of an alternate supply. Nonacute violations generally result from the introduction of non-fecal coliform organisms and are reflective of microbial activity in the distribution system and the need for better operation and maintenance of the water system's infrastructure. Fortunately, the nonacute violations can generally be addressed quickly, although some may require infrastructure improvements that can be costly. If a transient non-community or non-transient non-community water systems cannot quickly resolve the problem (for example make infrastructure improvements), they have the ability to temporarily shut down until the problem is solved. Community water systems cannot be shut down in the same way.

The USEPA revised the total coliform rule (rTCR), which became effective on April 1, 2016. The rTCR replaces the TCR Monthly Total Coliform MCL with a new total coliform treatment technique requirement. The rTCR also establishes a "find and fix" approach for investigating and correcting causes of coliform problems within water distribution systems. California has not yet adopted the rTCR regulations. Therefore, California PWS need to comply with both the California TCR and the USEPA rTCR until the State Water Board adopts the rTCR regulations.

Table 4-10 : TCR MCL violations for years 2015-2019

System Size	2015	2016	2017	2018	2019	Total Number of violations
Large Community Water Systems	3	1	3	2	4	**13**
Medium Community Water Systems	26	8	26	26	18	**102**
Intermediate Community Systems	30	4	20	15	17	**86**
Small Community Water Systems	163	50	137	72	81	**503**
Non-Transient Non-Community	147	53	110	96	103	**903**
Transient Non-Community	238	87	230	188	160	**509**
Total Number of violations	**607**	**203**	**525**	**398**	**383**	**2116**

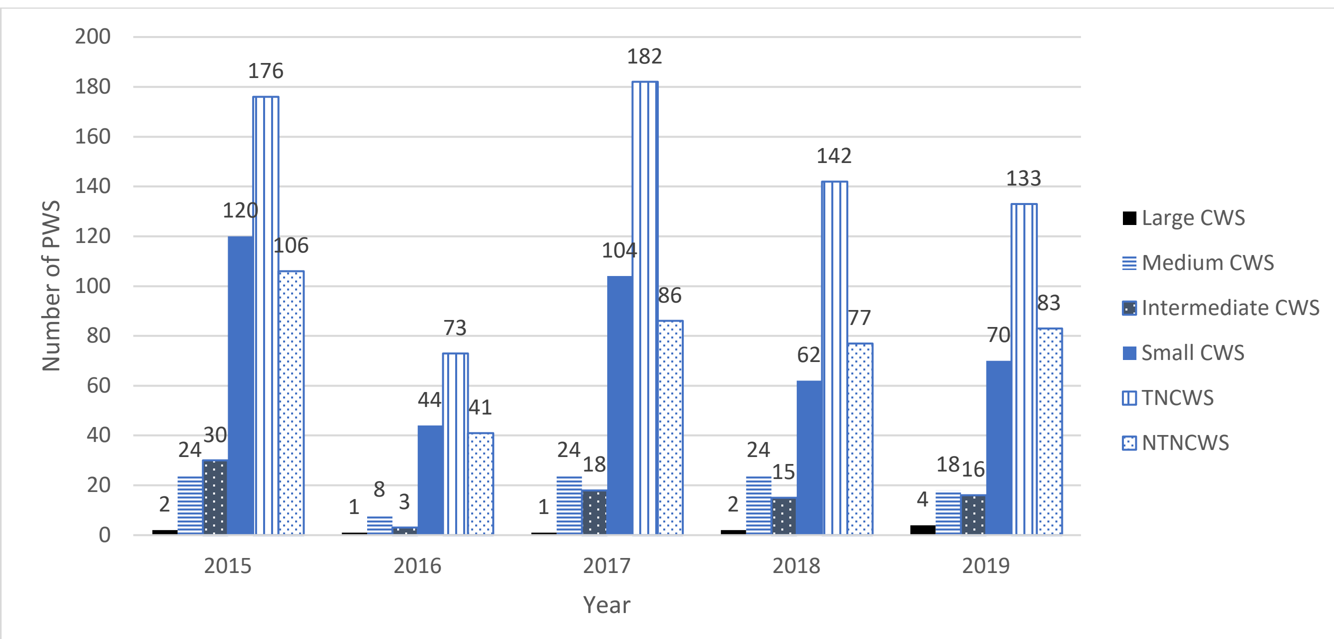

Figure 4-7 - Number of PWS with TCR violations for years 2015-2019

Table 4-10 summarizes the TCR and rTCR MCL violations for 2015-2019. Although most of the violations were nonacute violations and did not represent a public health risk, TCR violations are reflective of the problems with aging infrastructure and poor maintenance and operation of the water system. Over 90 percent of the violations were by small community (<200 service connections), non-transient non-community, or transient non-community water systems.

4.3.2 Disinfection Byproducts

All community and non-transient non-community water systems are required to meet standards for disinfection byproducts (DBP) to reduce the potential for long-term health effects. There are MCL for total trihalomethanes (TTHM) (bromodichloromethane, bromoform, chloroform, and dibromochloromethane), chlorite, bromate, and five haloacetic acids (HAA5) (monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid). There are also requirements for disinfectant residuals including chlorine, chloramine, and chlorine dioxide.

All community and non-transient non-community water systems that provide disinfected drinking water are required to comply with the Stage 1 and Stage 2 Disinfectants and Disinfection By-Products Rules (DBPR). Additionally, transient non-community water systems that use chlorine dioxide are required to comply with the requirements for chlorine dioxide. The DBPR established: 1) MCL for four by-products of drinking water disinfection - total trihalomethanes (TTHM), haloacetic acids (HAA5), bromate, and chlorite; 2) maximum disinfectant residual Levels (MRDL) for three disinfectants – chlorine, chloramine, and chlorine dioxide; 3) treatment technique (TT) requirements for the control of total organic carbon (TOC), a disinfection byproduct precursor in surface water sources using conventional surface water treatment; and 4) TT requirements for certified treatment operators.

Table 4-11: TTHM and HAA5 MCL violations for years 2015-2019

System Size	2015	2016	2017	2018	2019	Total Number of violations
Large Community Water Systems	91	70	82	74	63	**380**
Medium Community Water Systems	54	52	41	41	45	**233**
Intermediate Community Systems	26	44	31	16	21	**138**
Small Community Water Systems	26	20	26	23	23	**118**
Non-Transient Non-Community	58	48	25	24	17	**172**
Total Number of violations	**255**	**234**	**205**	**178**	**169**	**1041**

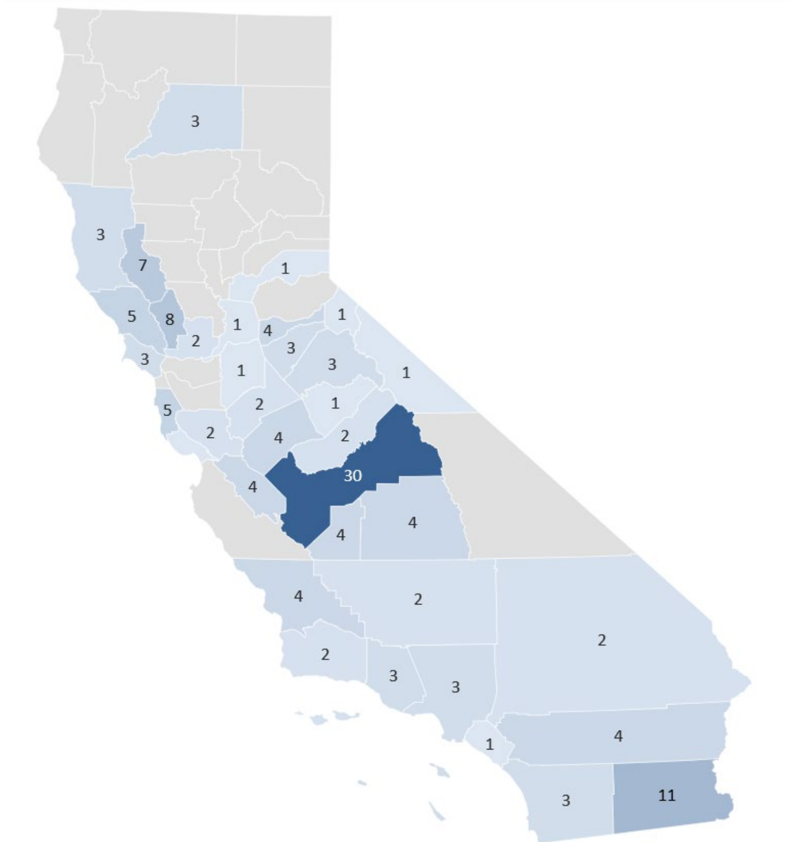

Figure 4-8 - Number of PWS with TTHM and HAA5 MCL violations for years 2015-2019

Exceedance violations of MCL for disinfection byproducts (DBP) for 2015-2019 are shown in Table 4-11. Of the DBP violations shown in Table 4-11, about 63 percent were due to an exceedance of TTHM MCL. 36 percent of the violations occurred in large community water systems.

Case Study / Example

Imperial County PWS have historically struggled with DBP MCL exceedances, accounting for 59 of the total violations in Table 4-11. This is due to several factors including the use of surface water, and elevated water temperature. Compounding the issue, some Imperial County PWS serve disadvantaged customers (median household income is less than 80 percent of the statewide median household income) which limits their ability to install treatment. One example of a PWS that struggled with the DBP MCL is the Seeley Community Water District (CWD). Seeley CWD exceeded the TTHM and HAA5 MCL 17 times between 2015 to 2017. In 2018, Seeley CWD installed a spray aeration treatment system to remove the DBP, however even with the treatment they continue to have elevated levels of DBP.

4.3.3 Lead and Copper

In 1991, USEPA promulgated the Lead and Copper Rule (LCR), which was the most extensive regulation involving water quality associated with materials used in the water distribution system. Monitoring and compliance requirements did not take effect until several years after the LCR was adopted. The LCR applied to community and non-transient non-community water systems and established Action Levels for lead of 15 µg/L and for copper of 1.3 mg/L. Compliance is determined by a statistical analysis of water samples taken from a number of household faucets served by the system. If an Action Level is exceeded pursuant to certain monitoring criteria for either or both chemicals, remediation methods must be implemented. In addition, water systems are required to install corrosion control treatment if the water sources have the potential to become corrosive.

Table 4-12: LCR violations for years 2015-2019

System size	2015	2016	2017	2018	2019	Total Number of violations
Large Community Water Systems	0	0	0	0	0	**0**
Medium Community Water Systems	0	0	0	0	0	**0**
Intermediate Community Systems	0	0	0	1	0	**1**
Small Community Water Systems	0	0	2	4	2	**8**
Non-Transient Non-Community	0	1	2	1	1	**5**
Total Number of violations	**0**	**1**	**4**	**6**	**3**	**14**

Table 4-12 shows the LCR monitoring violations for exceedance of an action level, failure to replace a lead service line, failure to complete a corrosion control study and failure to perform public education from 2015-2019. Of the 14 monitoring violations, 57 percent were by small community water systems (<200 service connections); another 36 percent were non-transient non-community water systems.

4.4 ESTIMATED COST OF REQUIRING PWS SERVING FEWER THAN 10,000 SERVICE CONNECTIONS TO MEET PRIMARY DRINKING WATER STANDARDS AND PUBLIC HEALTH GOALS

4.5 ESTIMATED COST TO MEET PRIMARY DRINKING WATER STANDARDS

The costs of requiring PWS serving fewer than 10,000 service connections to meet primary drinking water standards cannot be accurately estimated given the variables involved in such an estimate. While large PWS generally have reasonable estimates for treatment costs, often because they have operated or tested treatment systems, in many cases, the treatment processes used by large PWS are not suitable for use by small PWS.

For example, it may be difficult for a small PWS to meet the primary standard for arsenic. The best available treatment technology is generally too costly and technical to operate and maintain for many smaller PWS, especially those with a limited rate base and level of engineering and operational expertise. Many small PWS, rather than installing treatment, have looked to consolidate with one or more neighboring PWS to receive drinking water meeting standards at a lower cost. To address the many barriers to consolidation, the State Water Board provides DWSRF incentives to larger systems to subsume smaller systems and is committed to further pursuing solutions to address the barriers to consolidation.

4.5.1 Estimated Cost to Meet Public Health Goals

Estimating the cost of requiring PWS serving fewer than 10,000 services connections to meet PHG is difficult. Since there is no requirement for PWS to meet PHG, large PWS (those serving more than 10,000 service connections) do not have experience with such costs. Large PWS are only required to prepare a report that estimates the cost to meet PHG and to hold a public hearing to take comment on the report.

In addition, the cost to PWS serving fewer than 10,000 service connections to meet PHG would far out-weigh the potential population risk reduction. Thus, the focus should be on compliance with drinking water standards.

For example, the PHG for arsenic is 0.004 µg/L, while the lowest level that arsenic can be reliably measured in water is 2 µg/L. When adopting the MCL for arsenic of 10 µg/L, the annual cost to different size PWS was estimated to meet the proposed MCL at the lowest measurable level. For PWS serving fewer than 10,000 service connections, the estimated cost to meet an MCL of 10 µg/L was approximately $77 million, while the estimated cost to meet an MCL of 2 µg/L was approximately $417 million. Such a cost burden would be unmanageable, particularly among the smaller PWS that, as indicated in this chapter, are having extreme difficulty complying with the existing arsenic MCL.

4.6 REGULATORY COMPLIANCE ISSUES

Regulations have been adopted resulting in increased monitoring requirements, more MCL, such as the 2017 MCL for 1,2,3 TCP, new DBP and SWTR rules, and source water protection programs. Compliance with regulations has been good among large water systems. However, some small water systems, particularly community water systems serving fewer than 200 service connections and smaller non-transient, non-community water systems, have had considerably more difficulty complying with the regulations.

Additionally, the State Water Board recognizes that many state small water systems with fewer than 15 service connections may serve more than 25 individuals daily and should therefore be regulated as a PWS.

4.6.1 Human Right to Water

In 2012, California became the first state to enact legislation recognizing a Human Right to Water. AB 685, which became effective January 1, 2013, declared that it is "the established policy of the state that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes." However, the Human Right to Water can be threatened by many factors, including water supply availability, contaminants, high costs of treatment and distribution systems, and the number and nature of small water systems. The State Water Board is actively pursuing initiatives to address the Human Right to Water, beginning with the state's residents who are served by public water systems but who do not receive safe drinking water. While this chapter focuses on public water systems, the Human Right to Water also applies to other drinking water systems such as state small water systems and domestic wells.

The Water Boards formalized efforts to implement the Human Right to Water (HR2W) with the passage of resolution no. 2016-0010 on February 16, 2016, which identified the human right to water as a top priority and core value. The resolution stated that the Water Boards would work "to preserve, enhance, and restore the quality of California's water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations."

4.7 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

While many drinking water quality issues have been largely addressed over the past two decades, arsenic and nitrate continue to remain the principal contaminants that affect PWS that serve fewer than 10,000 service connections.

The distributions of violations discussed in this Chapter for 2015-2019 within the different sized community, transient non-community and non-transient non-community water systems are summarized in the tables below

Table 4-13: Distribution of PWS with violations for years 2015-2019

System Size	2015	2016	2017	2018	2019
Large Community Water Systems	4%	4%	3%	5%	4%
Medium Community Water Systems	7%	6%	6%	7%	6%
Intermediate Community Systems	7%	6%	7%	7%	7%
Small Community Water Systems	34%	37%	32%	28%	29%
Non-Transient Non-Community	23%	19%	28%	22%	21%
Transient Non-Community	25%	27%	24%	31%	34%

Table 4-13 summarizes the percentage of PWS that incurred violations for the various regulations included in Table 4-2 to Table 4-12 above. Among community water systems, those with fewer than 200 service connections have most of the violations. Between 2015-2019, on average 32 percent of the PWS with violations were incurred by small community water systems, 28 percent were incurred by non-transient non-community water systems and 23 percent were incurred by transient non-community water systems.

Table 4-14: Distribution of MCL and Other Violations in Large Community Water Systems 2015-2019

Contaminant or Treatment Technique	Total Violations for all PWS	Number of Violations for Large CWS	Percent of Large CWS violations
Arsenic MCL	1982	0	0%
Nitrate MCL	1528	2	0%
Hexavalent Chromium MCL (2015-2017)	170	19	11%
Uranium MCL	614	1	0%
DBCP MCL	41	0	0%
1,2,3-TCP MCL (2018-2019)	1013	183	18%
TCR MCL	2116	13	1%
DBP MCL	1041	380	37%
SWTR/ IESTWR	330	7	2%
Lead & Copper Rule	13	0	0%

Table 4-15: Distribution of MCL and Other Violations in Medium Community Water Systems 2015-2019

Contaminant or Treatment Technique	Total Violations for all PWS	Number of Violations for Medium CWS	Percent of Medium CWS violations
Arsenic MCL	1982	105	5%
Nitrate MCL	1528	3	0%
Hexavalent Chromium MCL (2015-2017)	170	24	14%
Uranium MCL	614	17	3%
DBCP MCL	41	1	2%
1,2,3-TCP MCL (2018-2019)	1013	79	8%
TCR MCL	2116	102	5%
DBP MCL	1041	233	22%
SWTR/ IESTWR	330	6	2%
Lead & Copper Rule	13	0	0%

Table 4-16: Distribution of MCL and Other Violations in Intermediate Community Water Systems 2015-2019

Contaminant or Treatment Technique	Total Violations for all PWS	Number of Violations for Intermediate CWS	Percent of Intermediate CWS violations
Arsenic MCL	1982	174	9%
Nitrate MCL	1528	19	1%
Hexavalent Chromium MCL (2015-2017)	170	12	7%
Uranium MCL	614	56	9%
DBCP MCL	41	0	0%
1,2,3-TCP MCL (2018-2019)	1013	107	11%
TCR MCL	2116	86	4%
DBP MCL	1041	138	13%
SWTR/ IESTWR	330	9	3%
Lead & Copper Rule	13	1	8%

Table 4-17: Distribution of MCL and Other Violations in Small Community Water Systems 2015-2019

Contaminant or Treatment Technique	Total Violations for all PWS	Number of Violations for Small CWS	Percent of Small CWS violations
Arsenic MCL	1982	1087	55%
Nitrate MCL	1528	547	36%
Hexavalent Chromium MCL (2015-2017)	170	75	44%
Uranium MCL	614	397	65%
DBCP MCL	41	3	7%
1,2,3-TCP MCL (2018-2019)	1013	143	14%
TCR MCL	2116	503	24%
DBP MCL	1041	118	11%
SWTR/ IESTWR	330	238	72%
Lead & Copper Rule	13	7	54%

Table 4-18: Distribution of MCL and Other Violations in Non-Transient Non-Community Water Systems 2015-2019

Contaminant or Treatment Technique	Total Violations for all PWS	Number of Violations for NTNCWS	Percent of NTNCWS violations
Arsenic MCL	1982	616	31%
Nitrate MCL	1528	522	34%
Hexavalent Chromium MCL (2015-2017)	170	40	24%
Uranium MCL	614	143	23%
DBCP MCL	41	37	90%
1,2,3-TCP MCL (2018-2019)	1013	501	49%
TCR MCL	2116	509	24%
DBP MCL	1041	172	17%
SWTR/ IESTWR	330	14	4%
Lead & Copper Rule	13	5	38%

Table 4-19: Distribution of MCL and Other Violations in Transient Non-Community Water Systems 2015-2019

Contaminant or Treatment Technique	**Total Violations for all PWS**	**Number of Violations for TNCWS**	**Percent of TNCWS violations**
Nitrate MCL	1528	435	34%
TCR MCL	2116	903	43%
SWTR/ IESTWR	330	56	17%

Table 4-14, Table 4-17, Table 4-18: Distribution of MCL and Other Violations in Non-Transient Non-Community Water Systems 2015-2019

Contaminant or Treatment Technique	Total Violations for all PWS	Number of Violations for NTNCWS	Percent of NTNCWS violations
Arsenic MCL	1982	616	31%
Nitrate MCL	1528	522	34%
Hexavalent Chromium MCL (2015-2017)	170	40	24%
Uranium MCL	614	143	23%
DBCP MCL	41	37	90%
1,2,3-TCP MCL (2018-2019)	1013	501	49%
TCR MCL	2116	509	24%
DBP MCL	1041	172	17%
SWTR/ IESTWR	330	14	4%
Lead & Copper Rule	13	5	38%

Table 4-19, Table 4-17, Table 4-18,and Table 4-19 summarize the total number of violations and corresponding percentages for each type of PWS for the various regulations included in Table 4-2 to Table 4-12 above. Based on Table 4-14, Table 4-17, Table 4-18: Distribution of MCL and Other Violations in Non-Transient Non-Community Water Systems 2015-2019

Contaminant or Treatment Technique	Total Violations for all PWS	Number of Violations for NTNCWS	Percent of NTNCWS violations
Arsenic MCL	1982	616	31%
Nitrate MCL	1528	522	34%
Hexavalent Chromium MCL (2015-2017)	170	40	24%

Uranium MCL	614	143	23%
DBCP MCL	41	37	90%
1,2,3-TCP MCL (2018-2019)	1013	501	49%
TCR MCL	2116	509	24%
DBP MCL	1041	172	17%
SWTR/ IESTWR	330	14	4%
Lead & Copper Rule	13	5	38%

Table 4-19 Table 4-17, Table 4-18, and Table 4-19most violations are by small community, non-transient non-community and transient non-community water systems. Small community water systems were the most likely to violate the inorganic MCL (arsenic, nitrate and hexavalent chromium) and uranium MCL violations. non-transient noncommunity systems were responsible for most of the SOC MCL (DBCP and 1,2,3-TCP) violations. Transient non-community systems were responsible for most of the TCR violations. Large community water systems were more likely to violate the DBP MCL (TTHM and HAA5). Both small community and non-transient noncommunity water systems were likely to violate the LCR.

For regulations to protect against microbiological contaminants, transient non-community water systems have two to three times the violations of non-transient non-community water systems.

Recently revised or adopted MCL for contaminants such as uranium and DBP and treatment technique rules such as the SWTR and the IESWTR have also had a significant impact on these PWS, particularly the smallest ones. The new MCL for 1,2,3-TCP will likely have a similar effect on small community water systems. In addition, when a new MCL for the ubiquitous hexavalent chromium is reestablished in 2021, the costs to small community and non-transient non-community water systems of meeting the new standard may present challenges similar to those of the arsenic MCL.

The TCR also continues to present challenges to small community, transient non-community and non-transient non-community water systems. Violations of the TCR may reflect infrastructure problems for the smaller systems, and/or they may reflect inadequate technical, managerial, or financial shortcomings that may be associated with such systems.

The compliance information presented in this Chapter clearly indicates that the overwhelming majority of water quality issues affect PWS that serve fewer than 10,000 service connections, and that affected systems include both community and non-transient non-community water systems. Among community water systems that were not in compliance with chemical primary drinking water standards, more than 99 percent served fewer than 10,000 service connections. Among those that failed to meet the standards for radionuclides, 98 percent served fewer than 10,000 connections.

More importantly, small community water systems serving fewer than 200 service connections accounted for the largest percentage of violations for all regulated contaminants and treatment techniques requirements for which there were violations. Most troubling are the violations of the requirements for the treatment of surface waters, which increase the risk of waterborne infectious disease transmission. The same pattern was also true for non-transient and transient non-community water systems, most of which are "small" size.

These findings highlight the ongoing problems faced by water systems that either serve small communities or are small facilities that serve the same non-resident populations during much or all of the year such as rural schools, small farming operations, and churches. The findings are consistent with those contained in the January 2013 legislative report, "Communities that Rely on a Contaminated Groundwater Source for Drinking Water," (http://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/index.shtml).

That January 2013 legislative report found that between 2002 and 2010, a total of 265 community water systems that rely on contaminated groundwater had at least one MCL violation. The report found that the largest number of MCL violations involved three contaminants: arsenic, nitrate, and uranium; and that the violations were overwhelmingly associated with small community water systems of which about 81 percent served fewer than 1,000 service connections.

The inability of small community and non-transient non-community water systems to meet most of the requirements is a demonstration of the difficulties such small systems have with technical, managerial and financial (TMF) aspects of existing as a public water system. More information TMF is presented in Chapter 8.

In recognition of the compliance problems facing small water systems, a Small Water System Program Plan was developed by Division of Drinking Water that focuses on three areas: funding, technical assistance, and enforcement/compliance. Since the development of the Small Water System Program Plan, the legislation provided the Division of Drinking Water the means to develop the SAFER program. The SAFER program will address the compliance problems facing small water systems.

In conclusion, solutions to the compliance problems and operation of small water systems are multifaceted and can involve: (1) technical support to identify the most optimal solution to achieve compliance, (2) financial support for infrastructure improvements such as new treatment facilities or constructing a new well, and (3) developing a revenue stream that can address finances associated with ongoing operational costs of the water system--which includes maintenance of the system as well as operation of treatment facilities that will ensure compliance is maintained.

For many small community water systems, it is too financially and technically challenging to continue operating as a stand-alone system and, where feasible, consolidation with larger systems is the best solution to ensure that small community water system consumers can be confident that the drinking water they receive is safe. At the same time, the creation of new small community water systems should be discouraged.

Similarly, for transient and non-transient non-community water systems that have difficulties complying with regulatory requirements that ensure safe drinking water, consolidation is a good solution, when feasible. Where community water system can provide safe drinking water to a new proposed transient and non-transient non-community water systems, for example, to a gas station, restaurant, or a school, use of water from the community water system is preferred to creation of a new transient and non-transient non-community water system.

Recommendations

4-1 The State Water Board will continue to promote consolidation and utilize administrator programs, including transient non-community and non-transient non-community water systems, wherever feasible and appropriate. Consolidation is not limited to full or physical consolidation of drinking water treatment and delivery systems, and may include technical, managerial, financial or physical arrangements between water systems.

References

Chapter 524, Statutes of 2012 (AB 685) (https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120AB685#:~:text=AB%20685%2C%20Eng.,State%20water%20policy.&text=This%20bill%20would%20declare%20that,%2C%20cooking%2C%20and%20sanitary%20purposes.)

Division of Drinking Water's 2019 Annual Compliance Report (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/docs/acr_2019_final.pdf)

State Water Board's Groundwater Information Accessibility and Identification of Communities Reliant on Contaminated Groundwater–AB 2222 Report (https://www.waterboards.ca.gov/water_issues/programs/gama/ab2222/docs/ab2222.pdf)

State Water Board, Recommendations Addressing Nitrate in Groundwater website (https://www.waterboards.ca.gov/water_issues/programs/nitrate_project/index.html)

State Water Board Chromium-6 Drinking Water website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.html)

State Water Board 1,2,3,-Trichloropropane (1,2,3 - TCP) website

(https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/123TCP.html)

CHAPTER 5 DRINKING WATER INFORMATION MANAGEMENT

5.1 INTRODUCTION

Timely and accurate information and data are critical in protecting public health and providing assurance to the public. The rapid pace of technological improvements in data management systems presents an ongoing need to update legacy systems to improve data intake and compliance decision support and increase connectivity with other data systems to streamline business functions. Additionally, technological improvements in data and information systems provide a great opportunity to improve timely and accurate communication of information to the public and public water systems (PWS). With increased use and accessibility of social media and instant messaging, news and information generated by individuals or content providers are provided in almost real time. There is a great opportunity and need to establish a presence in these new venues for communicating timely and accurate public health information to the public.

It is important to note that providing data is not the same as providing useful information. As we use the terms, data are the actual results (for example, the numerical results generated by analyzing a water sample) or raw facts, while information is the interpretation of data or what is derived from the data (for example, a determination that a violation has occurred based on mathematical calculations using the data). This difference can be significant when data are readily available without the knowledge of how to use the data and what information those data convey. Data must first be analyzed and transformed into information for it to have value. For example, compliance with many Maximum Contaminant Levels (MCL) is based on an annual average of analytical results. Even if one result exceeds the MCL, it is not necessarily an MCL violation if other results within the same year can bring the average to below the MCL. Data can be transformed into knowledge when it is combined with other data or analyzed in some manner. Wisdom can be gained from knowledge through visualization. Appropriate action can be taken based on the wisdom gained. Ultimately, this action should lead to better outcomes for the end users. The transformation of data into better outcomes relies on several steps, one of which is the informed transformation of raw data into knowledge.

The Division of Drinking Water (DDW) provides public access to both the data it gathers and the information it derives from evaluation of the data. While there are numerous benefits for providing increased accessibility of data to the public, there have been occasions where incorrect assumptions were made in the evaluation of the data by external users, resulting in confusion and conflicting information about drinking water safety. DDW opts for transparency and provides public access to all water quality data it collects. However, the manner in which the data is presented may make it difficult for a member of the public to differentiate, for example, between data associated with water delivered to the public for consumption, and data that represents the raw water prior to treatment. Currently, DDW includes language on its website to explain the issue and how to contact DDW for more information. DDW is working to improve public awareness of drinking water regulations and compliance determination among users of the data, educate the public about safe drinking water, and provide additional explanation of datasets that are posted.

DDW is increasingly transforming data into information, and is working to make this information accessible, discoverable, and usable to the public, other state agencies, academia, policymakers, and others, as part of the AB 1755, the Open and Transparent Water Data Act (Chapter 506, Statutes of 2016). DDW is also working to increase the availability and usability of open-source tools, to make information more readily accessible to drive both public understanding and policy decision making.

DDW relies on having access to high quality data sets, analytical tools, and public-access portals to make accurate and timely regulatory determinations while providing transparency. Due to the potential direct impact of unsafe water on public health, the data needs of DDW have a heightened importance and urgency. To streamline data processes, DDW takes advantage of the data tools developed by USEPA in carrying out the program. Since these tools are mostly designed to meet the reporting needs of the USEPA, DDW currently uses a variety of other data tools to address the additional business needs in order to support an effective drinking water program. DDW has determined that these stand-alone data tools must be integrated to improve overall business practices, improve accessibility and transparency, increase usability of data, and facilitate transformation of data into information.

DDW continues to prioritize, develop, and implement data projects within current resources. However, due to the long list of priority projects that have been identified, additional resources are needed in order to support the increasing demands on DDW's drinking water data and information system. This chapter describes DDW's current data systems, identifies limitations of the data systems that may impact decision-making, regulatory determinations, and provision of accurate and timely dissemination of information to the public (such as during an emergency response), and provides recommendations on development of priority data projects.

5.2 DATA GOVERNANCE

In order to improve data integrity and information management, DDW embarked on established business processes and governance to guide DDW's data-related needs. The data governance process is described in the sections below.

5.2.1 Quality Assurance Section

DDW established the Quality Assurance Section in April 2017 ensure that water quality data and water system information used for decision making was of known and documented quality through the development of processes and data systems to improve data quality and data accessibility. The Quality Assurance Section's main task is ensuring the accuracy, quality, and reliability of information brought in to DDW and to ensure that same information is accessible and meaningful to the public. The Quality Assurance Section also provides direction to the efforts of the Data Management Unit. The Data Management Unit was expanded in 2016 from two full time positions to six full time positions. The expansion significantly improved DDW's maintenance of data and information management systems, increased progress toward fully transitioning to and implementing SDWIS/STATE (see Section 5.3.1 for additional information) and allowed for advance planning work to be conducted. Since its inception, the Quality Assurance Section has been able to highlight the Data Management Unit's priority work to upper management and improve DDW's efforts to provide accessible drinking water information to the public.

The Quality Assurance Section is focused on improving not only the availability of data, but also the quality of the data being made available to the public. As part of the Open and Transparent Water Data Act (Chapter 506, Statutes of 2016), efforts are being made to streamline data and improve publication of datasets. The Quality Assurance Section is assisting with efforts among numerous state agencies, including the Department of Water Resources, and with internal partners such as the Division of Water Quality, Office of Information Management and Analysis, Office of Research, Planning, and Performance, and (ORPP) Office of Public Participation to share water quality data and streamline reporting of similar information needed by multiple agencies. The increased collaboration among state agencies which have a role in ensuring the quality of the state's water resources benefits the public by facilitating access to knowledge about water quality. Public portals have been developed, and continue to evolve, to allow public access to drinking water quality data as well as information regarding water systems.

However, the efforts begun thus far only mark the beginning. The Quality Assurance Section is taking steps to improve data quality. For example, to demonstrate the data and information that is received is of known and documented quality requires knowledge of data quality from beginning to end. For water quality results, this would be from sample collection to data reporting. This process includes many parties: the sampler, the person(s) transporting the samples, the laboratory, ELAP (for accrediting the laboratories), DMU, and DDW staff. The Quality Assurance Section is working to begin intaking information to document the data quality including the chain of custody form for each sample and the quality control parameters of the sample analysis, to be reported along with the analytical results. This includes parameters such as reporting percent recovery, the laboratory reporting level, method detection level, trip and field blank results, and other additional quality control information. The intake and analysis of additional quality control data will result in improved data quality. A new data intake tool is being developed, the California Laboratory Intake Portal or CLIP, which is described in Section 5.3.2.

5.2.2 Data Integration Execution Team (DIET)

The Data Integration Execution Team (DIET) was formed in December 2017 to supplement the Quality Assurance Section, and better understand past issues and develop a vision to address existing and future data needs. DIET was tasked with establishing standard business processes and assisting with their implementation, with a goal of integrating existing data collection and use into a single point of access system. Its mission is to provide technical expertise and support to continuously improve DDW operational efficiency and enhance services to stakeholders by leveraging information technology.

5.2.3 Data Executive Steering Committee (DESC)

The Data Executive Steering Committee (DESC) was formed shortly after DIET as part of the data governance structure. DESC provides direction to DIET, prioritizes workload and resources, facilitates implementation of data-related business process changes, reviews data project proposals for merit, business need, and alignment with DDW goals, adopts business rules, and makes recommendations to executive management.

5.2.4 Data Strategic Plan

In order to guide data-related needs as well as unify efforts to make information accessible, discoverable, and usable to the public, other state agencies, academia, and others, a Data Strategic Plan has been created. Its overall mission is to continuously improve DDW operational efficiency and enhance services to stakeholders by leveraging information technology. The Data Strategic Plan seeks to provide accessible data of known and documented quality to enhance the knowledge and understanding of California’s water resources to promote elevated decision-making for all stakeholders. The goals of the Data Strategic Plan include understanding data, data quality, prioritizing information development, data accessibility, data consistency, and streamlining data.

5.3 DRINKING WATER DATA SYSTEMS

DDW uses several data management systems to intake, manage, track, and report data and information relevant to operations of its various programs. Each system is described as it currently operates.

5.3.1 SDWIS

The Safe Drinking Water Information System (SDWIS) contains PWS inventory information maintained by drinking water regulatory programs in order to meet the reporting requirements established by the SDWA and related regulations and guidance.

SDWIS has two components, SDWIS/STATE and SDWIS/FED. SDWIS/STATE was developed to provide state drinking water regulatory programs with a uniform and consistent means to track and report data to USEPA as required. States can elect to use SDWIS/STATE, or use other data management systems, such as DDW's decommissioned PICME system, that are able to transfer data in the required format to USEPA. SDWIS/FED is a system that intakes data reported by states and regions and is the federal version of SDWIS/STATE.

USEPA is responsible for providing updates to SDWIS/STATE to track compliance with new rules and new reporting requirements established under the federal Safe Drinking Water Act. Installations of SDWIS/STATE are maintained by individual drinking water regulatory programs. USEPA is developing a next generation SDWIS (SDWIS Prime) that will be cloud-based, to alleviate the need for individual states to maintain local installations of SDWIS/STATE. USEPA intends to phase out technical support for SDWIS/STATE soon after SDWIS Prime becomes available for implementation.

SDWIS/STATE

DDW began transitioning from a legacy data system (PICME) into SDWIS/STATE starting in 2009, but has not fully implemented some key features of SDWIS/STATE, such as its water quality, schedules management, and compliance decision support modules. DDW currently uses SDWIS/STATE to allow DDW field offices to maintain PWS inventory information, including basic water system information, site visits (inspections and sanitary surveys), lead and copper rule compliance, violations and enforcement actions, and to report this information to SDWIS/FED. Because SDWIS/STATE does not have a permit inventory component, the development of a permit inventory and tracking system has been an identified need on DDW's data project priority list since DDW transitioned to the State Water Board. DDW is taking additional steps now, via development of a new laboratory intake portal, to begin phasing into full use of SDWIS/STATE. The transition to SDWIS/STATE is implemented in three phases:

Phase 1 (completed) brought SDWIS/STATE into production for entering and maintaining PWS inventory information. The inventory migration phase included extensive data cleanup before migrating data from PICME to SDWIS/STATE and extensive staff training for ongoing entry and maintenance. This phase also included collecting 90th percentile data from the various lead and copper databases and spreadsheets located in each field office, migrating the data into SDWIS/STATE, and decommissioning local data repositories for lead and copper.

Phase 2 (in progress) will bring SDWIS/STATE into production for entering and maintaining water quality data. In order to complete this phase, all existing water quality data will need to be migrated to SDWIS/STATE and new processes developed for DDW to intake data from laboratories (see Section 5.3.2, which describes the new intake portal under development).

Phase 3 will bring SDWIS/STATE into production for monitoring and compliance decision support for all rules. This includes training staff to use the SDWIS/STATE compliance decision support tools, which will streamline identification of potential violations and compliance tracking.

SDWIS Prime

The USEPA is undertaking the SDWIS Modernization Program to provide new system capabilities that improve the reporting by primacy states and provide an enhanced and more efficient way to manage data flows into and out of SDWIS. This new tool, SDWIS/PRIME, will move data from servers to the cloud, and is being developed to replace SDWIS/STATE.

Deployment of SDWIS Prime, originally planned for summer 2018, has seen significant delays. USEPA discovered a critical flaw in the SDWIS Prime data model in 2019 that caused problems in data migration during testing, and currently does not have an estimate for deployment. USEPA continues to provide technical support for SDWIS/STATE. With the history of delays for SDWIS Prime development, SDWIS/STATE will continue to be supported by USEPA for the foreseeable future.

It should be noted that use of any USEPA developed compliance reporting tool is an option for states, not a requirement. The basic requirement is for each state that has been granted primacy under the Safe Drinking Water Act to provide reporting of specific compliance elements to USEPA's SDWIS/FED. The use of USEPA-developed tools lessens the burden on states to develop their own tools that meet this requirement. Additionally, there is the benefit that USEPA would upgrade SDWIS as new regulations are adopted to ensure appropriate and adequate reporting of public water system compliance. This has not always been the case in actual practice. USEPA does not develop SDWIS to implement state-only rules, such as the Operator Certification Regulations or provide the ability to track other state-only rules such as domestic water supply permits required to be issued to each regulated public water system.

5.3.2 Water Quality Data Management

Gathering accurate and timely PWS water quality data is critical to protect public health and is one of DDW's core functions. DDW uses several data applications and tools to intake water quality data, store water quality data, provide user application tools for staff to access and analyze the data to meet their regulatory oversight needs, and provide public and stakeholder accessibility tools to view and download water quality data.

WQM

Water Quality Management (WQM) is the repository of drinking water quality monitoring results and is the database of record for water quality data submitted by analytical laboratories certified by ELAP to conduct the sample analyses. WQM was developed by DDW and was put into production in 1988. It is one of the oldest and most critical data systems that DDW maintains. In recent years DDW has determined that laboratory quality control (QC) samples and data elements should be submitted with the field sample data to improve the documentation of data quality. As a result, DDW has identified the need to update WQM. DDW is planning to replace WQM as part of the phased transition to SDWIS/STATE (see Section 5.3.1).

Data from WQM is routinely extracted and fed into other State Water Board databases. DDW provides public access to the data by routinely updating the datafiles posted on DDW's water quality data webpage, where researchers and others requesting the data can directly download the files. DDW also offers access to PWS water quality data via Drinking Water Watch(see Section 5.3.3).

WQI

Water Quality Inquiry (WQI) is the information management system developed by DDW in 1988 that allows DDW staff to maintain and manage monitoring schedules, assess compliance with monitoring requirements, and access and create reports summarizing the data in WQM. Monitoring schedules, water quality data, and reports from WQI are displayed in Drinking Water Watch, which is accessible to PWS and the public.

Write-On: Write-On is a software application developed by DDW in 1988 to facilitate the entry of water quality monitoring data into WQM. Laboratories with Lab Information Management Systems (LIMS) can submit electronic files directly to DDW's WQM Upload Portal. Laboratories without LIMS can use Write-On to generate files for upload to the WQM Upload Portal. DDW continues to support the Write-On application and regularly updates the library files, but no longer has the ability to update the Write-On application itself due to the antiquity of the program language.

DDW plans to replace WQM, WQI and Write-On with CLIP in the next few years to modernize its data intake systems and to allow data to be uploaded directly into

SDWIS/State for improved compliance determinations.

LTS

Lab-to-State (LTS) and XML Sampling are a pair of tools supplied with SDWIS/STATE that allow labs to submit water quality data files to DDW, and for DDW to upload those files to SDWIS/STATE. DDW currently uses LTS and XML Sampling to receive lead and copper data into SDWIS/STATE.

CLIP

The California Lab Intake Portal (CLIP) will replace WQM, WQI and Write-On. DDW has selected a third-party vendor, EarthSoft, Inc., and its data management and decision support system EQuIS to provide an Excel spreadsheet template that will replace the EDF v1.2i data format used by Write-On and currently specified in State regulation as the data reporting format required for drinking water quality data. EarthSoft will also supply data error check tools through EQuIS and provide a web interface for laboratory reporting. DDW has identified a phased approach for CLIP design to ensure the earliest implementation date of the basic data intake portal, with future versions to provide the intake of the quality control (QC) elements associated with each laboratory analysis and bacteriological water quality data, which is currently reported manually directly to field offices.

Although USEPA developed a similar application known as the Compliance Monitoring Data Portal (CMDP) for submission of water quality data to SDWIS/STATE and the future SDWIS Prime, the centralized management of analyte lists by USEPA is an administrative hurdle. Additionally, CMDP does not currently have a robust set of data quality checks. DDW made the decision to build CLIP to not only intake all water quality data but also the associated QC data using the EQuIS proprietary data format. DDW will need to develop CLIP to meet USEPA requirements for electronic submittal known as the Cross-Media Electronic Reporting Rule (CROMERR). Once complete, CLIP will intake water quality data submitted by laboratories for migration into SDWIS/STATE. Implementation is currently anticipated to begin in early 2021. When CLIP is fully implemented, DDW will be able to provide more reliable data for the public and policy makers.

5.3.3 Drinking Water Watch

Drinking Water Watch (DWW) is a tool that displays information directly from SDWIS/STATE on both internal and external facing platforms. DDW has modified DWW to better display SDWIS/STATE data as well as integrate WQM, WQI data reports, and other information links and supports the development of two user interfaces, modified Drinking Water Watch (mDWW) (internal) and public Drinking Water Watch (pDWW)(external). Both platforms are critical interfaces for information access, with mDWW providing needed tools for use by DWW staff to assist in the implementation of the Safe Drinking Water Act, and pDWW providing a meaningful point of information access to the public in an easy to understand format. Currently, pDWW allows the public to view information such as water system locations, contact information, facility and sampling point inventory, water quality results, and violation and enforcement information.

5.3.4 Electronic Annual Reporting System

DDW developed and placed the Electronic Annual Reporting System into production in 2009 to replace the paper format annual report forms. The Electronic Annual Report (EAR) is an important way for the State Water Board to gather updated information from PWS that support the requirement for maintaining inventory information under the primacy agreement with USEPA. The EAR Portal hosts the electronic submittal by PWS's of the annual Consumer Confidence Report and certification, as well as submittal of updated Water Quality Emergency Notification Plans and Disadvantaged Community certification forms. It also provides a unique platform from which to gather information on emerging issues such as information on lead service lines pursuant to Senate Bill (SB) 1398 (2016) and SB 427 (2017), as well as financial information to support implementation of SB 200 (Safe and Affordable Drinking Water Act, 2019).

Increasingly, other State Water Board units and Agency partners have discovered that the EAR is a valuable platform for them as well. The EAR is the only application available to gather information directly from PWS. The information gathered through the EAR is used not only by DDW staff, but also by the public, policymakers, academia, non-governmental organizations (NGO), and others, to assist in evaluations and decision-making. The EAR provides a platform for the following agencies to gather data:

- The Department of Water Resources (DWR) Water Use and Efficiency Branch is using the EAR to collect monthly water production data for their Public Water Systems Statistics Surveys that is used to update Bulletin 160 (California Water Plan) and Bulletin 166 (Urban Water Use in California).
- ORPP has partnered with DDW to use the EAR to collect information on water loss, water rates, water conservation, and climate change adaptation/resiliency. This data is used by ORPP to craft guidance on a variety of issues related to water; it is also being used to inform analyses required for the rulemaking process.
- The State Water Board’s Fee Billing Unit uses data from the EAR to determine the annual fees to collect from each PWS to support the operation of DDW, as well as verify disadvantaged community status for application of fee reductions. The EAR Portal also hosts the electronic submittal by PWS's of the annual Consumer Confidence Report and certification, as well as submittal of updated Emergency Water Quality Notification Plans.

Data submitted to the EAR does not always accurately reflect the information in SDWIS. Currently, DDW field staff must manually update changes from the previous year’s EAR into SDWIS for each water system to reflect the current EAR data. Because the EAR and SDWIS are not linked, if an update is made in the EAR, such as to the population or number of service connections, it may not be reflected in SDWIS. This could be due to a number of reasons such as a lack of SDWIS updating or inaccurate reporting in the EAR which was clarified by the DDW field office and the correct values put in SDWIS. Issues such as these could lead to issues with data analysis for those who use EAR data directly. Additionally, EAR data has significant quality control issues and problems with the structure of the backend tables. There is currently an IT project in process to redevelop the EAR in a new format that should help address these issues.

5.3.5 Consolidation Information

Beginning in 2017, statistics relating to consolidations have been compiled every six months and are published on the State Water Board's website:

https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/dashboard.html

These include the Consolidated Water Systems lists since 2017 and the number of public water systems in California by county. There is also a list summarizing the water systems serving economically disadvantaged communities with water quality or quantity issues that are currently evaluating the feasibility of consolidation or are in a construction project for consolidation through the Division of Financial Assistance.

Additionally, the status of water systems undergoing mandatory consolidation is available for public review on the "Mandatory Consolidation or Extension of Service for Disadvantaged Communities" website:

https://www.waterboards.ca.gov/drinking_water/programs/compliance/index.html

A consolidation map has been created which utilizes the water system boundary maps that are discussed further in Section 5.3.6., and it can be a useful component in assisting in consolidation planning by identifying water system proximity for consolidation planning both locally and regionally. Supporting geographical information systems (GIS) capabilities are important to ensure fully functionable tools are available to enhance the evaluation process.

5.3.6 System Area Boundary Lookup (SABL)

The Water Boundary Tool (WBT) was created and maintained by the California Department of Public Health – California Environmental Health Tracking Program (Tracking California) until July 2019, using funding provided by the Water Board. The WBT facilitated the creation and collection of customer service area boundaries for public water systems in California and published the geographic information system (GIS) layers online. Various internal and external stakeholders including the State Water Board utilized the WBT in the planning and prioritization of funding drinking water system improvements, regionalization, consolidation and technical assistance in support of the Human Right to

Water Act (Chapter 524, Statutes of 2012). This bill established consideration of a human right to water as state policy when revising, adopting, or establishing policies, regulations, and grant criteria that are pertinent to the uses of water.

The WBT was initially created with the goal of producing a high-resolution digital map of drinking water system customer service areas for the entire state of California. Additionally, a GIS layer was created to assist with emergency preparedness and public health prevention and response. This allowed the WBT to assist in emergency situations, such as quickly identifying water systems, or their associated infrastructure, impacted by a fire or other emergency event. All these aspects make the WBT a useful tool to better allow stakeholders to research and enhance the understanding of the relationship between drinking water, health, and the environment.

In 2019, the State Water Board determined that it was necessary to take ownership of the development and maintenance of water system boundaries and to collect additional information to enhance the boundaries. As such, the State Water Board discontinued funding support of the WBT in July 2019. DDW downloaded all existing boundaries from the WBT and began its efforts to verify all the boundaries that existed at that time, including collecting the additional information. DDW is hosting these verified boundaries in the newly created System Area Boundary Layer (SABL). It is intended that SABL will host the water system boundaries of record for all agencies and stakeholders use. The State Water Board has identified boundaries to be useful to, but not limited to, the following entities or activities:

- Public Water Systems
- Water System Regulators
- Federal, State, and Local Agencies
- Legislature
- Educational Institutions
- Research/Academia
- Environmental Justice
- Emergency Response
- Land Use Planning / Consolidation Evaluation
- Human Right to Water
- Public

In May 2020, Tracking California notified the State Water Board that they would be shutting down the WBT effective July 1, 2020, as they had not secured further funding for its operation/maintenance.

DDW is currently working on developing the System Area Boundary Layer Admin App (SABL Admin), an administrative tool that allows District Offices, Local Primacy Agencies and public water system staff to create, update, and upload system area boundaries to the

SABL. Concurrently, the SABL-Look up Application is being created by the DDW GIS workgroup that will be a forward-facing application that will combine the SABL, other reference GIS layers and analysis tools, and SDWIS data.

5.3.7 Geographical Information Systems (GIS)

Recognizing the importance of geographical information systems (GIS) in implementing the mission of DDW, a GIS Workgroup was formed in 2016 which is comprised of DDW staff. The GIS Workgroup has been working to first assess the existing locational datasets for completeness and accuracy, starting first with wells, treatment plants, and PWS service area boundaries. Although the GIS Workgroup has been assisting in filling GIS needs, there is no dedicated GIS staff. Additional GIS capability is essential to provide more robust emergency response and routine data evaluation. The GIS Workgroup assists in creating maps in response to water quality evaluations such as recent per- and polyfluoroalkyl substances (PFAS) sampling requirements, and emergency events on an ad hoc basis; however, a more sustainable solution is needed particularly as mapping needs continue to increase.

For example, during summer 2019 the GIS Workgroup created a Public Safety Power Shutoff (PSPS) map to identify utilities affected by power shutoffs caused by threatening weather events. However, the usefulness of this data is hampered by the need for direct user interfacing to generate the maps as well as insufficient data. Timely access to accurate information is necessary to identify and coordinate with any affected water systems. Additional resources are necessary in order to continue supporting GIS interfaces to provide meaningful and useful visualizations to meet routine and emergency needs.

In addition to PSPS maps, the GIS Workgroup has developed several other projects to better convey information. Some of these include an emergency response map which includes dynamic feeds for earthquakes, fires, and floods to identify at risk water systems or facilities; lead service line inventory maps; contaminant specific maps displaying geographically located detections; groundwater cleanup mapping in conjunction with the Regional Water Boards and USEPA; and the DDW Water System Base Map which includes wells, treatment facilities, and service locations with some basic analysis tools.

Since much of the data DDW generates or utilizes has a geographic or spatial component, such as public water system and source locations, and distribution system water quality data, use of GIS can assist and improve data assessment and public health impact evaluations. GIS lets users visualize, question, analyze, interpret, and understand data to reveal relationships, patterns, and trends. GIS technology can help the State Water Boards, CDPH, policymakers, and others collaborate, manage, and integrate public health water quality data, perform statistical analysis, visualization and reporting, and document data and information. In order to meet these needs, DDW must maintain and enhance its existing GIS capabilities through additional resources and resource sharing.

5.3.8 Drinking Water Source Assessment and Protection (DWSAP) Program

The drinking water source assessment is the first step in the development of a complete drinking water source protection program. The assessment includes: A delineation of the area around a drinking water source through which contaminants might move and reach that drinking water supply; an inventory of possible contaminating activities (PCA) that might lead to the release of microbiological or chemical contaminants within the delineated area; and a determination of the PCA to which the drinking water source is most vulnerable.

Preparation of a source water assessment report for the DWSAP Program previously used TurboSWAP, which was developed by the University of California, Davis – Information Center for the Environment (UCD-ICE) specifically for the California DWSAP program. However, the TurboSWAP program ended in 2015. The State Water Board is currently planning on developing a replacement software that will assist in the preparation of source water assessment reports. The new software will be known as Source Water Assessment Tool (SWAT).

5.3.9 School and Child Care Center Lead Monitoring and Reporting

In 2017, DDW issued permit amendments to approximately 1,200 community water systems to facilitate water sampling for lead for California's K-12 schools. This was enhanced by the passage of Chapter 746, Statutes of 2017 (AB 746), effective January 1, 2018, which required community water systems serving school sites of local education agencies not independently permitted as water systems to test lead levels in drinking water at all facilities located on public school property which were constructed before January 1, 2010. This sampling was to be completed by July 1, 2019. These sample results were submitted electronically to DDW and posted on the "Lead Sampling of Drinking Water in California Schools" website:
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/leadsamplinginschools.html

Chapter 676, Statutes of 2018 (AB 2370), which was signed into law by the Governor on September 22, 2018, requires that licensed child care centers located in buildings constructed before January 1, 2010, have their drinking water tested for lead between January 1, 2020, and January 1, 2023, and every five years after the initial date of testing. It further requires that these samples be electronically submitted to DDW, and if the test results show elevated lead levels, DDW must in a timely manner, report the results for the affected licensed child care center to the California Department of Social Services (CDSS). DDW must also post all lead test results received on an internet website that is accessible to the public in a timely manner. DDW has developed, in conjunction with the Water Board's Division of Information Technology (DIT), a new data intake system and database for the aforementioned child care center lead results that is now online for intake of child care center lead data. DDW continues to collaborate with CDSS to ensure complete implementation of requirements under AB 2370.

5.3.10 Safe and Affordable Drinking Water

Financial Capacity Dashboard

As part of Chapter 449, Statutes of 2018, The Budget Act of 2018, (SB 862), the State Water Board was appropriated funding to implement a Needs Analysis on the state of drinking water in California. As part of this effort a financial capacity pilot web tool or dashboard is being developed for water systems between 500 and 3,300 service connections. The data collected by this effort, and ultimately displayed by this web tool or dashboard, will provide increased transparency to the public, policymakers, and others regarding the financial viability of water providers, as well as a powerful tool to help demonstrate the relative costs associated with providing drinking water. The financial capacity dashboard pilot can be found at the following website:

https://efc.sog.unc.edu/resource/california-small-water-systems-rates-dashboard

Provided the pilot is well received, inclusion of additional water systems or development of a similar in-house tool will be initiated.

SAFER Clearinghouse

In response Chapter 120, Statutes of 2019 (SB 200), the State Water Board created a new Safe and Affordable Funding for Equity and Resilience (SAFER) Drinking Water Program to ensure that the approximately one million Californians who currently lack safe drinking water receive safe and affordable drinking water as soon as possible. To undertake this task, the State Water Board must be able to identify PWS domestic wells, and state small water systems violating or at risk of violating drinking water standards, and conduct a cost-analysis for interim and long-term solutions for identified systems. The SAFER Program is in the process of developing a new database platform, known as the SAFER Clearinghouse, which will collect, manage, and analyze data from a variety of disparate data systems, like SDWIS and Loan and Grants Tracking System, to adequately manage the tasks specified under SB 200.

The SAFER Clearinghouse will be used by multiple divisions within the State Water Board to identify, prioritize and track progress toward bringing a safe and affordable drinking water supply to communities. The SAFER Clearinghouse will enable new DDW SAFER staff to oversee and manage the identification and prioritization of water systems; the provision of technical assistance; assigned Administrators; provision of interim water supplies; status of violations and compliance with issued enforcement orders; as well as tracking the funding of planning and construction projects to address drinking water issues.

It will also be used by the State Water Board management to demonstrate progress toward achieving the human right to water, and provide information to the Board, the public, and stakeholders on SAFER implementation.

5.3.11 Human Right to Water (HR2W) Web Portal

The State Water Board formalized efforts to implement the Human Right to Water (HR2W) law that became effective January 1, 2013, with the adoption of Resolution No. 2016-0010 on February 16, 2016, which identified the human right to water as a top priority and core value of the Water Boards. The resolution stated the Water Boards would work "to preserve, enhance, and restore the quality of California's water resources and drinking water for the protection of the environment, public health, and all beneficial uses, and to ensure proper water resource allocation and efficient use, for the benefit of present and future generations."

DDW was then tasked to begin work with stakeholders and develop performance measures for the evaluation of the Water Board's progress toward the realization of the human right to water, evaluate that progress, and explore ways to make that information more readily available to the public. In February 2017, DDW launched the HR2W Portal, which serves as the primary location for the public to find information related to the Water Boards efforts to ensure that every Californian has access to safe, clean, and affordable drinking water.

With data on more than 3,000 community, school and daycare public water systems in California, the website lets users look up their water system and see whether it complies with federal and state drinking water standards. The site includes an interactive map that shows the locations of public water systems and indicates their compliance status with the federal and state drinking water standards for contaminants such as nitrate and arsenic. The website includes information on state efforts to assist local communities in addressing contamination problems and improve access to safe, affordable drinking water. The HR2W Portal continues to be updated with new information as it becomes available, including content on drinking water affordability and accessibility.

However, there are some areas of improvement for the HR2W portal, including how the water systems are mapped relative to their service area boundaries. The map is currently locating water systems at the centroid of the zip code of their physical location rather than within their identified water system boundary. Improved GIS map tools are needed to make the map more accurately represent where the human right to water is not being achieved.

In July 2017, DDW entered into an inter-agency agreement with the Office of Environmental Health Hazard Assessment (OEHHA) to provide the State Water Board with statewide metrics related to the adequacy of California's drinking water with respect to its safety (via quality indicators), affordability, and accessibility, for consideration in DDW's own efforts in documenting the human right to water. Under this contract, OEHHA has developed indicators for each of these three components of drinking water adequacy, quantified indicators with statewide data, shared results, identified needs for improved data, and will propose a mechanism to monitor progress over time. This agreement was extended through June 2020 to allow OEHHA to complete the HR2W report and create an online tool that visualizes the HR2W indicators that are defined in the report.

5.3.12 Other Non-Integrated Data Systems (at DDW Field Offices)

The Drinking Water Program field offices comprised of 24 Districts as well as 29 LPA have long utilized a variety of disparate, non-integrated spreadsheets and data systems in order to track, store, and manage data collected from over 7,300 public water systems for compliance determination. The Districts and LPA developed these individualized, non-integrated data systems out of necessity as there is currently no platform that encompasses all data tracking needs in a unified manner. Over forty types of unique data systems have been developed by the field for individual office use. None of these tracking systems are maintained by support staff, DIT, or third-party contracts; rather they are supported and maintained by various knowledgeable district office staff, committees, and workgroups. Since these systems are not integrated into a single data set, the information is not accessible as raw data to the Drinking Water Program in a manner that is easily used to gain knowledge or insight into the data, which prevents cohesive action, as described in Section 5.1 as the path of data leading to better outcomes.

The data the Districts and LPA collect, review, and manage is vital to ensuring safe water is provided, such as through the review and assessment of water treatment effectiveness. The development of non-integrated data systems came out of necessity to enable individual Districts and LPA to perform their duties more efficiently. However, it limits the availability of data to the local level, and is not available at the state level for consolidated evaluations and decision making, and decreases the quality and uniformity of data.

The State Water Board plans to implement a DDW Data Enterprise System in order to integrate these disparate data systems into a single point of access system in order to create a more efficient, transparent, and consolidated system. The proposed project is to centralize these disparate data systems and make consistent business rules in order to centralize all these data systems to meet state regulations, DDW business needs and practices, and to implement USEPA business rules and federal regulations. In order to meet the USEPA reporting requirements, the State Water Board intends to expand its use of SDWIS and will develop the Data Enterprise System to work in tandem with SDWIS to consolidate and automate data management efforts. This effort will reduce standalone databases and centralize data for ease of accessibility for all users that is comprehensive, reliable, and defensible.

Over the next few years, the State Water Board intends to first create CLIP as described in Section 5.3.2, which will act as a gatekeeper for all laboratory water quality data submissions. The State Water Board will work to ensure CLIP follows the Cross-Media Electronic Reporting Rule to ensure that water quality results are submitted in a reliable, defensible, and standardized manner. The Data Enterprise System will then be expanded to incorporate additional data needs. Functionality will be added on a priority basis, selecting the most mission critical data systems to develop first.

The Data Enterprise System will expand usership and information accessibility by creating a role-based web interface. External users will have the ability to submit, update, and maintain the data which they are required to report to DDW. This will provide additional control over the quality of information submitted to DDW. DDW staff will have the ability to review and accept user submissions. This will result in increased staff productivity as external users will be entering and managing their own data into the Data Enterprise System as opposed to DDW staff manually entering and managing data into various disparate systems. Additional savings will be realized by automating and streamlining business rules, processes, and compliance determinations. The data in this Data Enterprise System will be of higher quality, more easily accessible, and allow users such as policymakers, NGO, and academia to directly access the information.

5.3.13 Residential Water Treatment Device Registration Portal

Any water treatment device (WTD) that has a health or safety benefit claim may not be sold or otherwise distributed in California unless it is first listed on the State Water Board's internet website. California Health and Safety Code Section 116825 defines a WTD as "any point of use or point of entry instrument or contrivance sold or offered for rental or lease for residential use, and designed to be added to the plumbing system, or used without being connected to the plumbing of a water supply intended for human consumption in order to improve the water supply by any means." It also defines "health and safety claim" as a claim that a WTD will remove or reduce a contaminant regulated by a primary drinking water standard. California's WTD registration program regulates only WTD for which health and safety benefit claims are made.

In order to better facilitate the tracking of WTD registration, a WTD registration portal is currently under development. This portal will facilitate the intake of registration data and ultimately display registered WTD to the public based on contaminant of concern. Once complete, the portal will enhance the availability of information to the public regarding WTD that are currently registered in California to better allow informed decisions to be made. Currently, registered WTD are posted on a manually updated spreadsheet on the Residential Water Treatment Device website:

https://www.waterboards.ca.gov/drinking_water/certlic/device/watertreatmentdevices.html

5.4 LOCAL PRIMACY AGENCIES (LPA)

With the enactment of Chapter 1248, Statutes of 1992 (AB 2995), there was a significant change to the responsibility for oversight of small PWS serving less than 200 service connections (defined as “small water systems” in Title 22 CCR §64251). The State Water Board was authorized to delegate its regulatory powers over these systems within a county to Local Primacy Agencies (LPA) through a Local Primacy Delegation Agreement specifying the activities required to maintain primacy delegation. As of November 2020, there are 29 LPA, down from 36 in 1992 (Table 2-2 in Chapter 2).

The original LPA used a variety of data management systems to track and report data for small water systems. Upon implementation of AB 2995, each contracting LPA had to meet specific reporting requirements for data. Each LPA either established its own data management system or switched to EnvisionConnect, a privately developed data management system, to meet the requirements.

In Fiscal Year 2012-13, the Drinking Water Program identified significant issues with access to accurate LPA data and decided to begin the process of requiring the LPA to utilize SDWIS/STATE for data management and reporting activities under new Local Primacy Delegation Agreements (LPDA) that were executed with all LPA during that fiscal year. In addition to the executed LPDA, the state provided one-time grant funds to the LPA to assist them with the LPDA compliance. The funding was to be used for data reporting, training, staffing, equipment, and other related drinking water program oversight items. The initial deadline for all LPA to switch to SDWIS/STATE was the end of 2014; however, the process ended up being slow and complicated. In January 2017, each current LPA received an amended LPDA requiring reporting using SDWIS/STATE of all data elements implemented by DDW. As of mid-2017, all LPA have SDWIS/STATE accounts and are evaluated on a quarterly basis to ensure that they are meeting their data reporting requirements under the LPDA amendment.

There are still hurdles to overcome to improve LPA reporting via SDWIS/STATE. Regular problems with specific SDWIS/STATE modules (Contacts, Lead and Copper Rule) have been identified where LPA are accessing SDWIS/STATE outside the State Water Board firewalls. The solution is often resolved by helping the LPA adjust ‘compatibility’ settings but continues to result in frustration by LPAs.

One solution to this problem is a separate data entry portal outside of State Water Board firewalls for information required to be entered into SDWIS/STATE, hence ‘shielding’ the LPA from direct entry into SDWIS.

5.5 STATE SMALL WATER SYSTEMS (SSWS)

State small water systems (SSWS) are non-public water systems that are overseen by their respective Counties and serve at least five, but not more than 14 service connections and do not serve more than an average of 25 individuals daily for more than 60 days out of the year. There is an increased effort to ensure the human right to water to each of the customers or users of SSWS. Pursuant to SB 200, the State Water Board is tasked with gathering information related to SSWS including locations, contacts and water quality. In order to meet this data collection need, a new data system should be developed that can support data from SSWS and interface into DDW's existing data management systems for ease of reporting by the respective Counties, as well as ease of data use by the respective stakeholders. The development of a reporting system needs to consider the County resources available, balancing the limitations of County resource availability while supporting the need to provide information to the public and policymakers that is representative of these SSWS.

5.6 ENVIRONMENTAL LABORATORY ACCREDITATION (ELAP) PROGRAM

The ELAP application and accreditation management system is an internally facing Microsoft Access database system that manages the information of accreditation for ELAP. The system consists of a front-end 2010 Microsoft Access database and a back-end SQL database. The front-end Access database contains forms, tables, queries, and reports while data is stored on the back-end SQL database. The ELAP database maintains the information for laboratory applications, Fields of Testing/Accreditation, on-site assessment data, payment amount and history, and certificate timelines.

ELAP uses the database to accredit laboratories located in the state of California and throughout the nation. The database has been used since the program transitioned from the California Department of Public Health to the State Water Board in 2014 and continuously by ELAP since 1995. The database is a critical software platform that is used daily by all ELAP staff in the Sacramento, Richmond, and Glendale offices.

The current database doesn't meet the program needs. ELAP staff enter information for accrediting laboratories manually. Information for laboratory applications, proficiency testing results, on-site assessment evaluations, and dates for accreditation are also manually entered by staff into the database. This labor-intensive effort has exacerbated the shortage of staff resources and lengthened the time to complete the accreditation of laboratories. In addition, the database does not store historical information for laboratories nor enable auditable tracking of staff data input.

ELAP needs software tools to help meet workload demands and to ensure consistency when accrediting laboratories. The current database meets some of the needs of the program but does not provide all the features and functionalities needed for the program to achieve its mission. Acquisition of new software is needed to improve the processing efficiency of information being evaluated for laboratory accreditation. With new accreditation software, automated processes will enhance management of the overall accreditation process. ELAP is currently partnering with the DIT to address the program's information technology needs. Acquisition of accreditation software is critical for ELAP to fully achieve its legislative mandates and establish credibility both state- and nation-wide as an effective environmental laboratory accreditation program.

5.7 COLLABORATION WITH OTHER AGENCIES

DDW collaborates with a number of other state agencies. Collaborating with other organizations and data systems enhances publicly accessible open data by integrating water data into open-access platforms to assist users in making more informed data-driven decisions. Updates to DDW data systems will require involvement and communications with these other organizations.

5.7.1 CDPH Environmental Health Investigations Branch (EHIB)

EHIB is under the CDPH, Division of Environmental and Occupational Disease Control and has been investigating possible adverse health outcomes due to exposure to drinking water contaminants. EHIB uses water quality data from WQM, WQI, and public water system boundaries to carry out their investigations and surveillance.

5.7.2 Office of Environmental Health Hazard Assessment (OEHHA)

DDW shares information with OEHHA from all data sources, including SDWIS, WQI, EAR and water system boundaries in order to support several efforts by OEHHA. The CalEnviroScreen uses DDW water system information to update and improve the scoring hosted on the tool. Under a contract with DDW, OEHHA has used PWS information to further the development of Human Right to Water indicators and a Human Right to Water tool.

5.7.3 Department of Water Resources (DWR)

DDW collaborates with DWR in several efforts related to data. Information on water production and deliveries has been gathered in a format to meet DWR's monthly data needs since about 2013 and is provided to DWR at the end of each EAR reporting year. DDW has also provided information to DWR to assist in the implementation of Chapter 14, Statutes of 2018 (SB 606) and Chapter 15, Statutes of 2018 (AB 1668) related to drought risks for smaller water systems (less than 3,000 service connections). As part of this effort, significant amounts of SDWIS and EAR data were used to develop the Drought Risk Tool. Most recently, DDW and DWR have been collaborating on water system boundaries, and the possibility of hosting urban water supplier boundaries on the SABL tool.

As part of implementation of AB 1755, the Open and Transparent Water Data Act (Chapter 506, Statutes of 2016), DDW and other State Water Board partners have also been collaborating with DWR and other agencies and public water system stakeholders to begin addressing data streamlining, in which the goal is to intake information from our regulated community in one place, rather than requiring separate reporting of similar information to multiple agencies.

Furthermore, 2018 conservation legislation (SB 606 & AB 1668), directed the DWR and the State Water Board to streamline water data reporting. Water Code Section 10609.15 outlines these directives, which include, but are not limited to, analyzing opportunities for more efficient publication of urban water reporting requirements and for integrating various data sets in a publicly accessible location.

5.7.4 Governor's Office of Emergency Services (CalOES)

CalOES has used SDWIS information such as water system size through public Drinking Water Watch, and water system boundaries hosted on the State Water Board website during disaster and emergency response to assist in identifying potentially affected water system utilities and addressing repopulation of impacted areas. During summer of 2019, CalOES provided DDW with direct access to PSPS map updates to enable the development of an internal GIS tool to identify PWS within PSPS areas.

5.7.5 Department of Pesticide Regulation (DPR)

DPR uses the source water locations and drinking water quality source data within its own programs to monitor pesticide contamination of surface water and groundwater.

5.7.6 California Water Quality Monitoring Council

In November 2007, a Memorandum of Understanding (MOU) was signed by the Secretaries of the California Environmental Protection Agency (CalEPA) and the California Natural Resources Agency to establish the California Water Quality Monitoring Council (Monitoring Council). The MOU was mandated by Chapter 750, Statutes of 2006 (SB 1070) and requires the boards, departments, and offices within the CalEPA and the California Natural Resources Agency to integrate and coordinate their water quality and related ecosystem monitoring, assessment, and reporting. The Monitoring Council seeks to provide multiple perspectives on water quality information and to highlight existing data gaps and inconsistencies in data collection and interpretation, thereby identifying areas for needed improvement in order to better address the public's questions. DDW is a Member of the Monitoring Council. Currently, the Monitoring Council is hosting a website to assist the public find information on whether their water is safe to drink. In a collaborative effort, DDW staff are included on that workgroup to ensure the information provided is clear and pertinent for the public.

5.8 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

After the transition of DDW to the State Water Board, greater expectations were placed on the Drinking Water Program to:

1) make water system information useful and transparent,
2) reduce the number of public water systems through targeted consolidations efforts,
3) further develop drinking water standards,
4) promote expanded uses of recycled water,

5) launch the human right to water initiative, and
6) concentrate on ensuring the sustainability of public water systems.

Obtaining meaningful data from water utilities, processing that data, and making it useful as well as accessible to the public is fundamental for the Drinking Water Program to meet these new expectations. In addition, there are increased demands for greater public access to water quality information used by the Drinking Water Program. To meet these greater demands, and at the same time ensure the integrity of water quality data, the Quality Assurance Section was created, of which the main task is to ensure the accuracy, quality, and reliability of information brought into the Drinking Water Program and to ensure that same information is accessible and meaningful to the public.

As noted in the 1993 Plan, "A strong regulatory program requires an effective and efficient information management program to collect, organize, and make accessible the information necessary to carry out that program." Additionally, as part of the Open and Transparent Water Data Act, DDW is working to increase access to water data to foster collaboration, improve transparency and accountability, integrate existing datasets, and move toward increased data-driven decision-making. DDW has recognized the effort needed to improve its data management, and has begun implementing significant improvements such as through the creation of the Quality Assurance Section, recent LPA transition to SDWIS/STATE from EnvisionConnect, planned SDWIS/STATE full implementation, and numerous data management projects currently in the planning stages to better track, manage, and display collected information for improved data accessibility such as the Data Enterprise System.

This is only the beginning of a better data management system. As the number of emerging contaminants continue to expand, and analytical techniques detect constituents at lower and lower concentrations, the need to ensure and maintain quality systems within DDW has never been more apparent. Making complex information easily accessible to the public requires extensive technical programming and comprehension of engineering practices pertaining to drinking water systems far beyond the previous norm, resulting in the creation of the Quality Assurance Section as the logical conclusion to the vast array of technical requests being made on DDW. However, the needs and technology may continue to grow much faster than the funding for and capability of DDW to meet those needs. Obsolescence of existing systems and additional new data needs will continue to be issues. In order to ensure accurate data systems are in place, long-term planning for both data system enhancements and replacements are important to ensure that data systems transition in a timely manner, allowing for development and selection of the optimal alternative. Currently, there are still many improvements to be made while incorporating new regulations and new reporting requirements. Therefore, it is important to remember that data management system funding and resources are needed to implement any new regulation or requirement.

In addition, there is now a significant effort among state agencies to share water quality data and to streamline reporting of similar information needed by multiple agencies. The public does benefit when they have access to knowledge about the quality of their water. This effort has been supported by legislative mandates but is also the result of greater collaboration among state agencies that have a role in ensuring that the quality of the state's water resources is maintained. State agencies that collect water quality data are also making these data available to the public in ways that are easy to obtain and understand. The State Water Board has responded to public interest about drinking water quality by developing public portals that not only allow the public to access drinking water quality data, but to obtain information about the water systems that serve them.

Recommendations

5-1 As the existing information systems are modernizations, the State Water Board should develop a strategy and work with those responsible for data submission to ensure future data system transitions occur in a systemic, optimized manner, allowing time for the selection and development of the preferred alternative.

5-2 To facilitate the intake of all water quality via CLIP, the State Water Board intends to pursue revised regulations that will allow the it to specify a data format for water quality submission by laboratories. This new format will include additional quality control elements, resulting in higher quality data that will be of known and documented quality.

5-3 To enhance timely and accurate determination of PWS compliance with drinking water standards, the State Water Board intends complete Phase 3 of the SDWIS/STATE transition plan to implement SDWIS/STATE's extensive compliance decision support tools.

5-4 To enhance public access and ensure transparent, accessible data, public Drinking Water Watch should be further developed in a strategic, planned effort in order to provide meaningful information to the public in an easy to understand format.

5-5 To improve the quality and usability of data collected from the Electronic Annual Report (EAR), the State Water Board intends to redevelop the EAR in a new format for improved data collection, quality control, and usability. Some of the changes will include a single format for all PWS, auto calculated fields, and prepopulated fields from DDW databases.

5-6 To assist in emergency response and enhance access to water data, the State Water Board will use the System Area Boundary Lookup (SABL) to allow continued information accessibility and facilitate easier identification of water system service areas and legal boundaries.

5-7 To meet the growing GIS needs of external and internal users, the State Water Board recommends increasing its GIS resources. This is particularly important for emergency preparedness and response, as well as sustainability.

5-8 To comply with AB 2370, which added Section 1596.7996 to the Health and Safety Code, the State Water Board intends to develop a new data intake system and database to receive and post lead water sample results for monitoring conducted from child daycare facilities on an internet website that is publicly accessible.

5-9 The State Water Board is planning to implement a DDW Data Enterprise System over the next few years to integrate disparate data systems into a single point of access system. This will centralize disparate, non-integrated data systems for ease of data tracking, storage, and management by DDW while incorporating role-based access to facilitate open access to data to improve transparency and accountability.

5-10 A new residential water treatment device registration portal is under development to ensure accurate information is conveyed to the public and other stakeholders regarding these devices which are making health and safety claims. This portal will better facilitate registration, including both new and updates, of residential water treatment devices.

5-11 To be able to identify state small water systems that consistently fail or are at risk of failing to provide an adequate supply of safe drinking water, as required by SB 200, a new data intake portal needs to be developed. The new intake portal will be integrated into DDW's existing data systems in order to streamline data collection while promoting data transparency.

5-12 To meet workload demands, fully achieve legislative mandates, and ensure consistency, ELAP intends to automate processes for the program, laboratories, and proficiency testing providers which will enhance the overall accreditation program.

5-13 Continue to improve SDWIS/STATE reporting by LPA by developing tools to allow reporting through the use of portals and platforms accessible outside of State Water Board firewalls to intake the information for subsequent uploading to SDWIS/STATE.

References

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Chapter 750, Statutes of 2006 (SB 1070) (http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200520060SB1070)

Chapter 524, Statutes of 2012 (AB 685) (https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120AB685#:~:te xt=AB%20685%2C%20Eng.,State%20water%20policy.&text=This%20bill%20would%20declare%20that,%2C%20cooking%2C%20and%20sanitary%20purposes)

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Chapter 120, Statutes of 2019 (SB 200) (https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200SB200)

State Water Board Human Right to Water Resolution Number 2016-0010, February 16, 2016 (https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2016/rs2016_0010.pdf)

State Water Board Drinking Water Programs website (https://www.waterboards.ca.gov/drinking_water/programs/)

USEPA SDWIS Federal Reporting Services website (https://www.epa.gov/ground-water-and-drinking-water/safe-drinking-water-information-system-sdwis-federal-reporting)

State Water Board's EAR Data from Public Drinking Water Systems website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/ear.html)

State Water Board's Consolidation Statistics website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/dashboard.html)

State Water Board's Mandatory Consolidation or Extension of Service for Disadvantaged

Communities website
(https://www.waterboards.ca.gov/drinking_water/programs/compliance/index.html)

State Water Board Drinking Water Source Assessment and Protection (DWSAP) Program website
(https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/DWSAP.html)

State Water Board's Lead Sampling in Schools website
(https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/leadsamplinginschools.html)

State Water Board Human Right to Water Portal
(https://www.waterboards.ca.gov/water_issues/programs/hr2w/index.html)

State Water Board's ELAP website
(https://www.waterboards.ca.gov/drinking_water/certlic/labs/)

State Water Board's Residential Water Treatment Devices website
(https://www.waterboards.ca.gov/drinking_water/certlic/device/watertreatmentdevices.html)

University of North Carolina's Environmental Finance Center California Financial Dashboard (https://efc.sog.unc.edu/resource/california-small-water-systems-rates-dashboard)

CHAPTER 6 METHODS AND INSTRUMENTS FOR SCREENING AND DETECTING CHEMICALS AND MICROBIAL AGENTS

6.1 INTRODUCTION

Analytical methods used to monitor for contaminants in drinking water have become more sophisticated and the scope and type of contaminants has broadened. Additionally, advances in technology have simplified some analytical methods and increased the speed to generate a result. In this chapter, methods used to monitor for these contaminants including chemical, radionuclide, and microbiological agents will be discussed.

There are generally two types of monitoring undertaken by public water systems (PWS) to screen and detect chemical, radionuclides, and microbiological agents in drinking water: compliance monitoring and occurrence monitoring. Compliance monitoring is used to determine compliance with federal and state drinking water standards. Approved methods for testing for these chemicals, microbes, and radionuclides are specified in federal and state regulations.

Occurrence monitoring is used to determine the extent to which unregulated contaminants are present in drinking water sources. Historically, California has had a vigorous program to monitor for contaminants, particularly chemicals that have not been or are currently not regulated at the federal or state level. These unregulated contaminants may be first detected as part of routine compliance monitoring for a closely related contaminant or a chemical that may be in wide use and has the potential to enter and contaminate drinking water sources. It is important to know whether certain forms of a chemical are present because of the significance of the potential public health risk.

Prior to the implementation of occurrence monitoring, the analytical method(s) to be used must be standardized. CDPH's Drinking Water and Radiation Laboratory and the State Water Board's Environmental Laboratory Accreditation Program (ELAP) work closely with testing laboratories to develop and standardize the appropriate drinking water analytical methods to assure reliability, ruggedness, and quality of the data produced. Commercial drinking water testing laboratories must be certified by ELAP to analyze samples for compliance with regulatory drinking water standards (see Section 6.2 for more about ELAP). The laboratories' results are transmitted directly by electronic means to the State Water Board. A more detailed discussion of occurrence monitoring is provided below.

It is important that the methods used for compliance monitoring ensure that a contaminant can be detected and reliably reported at a level at or below the applicable drinking water standard (maximum contaminant level, action level or treatment technique). The reporting level for regulated contaminants, that is, the level at which there is confidence that the chemical is present at the levels being reported for compliance purposes, is called the Detection Level for Purposes of Reporting (DLR). The DLR is established in regulations with the MCL. Methods used for occurrence monitoring must be sensitive enough to identify the presence of contaminants in drinking water sources at very low concentrations, in order to protect public health at current regulatory levels as well as those that may be applicable in the future.

All compliance testing by PWS must be carried out at a laboratory accredited by the State Water Board's ELAP. If an analysis is not done by a certified laboratory using approved methods for a particular contaminant, the PWS is deemed noncompliant with regard to its required testing.

Approved methods also contain important Quality Assurance and Quality Control requirements to ensure the integrity and validity of the data. As discussed in Chapter 5, the Quality Assurance Section supports DDW's compliance determinations and enforcement actions, which are based upon water quality data and information received from laboratories and public water systems.

PWS are required to annually provide customers with monitoring results through their Consumer Confidence Reports. In addition, PWS are required to notify their customers whenever they do not comply with an MCL or a microbial standard. The results of drinking water monitoring are also available at several websites:

- The Human Right to Water Portal: https://www.waterboards.ca.gov/water_issues/programs/hr2w/
- My Water Quality: https://mywaterquality.ca.gov/safe_to_drink/
- Drinking Water Watch: https://sdwis.waterboards.ca.gov/PDWW/

6.2 THE ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM (ELAP)

ELAP (https://www.waterboards.ca.gov/drinking_water/certlic/labs/) provides evaluation and accreditation of environmental testing laboratories to ensure the quality of analytical data used for regulatory purposes to meet the requirements of the State Water Board's drinking water program. In addition to drinking water, ELAP accredits laboratories for testing to meet the regulatory requirements of the state's wastewater, shellfish, food, and hazardous waste programs, for the protection of public health and the environment. ELAP-accredited laboratories have demonstrated capability to analyze environmental samples using approved methods.

Since ELAP's transfer in 2014 from CDPH to the State Water Board (along with the drinking water program), improvements have been made in its oversight activities related to laboratory accreditation. These improvements include coordination with the NELAC Institute's (TNI's) laboratory standards, which contribute to the National Environmental Laboratory Accreditation Program, as well as re-invigoration of ELAP's Environmental Laboratory Technical Advisory Committee (ELTAC), which provides support and guidance on matters of importance to the environmental and public health laboratory community.

ELAP's regulations are continuing to be updated to improve its laboratory accreditation program, to ensure that laboratories generate high quality data for the protection of public and environmental health. For more information, see ELAP's website on regulations (https://www.waterboards.ca.gov/drinking_water/certlic/labs/elap_regulations.html).

6.3 BACKGROUND ON EXISTING METHODS AND INSTRUMENTATION

The following provides an overview of the contaminants for which PWS must monitor along with a discussion of the complexity of the methods used. The most current and reliable source of information on specific methods can be found at USEPA's approved methods for drinking water website: (http://water.epa.gov/scitech/drinkingwater/labcert/methods_index.cfm). The USEPA website also provides information on methods used to evaluate the occurrence of unregulated contaminants in drinking water sources that are of public health interest.

6.3.1 Inorganic Chemicals

There are 17 inorganic chemicals that are regulated by the State Water Board. They are listed in Table 6-1 along with the respective regulatory limit (MCL) and the lowest level that they can be reliably detected (DLR).

The procedures require sophisticated instrumentation such as inductively coupled plasma/mass spectrometry (ICP/MS) and, in the case of asbestos, electron microscopy. Although the analysis of inorganic chemicals is generally conducted in the laboratory, detectors have also been developed to continuously measure the level of certain inorganic chemicals in water.

Table 6-1: Inorganic Chemicals MCL and DLR

Chemical	State Water Board MCL (mg/L)	USEPA MCL (mg/L)	State Water Board DLR (mg/L)
Aluminum	1.	Not Established	0.05
Antimony	0.006	0.006	0.006
Arsenic	0.010	0.010	0.002
Asbestos	7 MFL[1]	7 MFL[1]	0.2 MFL>10μm[1]
Barium	1.	2	0.1
Beryllium	0.004	0.004	0.001
Cadmium	0.005	0.005	0.001
Chromium, Total	0.05	0.1	0.01
Cyanide	0.15	0.2	0.1
Fluoride	2.0	4.0	0.1
Mercury	0.002	0.002	0.001

Chemical	State Water Board MCL (mg/L)	USEPA MCL (mg/L)	State Water Board DLR (mg/L)
Nickel	0.1	Not Established	0.01
Nitrate (as nitrogen)	10.	10	0.4
Nitrate+Nitrite (sum as nitrogen)	10.	10	0.4
Nitrite (as nitrogen)	1.	1	0.4
Perchlorate	0.006	Not Established	0.004
Selenium	0.05	0.05	0.005
Thallium	0.002	0.002	0.001

1. MFL=million fibers per liter; for fibers exceeding 10μm in length.

6.3.2 Organic Chemicals

Organic chemicals are divided into two groups: Volatile organic chemicals (VOC) and non-volatile synthetic organic chemicals (SOC). There are 50 organic chemicals that are regulated. They are listed in Table 6-2 and Table 6-3 along with their respective MCL and DLR.

Table 6-2: VOC MCL and DLR

Chemical	State Water Board MCL (mg/L)	USEPA MCL (mg/L)	State Water Board DLR (mg/L)
Benzene	0.001	0.005	0.0005
Carbon Tetrachloride	0.0005	0.005	0.0005
1,2-Dichlorobenzene	0.6	0.6	0.0005
1,4-Dichlorobenzene	0.005	0.075	0.0005
1,1-Dichloroethane	0.005	Not Established	0.0005
1,2-Dichloroethane	0.0005	0.005	0.0005
1,1-Dichloroethylene	0.006	0.007	0.0005
cis-1,2-Dichloroethylene	0.006	0.07	0.0005
trans-1,2-Dichloroethylene	0.01	0.1	0.0005
Dichloromethane	0.005	0.005	0.0005
1,2-Dichloropropane	0.005	0.005	0.0005
1,3-Dichloropropene	0.0005	Not Established	0.0005

Chemical	State Water Board MCL (mg/L)	USEPA MCL (mg/L)	State Water Board DLR (mg/L)
Ethylbenzene	0.3	0.7	0.0005
Methyl-tert-butyl ether	0.013	Not Established	0.003
Monochlorobenzene.	0.07	0.1	0.0005
Styrene.	0.1	0.1	0.0005
1,1,2,2-Tetrachloroethane	0.001	Not Established	0.0005
Tetrachloroethylene	0.005	0.005	0.0005
Toluene	0.15	1	0.0005
1,2,4-Trichlorobenzene	0.005	0.07	0.0005
1,1,1-Trichloroethane	0.200	0.2	0.0005
1,1,2-Trichloroethane	0.005	0.005	0.0005
Trichloroethylene	0.005	0.005	0.0005
Trichlorofluoromethane	0.15	Not Established	0.005
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.2	Not Established	0.01
Vinyl Chloride	0.0005	0.002	0.0005
Xylenes	1.750[1]	10	0.0005

1. MCL is for either a single isomer or the sum of the isomers.

Table 6-3: SOC MCL and DLR

Chemical	State Water Board MCL (mg/L)	USEPA MCL (mg/L)	State Water Board DLR (mg/L)
Alachlor	0.002	0.002	0.001
Atrazine	0.001	0.003	0.0005
Bentazon	0.018	Not Established	0.002
Benzo(a)pyrene	0.0002	0.0002	0.0001
Carbofuran	0.018	0.04	0.005
Chlordane	0.0001	0.002	0.0001
2,4-D	0.07	0.07	0.01
Dalapon	0.2	0.2	0.01
Dibromochloropropane	0.0002	0.0002	0.00001
Di(2-ethylhexyl)adipate	0.4	0.4	0.005
Di(2-ethylhexyl)phthalate	0.004	0.006	0.003
Dinoseb	0.007	0.007	0.002
Diquat	0.02	0.02	0.004
Endothall	0.1	0.1	0.045

Chemical	State Water Board MCL (mg/L)	USEPA MCL (mg/L)	State Water Board DLR (mg/L)
Endrin	0.002	0.002	0.0001
Ethylene Dibromide	0.00005	0.00005	0.00002
Glyphosate	0.7	0.7	0.025
Heptachlor	0.00001	0.0004	0.00001
Heptachlor Epoxide	0.00001	0.0002	0.00001
Hexachlorobenzene	0.001	0.001	0.0005
Hexachlorocyclopentadiene	0.05	0.05	0.001
Lindane	0.0002	0.0002	0.0002
Methoxychlor	0.03	0.04	0.01
Molinate	0.02	Not Established	0.002
Oxamyl	0.05	0.2	0.02
Pentachlorophenol	0.001	0.001	0.0002
Picloram	0.5	0.5	0.001
Polychlorinated Biphenyls	0.0005	0.0005	0.0005
Simazine	0.004	0.004	0.001
Thiobencarb	0.07	Not Established	0.001
Toxaphene	0.003	0.003	0.001
1,2,3-Trichloropropane	0.000005	Not Established	0.000005
2,3,7,8-TCDD (Dioxin)	3×10^{-8}	3×10^{-8}	5×10^{-9}
2,4,5-TP (Silvex)	0.05	0.05	0.001

All organic chemicals require testing using standard laboratory chemical methods including gas chromatography (GC), gas chromatography/mass spectrometry (GC/MS), liquid chromatography (LC), and immunoassay. GC methods are the least expensive while GC/MS methods generally provide the most reliable data. While the analysis of organic chemicals is generally conducted in the laboratory, GC and CG/MS based instruments are now portable to allow measurements to be made in the field. However, the costs for both portable systems and laboratory analysis for either GC or GC/MS analysis are comparable, principally because the maintenance costs are quite high for portable systems. In addition, miniaturizing of GC and GC/MS instruments has been proposed to allow for direct measurements of organic chemicals in water; however, general application of such instrumentation is well into the future. LC methods are used to test for certain polar, water soluble chemicals such as the pesticide oxamyl.

Immunoassay analysis is relatively new for chemicals in the water environment. It is a biochemical technique performed in a laboratory setting where an antibody (a protein) is used to quantitatively measure a chemical such as a drug, hormone, or a pesticide. Immunoassay techniques have been approved for two herbicide chemicals, atrazine and simazine.

6.3.3 Disinfectant and Disinfection Byproducts

Disinfectants and disinfection byproducts (DBP) are regulated under the various Surface Water Treatment Rules and the Disinfectant/Disinfection Byproducts Rules. There are 11 regulated DBP chemicals. The total trihalomethane (TTHM) is a summation of the following chemicals: bromodichloromethane, bromoform, chloroform and dibromochloromethane, and the haloacetic acids five (HAA5) is a summation of monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid and dibromoacetic acid. DBP are listed in Table 6-4 along with their respective MCL and DLR. The disinfectants are listed in Table 6-5. The limits for these disinfectants are defined as maximum residual disinfectant levels (MRDL), which are similar to MCL.

Table 6-4: Disinfection Byproducts MCL and DLR

Disinfection Byproduct	State Water Board MCL (mg/L)	USEPA MCL (mg/L)	State Water Board DLR (mg/L)
Total trihalomethanes (TTHM)	0.080	0.080	
Bromodichloromethane	Not Established	Not Established	0.0010
Bromoform	Not Established	Not Established	0.0010
Chloroform	Not Established	Not Established	0.0010
Dibromochloromethane	Not Established	Not Established	0.0010
Haloacetic acids (five) (HAA5)	0.060	0.060	
Monochloroacetic Acid	Not Established	Not Established	0.0020
Dichloroacetic Acid	Not Established	Not Established	0.0010
Trichloroacetic Acid	Not Established	Not Established	0.0010
Monobromoacetic Acid	Not Established	Not Established	0.0010
Dibromoacetic Acid	Not Established	Not Established	0.0010
Bromate	0.010	0.010	0.0050 0.0010[1]
Chlorite	1.0	1.0	0.020

1. For analysis performed using USEPA Method 317.0 Revision 2.0, 321.8, or 326.0

Table 6-5: Maximum Residual Disinfectant Level

Disinfectant Residual	State Water Board MRDL (mg/L)	USEPA MRDL (mg/L)
Chlorine	4.0 (as Cl_2)	4.0 (as Cl_2)
Chloramines	4.0 (as Cl_2)	4.0 (as Cl_2)

Disinfectant Residual	State Water Board MRDL (mg/L)	USEPA MRDL (mg/L)
Chlorine dioxide	0.8 (as ClO_2)	0.8 (as ClO_2)

The analysis of disinfectant residuals and DBP in water varies depending on the chemical and location throughout the distribution system. For example, with regard to the DBP, the TTHM are categorized as VOC and the methods of analysis are similar to those VOC listed in Table 6-2. In contrast, the haloacetic acids (HAA5) are considered non-volatile chemicals and, therefore, are subject to a different analysis. The same is true of bromate and chlorite.

Disinfectant residuals can vary dramatically across the distribution system, and will vary based on time. The most common approach is to analyze the disinfectant residual at a treatment facility, using a detector that continuously measures the residual level. The accuracy of the detectors is periodically checked against water samples analyzed in the laboratory. In locations where a disinfection residual analyzer is not installed, a field kit can be used to measure disinfection residual levels. These kits are similar to those used to measure disinfectant residuals in swimming pools.

6.3.4 Radionuclides

Radionuclides that are regulated in drinking water include the naturally-occurring uranium, radium-226 (a decay product of uranium-238), radium-228 (a decay product of thorium-232), tritium (hydrogen-3, which can also be produced by human activities), and strontium-90, a product of human activities related to nuclear fission. There are also two additional regulated constituents, gross alpha particle activity and gross beta particle activity, that are measures of the level of general radioactivity of water supplies and serve as screening standards to determine whether additional measurements of radioactivity are required.

Radioactivity is expressed in terms of picocuries per liter (pCi/L), for gross alpha particle activity, radium, and uranium (Table 6-6). For gross beta activity, tritium, and strontium, the standard is based on the levels of radioactivity that will deliver a certain annual exposure or dose, in millirems per year, to particular tissues or organs (Table 6-7).

Table 6-6: Radionuclides (Primary) MCL and DLR

Radionuclide	State Water Board MCL	USEPA MCL	State Water Board DLR
Radium-226	5 pCi/L (combined radium-226 & -228)	5 pCi/L (combined radium-226 & -228)	1 pCi/L
Radium-228	5 pCi/L (combined radium-226 & -228)	5 pCi/L (combined radium-226 & -228)	1 pCi/L

Radionuclide	State Water Board MCL	USEPA MCL	State Water Board DLR
Gross Alpha particle activity (excluding radon and uranium)	15 pCi/L	15 pCi/L	3 pCi/L
Uranium	20 pCi/L	30 µg/L	1 pCi/L

Table 6-7: Radionuclides (Vulnerable) MCL and DLR

Radionuclide	State Water Board MCL	USEPA MCL	State Water Board DLR
Beta/photon emitters	4 millirem/year annual dose equivalent to the total body or any internal organ	4 millirem/year annual dose equivalent to the total body or any internal organ	Gross Beta particle activity: 4 pCi/L
Strontium-90	8 pCi/L (= 4 millirem/yr. dose to bone marrow)	8 pCi/L (= 4 millirem/yr. dose to bone marrow)	2 pCi/L
Tritium	20,000 pCi/L (= 4 millirem/yr. dose to total body)	20,000 pCi/L (= 4 millirem/yr. dose to total body)	1,000 pCi/L

The current analytical methods consist typically of a sample preparation component and a radioactivity counting component (the concentration of radioactivity is determined by "counting" the emissions emanating from the particular radionuclide). Sample preparation is time consuming and can only be performed in a certified laboratory. After the initial sample preparation, counting requires sophisticated instruments that are expensive and must be well maintained.

Gamma-ray counters can be used effectively in the field for gamma (photon) emitters. Prolonged counting periods allow for achieving the desired detection limits for certain radionuclides. USEPA and other emergency responders for radionuclide emergencies rely on gamma counting for initial screening.

Strontium-90 and tritium are pure beta emitters that do not lend themselves to gamma counting.

6.3.5 Microbial Analysis

Historically, drinking water has been analyzed for the coliform group of bacteria as an indicator of water quality. Coliform bacteria are present throughout the environment while a specific subgroup, fecal coliform bacteria, are found in the intestinal tract of warm-blooded animals. Therefore, the presence of either total coliform bacteria or fecal coliform bacteria has been considered an indication that water is potentially contaminated by human or animal wastes and that pathogenic microbes may also be present.

State and federal regulations now require monitoring of additional indicator organisms, including *Escherichia coli* (*E. coli*), enterococci, and coliphage; monitoring of distribution systems for heterotrophic bacteria may also be required.

The use of indicator organisms is a valuable tool in the assessment of drinking water quality and the protection of public health. Their use provides timely results, affordability, and wide-spread analytical capability, either in commercial laboratories or by use of innovative test kits, as mentioned below.

Test kit methods such as Colilert, Colisure, Coliblue, E*Colite, and Enterolert have been developed for coliforms and enterococci. These innovative testing methods are rapid and are comparable in cost to usual laboratory methods. Thus, they offer a tangible and immediate benefit to small water systems, and an ease of the burden of required water testing.

When the use of indicator organisms is inadequate or when more information is needed, specific testing for pathogens is required. The parasitic protozoans *Cryptosporidium* and *Giardia* are regulated pathogens, and have requirements for testing that apply to certain PWS that use surface water sources.

More extensive, pathogen-specific testing is time consuming and expensive, owing to the required specialized equipment and laboratory expertise, and is impractical for routine monitoring of water supplies by PWS and their commercial laboratories. Therefore, testing for pathogens associated with water-borne disease, such as viruses (including adenovirus, rotavirus, norovirus), bacteria (including *E. coli O157:H7*, *Legionella*, *Campylobacter*), or parasitic organisms beyond *Cryptosporidium* and *Giardia* is limited. Generally, such specific testing occurs in academic research, or by public health officials in follow-up studies related to waterborne disease outbreaks (https://www.cdc.gov/healthywater/surveillance/index.html).

Recently the State Water Board, as part of its development of regulations for direct potable reuse, has funded research into monitoring and determining levels of pathogens in wastewater, as well as the feasibility of collecting pathogen data in wastewater during disease outbreaks. Because raw wastewater will serve as the source of drinking water in direct potable reuse, such research on pathogen monitoring, anticipated to be completed in 2021, will provide information that will contribute to the protection of public health. Information on this and other related research is available at the State Water Board's Regulating Direct Potable Reuse website, (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/direct_potable_reuse.html).

6.3.6 Lead and Copper Monitoring

The inorganic chemicals lead and copper are regulated differently than other contaminants, in that it they have action levels, which are based on monitoring taken from a sampling of a number of household taps and a statistical analysis of the results, instead of monitoring at the source or within the PWS distribution system. The different regulatory approach reflects concerns about lead and copper that may be associated with their release from pipes, fixtures, and plumbing connections.

The methods used to analyze for lead and copper are the same as those applied to other inorganic chemicals as previously described. As indicated these methods require sophisticated instrumentation such as inductively coupled plasma/mass spectrometry (ICP/MS) and atomic adsorption spectrophotometry and the analyses are carried out by qualified laboratories certified by ELAP. The action levels are not to be exceeded in more than 10 percent of samples taken during a required sampling period. The regulatory action levels for lead and copper are 0.015 mg/L and 1.3 mg/L respectively, and their respective DLRs are 0.005 mg/L and 0.050 mg/L. A detailed discussion of lead and copper issues can be found in Chapter 3.

6.4 UNREGULATED CHEMICAL MONITORING

6.4.1 USEPA Unregulated Chemical Monitoring Requirements (UCMR)

As part of the federal drinking water program, USEPA periodically identifies chemicals and other contaminants that will be subject to monitoring to determine whether regulation of those contaminants may be appropriate. A select number of PWS monitor for the UCMR analytes using laboratories and methods identified by USEPA and submit data to USEPA. California PWS that are selected for UCMR monitoring also submit their findings to the State Water Board. Testing for UCMR chemicals is done by laboratory methods, often by a limited number of laboratories. There have been several rounds of UCMR testing (see Appendix 4), as follows.

UCMR 1 included monitoring requirements for certain PWS for 25 contaminants for a specific time period from 2001 through 2003. Included in the UCMR 1 contaminants were molinate, methyl tert-butyl ether (MTBE), and perchlorate, three contaminants for which California MCL have been established. The MCL for molinate was adopted in 1989, the MCL for MTBE, in 2000 (and a secondary MCL for taste and odor in 1999), and the MCL for perchlorate, in 2007. USEPA has not yet established federal MCL for any contaminants from UCMR 1.

UCMR 2 included monitoring requirements for certain PWS for 25 contaminants for a specific time period from 2008 through 2010. Included in UCMR 2 is n-nitrosodimethylamine (NDMA), a nitrosamine discussed in Chapter 3, and a contaminant for which a PHG was requested by the CDPH drinking water program (now DDW) and received from OEHHA. No federal MCL have yet been established for any contaminants from UCMR 2.

UCMR 3 included monitoring requirements for certain PWS for 30 contaminants for a specific time period from 2013 through 2015. UCMR 3 included hexavalent chromium, for which a California MCL was established, effective July 1, 2014, but repealed in May 2017, as a result of its invalidation by a superior court judge, who determined that the California Department of Public Health (then home to DDW) "failed to properly consider the economic feasibility of complying with the MCL”. Also included in UCMR 3 is 1,2,3-trichloropropane (1,2,3-TCP); the California MCL for 1,2,3-TCP was adopted by the State Water Board in 2017. Another UCMR 3 contaminant, 1,4-dioxane, is one for which DDW has a notification level. Additionally, UMCR 3 included six PFAS compounds (PFOS, PFOA, PFNA, PFHxS, PFHpA and PFBS). DDW has notification levels for PFOS and PFOA, Hexavalent chromium, 1,2,3-TCP, 1,4-dioxane and PFAS are discussed further in Chapter 3.

UCMR 4 includes monitoring for certain PWS for 30 contaminants for a specific time period from 2018 through 2020. Included in UCMR 4 are 10 cyanotoxin chemical contaminants; these toxins can be of concern in areas of blooms of cyanobacteria (blue-green algae) (see Chapter 3). Also included are several pesticides, disinfection byproducts, alcohols, and metals. Among the metals is manganese, also discussed in Chapter 3.

Prior to UCMRs 1 through 4, testing was done by states, and referred to by USEPA as UCM-States Rounds 1-2 (1988-1997). Several thousand California PWS participated in these earlier sampling studies. Many of the chemicals from the earlier sampling programs are included in the regulated contaminants presented above.

For more information, see USEPA’s UCMR Program website (http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/).

6.4.2 Unregulated Chemical Monitoring in California

There are several specific chemicals that are presently unregulated but have been found to be present in drinking water sources in California. For example, in the early 2000s California water systems sampled for nine chemicals under the State’s unregulated chemical monitoring requirement The results of that monitoring eventually resulted in MCL for perchlorate in 2007, hexavalent chromium in 2014 and 1,2,3-TCP in 2017 (for more information see the State Water Board’s website on prior unregulated chemical monitoring)

In the 2015 Safe Drinking Water Plan, 1,2,3-TCP was identified as an unregulated contaminant in California drinking water. As mentioned above, 1,2,3-TCP’s MCL was adopted by the State Water Board in 2017. Another unregulated contaminant of interest is N-nitrosodimethylamine (NDMA), which is mentioned above, and which has been found to occur in some drinking water supplies, often as a byproduct of disinfection. NDMA appears to be a good candidate for monitoring under a new unregulated chemical monitoring regulation, in order to supplement data collected under the federal UCMR 2, as well as sampling data collected thus far by California PWS on a voluntary basis.

NDMA, like 1,2,3-TCP, requires testing using sophisticated instrumentation and analytical methods by qualified laboratories particularly given the need, based on potential public health concerns, to measure the presence of these chemicals at very low detection levels (part per trillion levels).

Perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), discussed in Chapter 3, are now being addressed in terms of sampling and analysis of environmental water and drinking water supplies. They, too, require sensitive analytical methods by qualified laboratories, as described on the State Water Board's PFAS website (https://www.waterboards.ca.gov/pfas/).

New and emerging contaminants are unregulated and may be new contaminants or those that may have been present but not detected. Methods for testing of constituents of emerging concern (CEC), which are discussed in Chapter 3, are also very sophisticated and are conducted by only highly qualified laboratories. In many cases the numbers of CEC can be substantial, which increases analytical work as the suite of potential chemicals present are not detected by just one or even two methods. In addition, methods development is still ongoing, particularly at the federal level. A description of the research activities being undertaken on methods development by USEPA are available online (http://www.epa.gov/ppcp/work2.html).

As a result, PWS do not routinely monitor for CEC except as required by UCMR provisions (Appendix 4) or where sources have been found to be contaminated by certain unregulated chemicals. Where an unregulated chemical contaminant has an associated Notification Level (NL), PWS with affected sources will routinely monitor for the chemical to ensure the NL is not exceeded. Exceeding a NL carries certain notification requirements, which are defined in law (Health & Safety Code Section 116455).

For projects that involve providing supplemental sources of drinking water through indirect potable reuse, there are monitoring requirements that ensure that all drinking water standards and applicable advisory notification levels are met and also that ensure that various treatment processes are functioning as they should. These monitoring requirements focus on indicator constituents that are representative of families or groups of chemicals, and enable determinations to be made relative to the effectiveness of chemical removal. The monitoring requirements for water recycling projects that supplement groundwater and surface water sources can be found at the Division of Drinking Water's water recycling webpage (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RecycledWater.html)

In addition, the State Water Board, as part of the Water Quality Control Policy for Recycled Water, has established monitoring requirements for CEC in recycled water used for groundwater recharge or reservoir water augmentation. The requirements include monitoring for health-based and performance indicator CEC, surrogates for CEC and bioanalytical tools for CEC. The complete description of the requirements are contained in Attachment A of the Water Quality Control Policy for Recycled Water.

To address other concerns related to monitoring recycled water used for drinking water, the State Water Board has embarked on research studies to specifically address monitoring. In 2018, for example, the State Water Board funded the following studies for consideration:

- Monitoring pathogens in raw wastewater to develop better empirical data on their concentrations and variability;
- The feasibility of collecting raw wastewater pathogen concentration data associated with community outbreaks of disease;
- Development of more comprehensive analytical methods to identify unknown contaminants, particularly low molecular weight compounds potentially in wastewater that may not be removed by advanced treatment and may not be detectable by current regulatory monitoring approaches.

6.5 MONITORING IN REAL-TIME, FIELD TEST KITS, AND PORTABLE TESTING

Portable testing equipment has become a key element of compliance in remote treatment facilities. Some chemical analyses, mostly for process monitoring, can be carried out in real-time in the field. The monitoring systems can provide continuous data on concentration of the specific chemical in water supplies. The chemicals that can be monitored in this way are presently limited. Examples of those that can be monitored in real-time include nitrate, fluoride, specific conductance, and chlorine residual. In addition, there are devices that can continuously monitor surrogate parameters such as turbidity, an indicator of the amount of particulate material and total organic carbon (TOC), and specific ultraviolet absorbance, which are indicators of the concentration of certain organic material. Additionally, as the technology improves total fluorescence may be used as a surrogate for demonstrating that treatment is effective in removing organic chemicals. Although these devices are generally cost-effective, they do require attendant telemetry systems to view and store the data and they must be maintained and periodically calibrated to ensure the data generated are accurate.

Several manufacturers have developed field test kits that allow for analyses of specific chemicals and groups of chemicals. The tests kits are principally designed to be used in response to emergencies including contamination events and terrorism. These analyses can provide results within a short period of time.

There has been continued progress in making sophisticated portable instrumentation such as GC and GC/MS systems. The portability of these devices has allowed for mobility of sophisticated laboratory analysis-particularly for organic chemicals. In general, both portable GC and GC/MS instruments serve as screening devices to detect the presence and concentration of organic chemicals with more detailed analyses being carried out in a fixed laboratory setting as necessary. It is expected that developments will continue.

6.6 EMERGENCY DRINKING WATER TESTING

Natural disasters such as earthquakes, wildfires, levee breaks, and other flood-related events can occur at any time in California. Water systems supplying water to communities are highly susceptible to these events. Generally, the biggest threat to water systems is bacterial contamination, however chemical contaminants have presented threats in some occasions- such as VOC in the 2018 wildfire in Paradise, California. Typically, the affected system's ability to provide drinking water can be restored in a relatively short time period.

On the other hand, if a natural disaster or terrorism event disrupted a water supply, and if reports of sick and/or dying consumers were evident, an entirely different and urgent response would be needed.

Since the agent causing harm may be a chemical, microbe, or radionuclide, broad screening methods will need to be used to identify the contaminant(s). In order to coordinate the proper collection of pertinent samples and report the findings to DDW in a timely manner, the voluntary California Mutual Aid Laboratory Network (CAMALNet) was established. The key participants are the larger water purveyors in California with testing capabilities and the CDPH Drinking Water and Radiation Laboratory. The following are the key purposes of CAMALNet:

1. Identify and develop relationships with laboratory directors.
2. Assess and document testing capabilities at each laboratory.
3. Maintain an inventory of equipment that may be put to use at short notice for non-routine testing.
4. Maintain an inventory of laboratory certification statuses for each laboratory by analytical method.
5. Maintain standardized sampling kits for use in an emergency. These kits are known as the Emergency Water Quality Sampling Kits (EWQSK).
6. Provide training and maintain readiness to collect samples using standardized sampling protocols.
7. In responding to an event, establish immediate contact among pertinent CAMALNet participants and agree on the most effective method to transport samples to the testing laboratory.
8. Perform periodic performance testing (PT) for unregulated and novel chemicals on PT samples supplied by the CDPH Drinking Water and Radiation Laboratory.

9. Set up protocols for the dissemination of laboratory findings to responsible parties as agreed.

In a terrorism incident, a perpetrator likely will not use a contaminant that is regulated under existing statutes. Consequently, testing for these agents may be complex and time-consuming. The challenge for laboratories responding to these events is to develop analytical methods that will allow rapid and unambiguous identification of the agent.

6.7 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Analytical methods used to monitor for contaminants in drinking water continue to evolve with new methods continuing to be developed. Although efforts have been made in reducing cost of analyzing the majority of contaminants that may be present in drinking water, to date, there has been limited success in developing less expensive methods. The successes that have occurred are in testing for chemicals that have been regulated over a long period of time at higher levels. An example of a major advancement in monitoring abilities is the development of inexpensive techniques to continuously monitoring surrogates such as total organic carbon, total fluorescence, as well as individual chemicals such as nitrate.

New chemicals or contaminants of emerging concern (CEC) generally associated with pharmaceuticals and personal health care products do not lend themselves to being detected and measured by less sophisticated methods/instrumentation. Most of these chemicals are highly water soluble and are generally found at low levels (parts per trillion) in drinking water sources, owing to their releases into the environment, principally via wastewater. Because the health effects, if any, of these chemicals are not known to occur at the low levels currently found in drinking water supplies, analytical methods should be sufficiently sensitive to detect and quantify their presence in drinking water sources to ensure that they do not increase in concentration, and to enable regulators to identify those of greater concern, so that effective limits on wastewater releases can be effectuated, either through industrial or domestic source control programs or other treatment techniques. Laboratory accreditation by ELAP is an important part of ensuring that appropriate analytical methods are being followed and that data produced are of high quality.

Efforts to determine the presence of waterborne microbial pathogenic agents in drinking water sources will continue to require more sophisticated analytical methods. As a result, there will be a continued reliance on monitoring for indicator organisms including coliform bacteria and enterococci that require less expensive and easy to use methods.

The development of methods for monitoring microbes, CEC, and regulated chemicals will continue to be of importance for recycled water projects, both for indirect potable reuse of groundwater and surface water sources, as well as for possible direct potable reuse projects. Focus will likely be on real-time monitoring and results.

There is little indication that the development of less expensive and easy to use analytical methods that would be available to small water systems or to consumers is forthcoming. Given the nature of the vast majority of contaminants that are present in drinking water sources, research toward developing such methods seems unlikely.

Recommendations

6-1 Research should continue to be focused on analytical methods used by laboratories for testing of emerging pathogens and CEC, as well as field testing methods for regulated contaminants.

6-2 The State Water Board will consider adopting a regulation for statewide UCMR monitoring for chemicals of public health concern, including NDMA and certain other CEC discussed in Chapter 3, to evaluate the extent of their presence in drinking water supplies. The results of UCMR monitoring will be used in determining whether a drinking water standard (MCL) is appropriate for a particular drinking water contaminant.

References

State Water Board's Human Right to Water Portal (https://www.waterboards.ca.gov/water_issues/programs/hr2w/)

State Water Board's Drinking Water Watch (https://sdwis.waterboards.ca.gov/PDWW/)

State Water Board's Information on Hexavalent Chromium website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chromium6.html)

State Water Board's Information on a Prior Unregulated Contaminant Monitoring Requirement website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/UCMR.html)

State Water Board's Information on Chemical Contaminants in Drinking Water website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.html)

State Water Board's Regulating Direct Potable Reuse website, (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/direct_potable_reuse.html)

State Water Board's Unregulated Chemicals Requiring Monitoring website (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/UCMR.html)

State Water Board's Per- and Polyfluoroalkyl Substances (PFAS) website (https://www.waterboards.ca.gov/pfas/)

State Water Board Division of Drinking Water's Recycled Water Information (https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/RecycledWater.html)

State Water Board Water Quality Control Policy for Recycled Water, December 2018 (https://www.waterboards.ca.gov/board_decisions/adopted_orders/resolutions/2018/121118_7_final_amendment_oal.pdf)

State Water Board Environmental Laboratory Accreditation Program (ELAP) website (https://www.waterboards.ca.gov/drinking_water/certlic/labs/)

State Water Board ELAP's Regulations website (https://www.waterboards.ca.gov/drinking_water/certlic/labs/elap_regulations.html)

Centers for Disease Control and Prevention Waterborne Disease & Outbreak Surveillance Reporting website (https://www.cdc.gov/healthywater/surveillance/index.html)

My Water Quality (https://mywaterquality.ca.gov/safe_to_drink/)

USEPA's Methods Approved to Analyze Drinking Water Samples to Ensure Compliance with Regulations (http://water.epa.gov/scitech/drinkingwater/labcert/methods_index.cfm)

USEPA's Certification of Laboratories that Analyze Drinking Water Samples to Ensure Compliance with Regulations website (https://www.epa.gov/dwlabcert)

USEPA's Monitoring the Occurrence of Unregulated Drinking Water Contaminants website (https://www.epa.gov/dwucmr)

USEPA's Research website (https://www.epa.gov/research)

CHAPTER 7 TREATMENT TECHNOLOGY AND HEALTH RISK REDUCTION

7.1 INTRODUCTION

Public water systems often use treatment technologies to ensure compliance with primary drinking water standards. Treatment technologies vary widely in complexity and cost. The most common treatment technology is a disinfection process used to help ensure the microbiological safety of the drinking water delivered to customers. Beyond simple disinfection treatment, more advanced treatment technologies are used to comply with primary drinking water standards and to address secondary drinking water standards including reduction of constituents such as iron and manganese as well as taste and odor compounds.

Table 7-1: PWS Existing Treatment Facilities November 2020

System Size (service Connections)	Number of Systems	Number of Groundwater Treatment Facility	Number of Surface water Treatment Facility
<200	3,170	4,777	1,904
200 to 999	471	941	1,020
1,000 to 10,000	437	1,041	1,354
>10,000	190	517	1,613

Error! Reference source not found. includes all PWS treatment facilities, including disinfection. Approximately half (47 percent) of the treatment facilities are for precautionary disinfection, which can be operated by either a T1 or D1 certified operator.

This Chapter discusses current treatment technologies used to meet drinking water standards as well as related issues and trends. The California SDWA prescribes enforceable primary standards for five major categories of drinking water contaminants consisting of Inorganic Chemicals, Organic Chemicals, Radionuclides, Microorganisms, Disinfectants and Disinfection Byproducts. A complete listing of these regulated contaminants is presented in Appendix 3 with their corresponding applicable MCL or Treatment Techniques (TT). In addition, regulations identify the best available treatment technologies applicable to these contaminants.

Individual treatment technologies are designed to be effective in removing or reducing specific contaminants including particulate, chemical, and biological contaminants. Depending on the type of contaminants present in the source water, one or a combination of treatment technologies may be applied. Relative to surface water sources, groundwater sources are more likely to contain chemical contaminants at levels of concern or above an MCL. Surface water sources are more prone to biological contaminants and must be filtered to remove particulate matter and microbes. All surface water sources require disinfection treatment to make the water microbiologically safe for human consumption. Some groundwater sources require disinfection to ensure the microbiological quality of the water. A disinfectant residual is maintained to ensure the safety of the water as it is distributed to customers.

Technologies used for reducing and/or removing biological contaminants include disinfection and filtration treatment processes. Technologies used for particulate or turbidity removal include filtration treatment processes. A variety of treatment technologies are used to reduce chemical contaminants. The following sections describe the major technologies used to address these contaminants.

7.2 BIOLOGICAL CONTAMINANT REDUCTION/REMOVAL TECHNOLOGIES

7.2.1 Disinfection

Disinfection is a treatment process that reduces pathogenic microorganisms in water through inactivation. Disinfection is required by the Surface Water Treatment Rule (SWTR) for all public water systems that obtain their water from surface water or from groundwater under the direct influence of surface water. In addition, these public water systems must maintain a disinfectant residual within the distribution system. Disinfection is also required by the Groundwater Rule (GWR) for some biologically contaminated water sources. Disinfection is provided by chlorination, chloramination, chlorine dioxide, ozonation, or ultraviolet (UV) light.

7.2.1.1 Chlorination

Chlorination is the most common method used for disinfection. There are a number of methods of delivery and chemical reactions utilized for chlorination. These include sodium hypochlorite solution or calcium hypochlorite tablets/pellets or chlorine gas. Most of these chemicals are made offsite at factories but sodium hypochlorite solution can also be produced onsite. The goal of all these methods is to produce a hypochlorite solution that is an effective disinfectant.

7.2.1.2 Chloramination

Chloramines are commonly used when the water supply is prone to produce high levels of disinfection byproducts (DBP), such as trihalomethanes or haloacetic acids, when chlorination is utilized. It may also be used for very large distribution systems in which hypochlorite can dissipate away, due to chloramines' greater stability. Chlorine and ammonia are combined to produce chloramines (monochloramine or dichloramine), which do not produce as many DBP.

7.2.1.3 Chlorine Dioxide

Chlorine dioxide is made by reacting sodium chlorite with sodium hypochlorite or with hydrochloric acid. Chlorine dioxide is a gas that reacts with the source water to be disinfected. Chlorite is a byproduct of this process and is regulated as a DBP. In California, there is minimal use of this treatment process.

7.2.1.4 Ultraviolet (UV) Light

UV light can be used to disinfect contaminated water. UV light penetrates the cell walls of a microorganism, which disrupts its genetic material causing inactivation of the microorganism. A special lamp generates the radiation that creates UV light by striking an electric arc through a lamp filled with mercury vapor. Drinking water applications generally use low pressure and medium pressure mercury vapor lamps. These lamps emit a broad spectrum of radiation. Low pressure UV lamps emit radiation with intense peaks at UV wavelengths of 253.7 nanometers (nm) and a lesser peak at 184.9 nm. Research has shown that the optimum UV wavelength range to destroy pathogens is between 250 and 270 nm. At shorter wavelengths (for example 185 nm), UV light is powerful enough to produce ozone, hydroxyl, and other free radicals that destroy pathogens.

7.2.1.5 Ozonation

Ozone is a colorless, very unstable gas that is effective as an oxidizing agent and disinfectant. It is effective in killing pathogens and oxidizing taste and odor and DBP precursor compounds with a relatively short exposure time. Since the gas is unstable and has a very short life, ozone generators must be used to produce ozone gas onsite. A DBP that is formed during ozonation is bromate, which is regulated.

7.3 FILTRATION

Filtration is used as the primary treatment for reduction and removal of particulate matter in surface water or of groundwater under the direct influence of surface water. With few exceptions, filtration is required by the Surface Water Treatment Rule (SWTR) for all public water systems that obtain their water from surface water or from groundwater under the direct influence of surface water.

7.3.1 Conventional Filtration

This process consists of the addition of coagulant chemicals, mixing, coagulation-flocculation, sedimentation and clarification, and filtration. The media used in the filtration process can be single media (for example sand) or dual media (for example anthracite and silica sand), or multimedia (for example anthracite, silica sand and garnet).

7.3.2 Direct Filtration

This process is similar to conventional filtration without the sedimentation and clarification step. It is suitable only for consistently low turbidity waters.

7.3.3 Slow Sand Filtration

In this process, untreated water percolates slowly down through a layer of fine sand, then through a layer of gravel, and ultimately collects in a system of underdrains. A biological layer of "schmutzdecke" forms on the surface of the sand, trapping small particles and microbes. The schmutzdecke also helps to degrade organic material in the water. Slow sand filtration requires a large surface area to accommodate the slow percolation rate and, thus, is suitable only for settings where lower volumes of treated water are needed.

7.3.4 Diatomaceous Earth (DE)

This process, also known as pre-coat or diatomite filtration can be used to directly treat low turbidity raw water supplies or chemically coagulated, more turbid water sources. DE filters consist of a pre-coat layer of DE, approximately 1/8 inch-thick, supported by a septum or filter element.

7.3.5 Advanced Filtration: Membrane Filtration

This is a pressure-driven separation process in which particulate matter larger than 1-micrometer is rejected by an engineered barrier, primarily through a size-exclusion mechanism and which has measurable removal efficiency for a target organism that can be verified through the application of a direct integrity test. The membranes can be spiral wound or made of hollow fibers. Some common types of membrane filtration are microfiltration, which employs membranes with a pore size range of approximately 0.1-0.2 micrometers (nominally 0.1 micrometers), ultrafiltration, which employs membranes with a pore size range of approximately 0.01 – 0.05 micrometer (nominally 0.01micrometers), and nanofiltration, which employs membranes with a pore size of approximately one nanometer.

Reverse Osmosis (RO) is another membrane filtration process. RO uses hydraulic pressure to oppose the liquid osmotic pressure across a semi-permeable membrane, forcing the water from the concentrated solution side to the dilute solution side. The RO membrane allows the passage of the solvent (water) but not particulate matter. RO can effectively remove virtually all particulates from water. including arsenic, barium, cadmium, chromium, radium, natural organic substances, pesticides, and microbiological contaminants. RO produces demineralized water as well as a brine residual for which proper disposal is required.

7.3.6 Oxidation Filtration

This process consists of first oxidizing the water, then filtering out the precipitate. This treatment method is commonly used for groundwater for the removal of arsenic, iron and manganese. Oxidation is most commonly done with the addition of chlorine, although other oxidizing chemicals can be used. Filtration media may be selective, for example greensand.

7.4 CHEMICAL CONTAMINANT REDUCTION/REMOVAL TECHNOLOGIES

Chemical contaminants are commonly removed using ion exchange, sorption technologies and membranes. This section provides a brief overview of these technologies along with other treatment technologies that are used to remove chemical contaminants in drinking water.

7.4.1 Ion Exchange (IX)

IX involves the selective removal of charged inorganic species from water using an ion-specific resin. The surface of the ion exchange resin contains charged functional groups that hold ionic substances by electrostatic attraction. As water containing undesired ions passes through a column of resin beds, charged ions on the resin surface are exchanged for the undesired species in the water. The resin, when saturated with the undesired species, is regenerated with a solution of the exchangeable ion (USEPA, 1998b). Generally, resins can be categorized as anion exchange or cation exchange resins. Anion exchange resins selectively remove anionic species such as nitrate (NO_3^-), sulfate (SO_4^{2-}), or fluoride (F^-) and exchange them for hydroxyl (OH^-) or chloride (Cl^-) ions. Cation exchange resins are used to remove undesired cations such as cadmium (Cd^{2+}) or barium (Ba^{2+}) from water and exchange them for hydrogen ions (H^+), sodium ions (Na^+) or potassium ions (K^+).

The pH of the source water is important when employing IX resins. For example, uranium exists in water at pH levels of 6.0 and higher as a carbonate complex, which is an anion, and has a strong affinity for anion resin in the chloride form. The process is effective on water with a pH of up to 8.2. A higher pH could result in uranium precipitation; a lower pH changes the nature of uranium to non-ionic and/or cationic species, which would prevent the exchange reaction from operating efficiently. It is advisable to control the inlet water pH to above 6.0. Sudden pH changes to below 5.6 can cause the resin to release previously removed uranium off the resin.

7.4.2 Sorption Technologies

Adsorption involves the removal of ions and molecules from solution and concentrating them on the surface of adsorbents. Adsorption is driven by the interfacial forces of the ions and the adsorbent. Adsorption media employed at drinking water plants include granular activated carbon (GAC), activated alumina, and iron media. Sorption technologies are used for the removal of organics including disinfection byproduct precursor compounds, compounds contributing to objectionable taste and odor, and inorganic contaminants such as arsenic.

7.4.3 Reverse Osmosis (RO)

In addition to removing particulate matter, RO is used to remove dissolved contaminants (solutes) from water. RO can effectively remove nearly all contaminants from water including arsenic, barium, cadmium, chromium, radium, natural organic substances, and pesticides. RO produces demineralized water as well as a brine residual for which proper disposal is required.

7.5 OTHER TECHNOLOGIES

7.5.1 Aeration Technologies

Aeration technologies are typically used for removal of volatile organic compounds or radon and for removal of excess carbon dioxide. Aeration involves the contacting of the water with air wherein the target chemical is transferred from the water to the air stream. There are a number of methods used for the mixing of air and water including packed aeration towers, shallow tray air strippers, mechanical aeration, and spray aeration.

7.5.2 Softening

Softening is used to remove calcium and magnesium ions from water. Types of technologies used include ion exchange, chemical flocculation, and precipitation.

7.5.3 Electrodialysis

Electrodialysis (ED) is less commonly used for chemical removal. It is a process in which ions are transferred through ion-selective membranes by means of an electromotive force from a less concentrated solution to a more concentrated solution. ED is very effective in removing fluoride and nitrate, and can also remove barium, cadmium, and selenium.

7.5.4 Sequestration

Sequestration is a chemical combination of a chelating agent and metal ions which will form a soluble complex. Sequestering does not remove the metal ion from the water, it prevents the metal ion from oxidizing and will keep it in solution. Commonly this treatment is used for iron, manganese and for corrosion control.

7.5.5 Biological Treatment

Biological treatment relies on bacteria or other small organisms to breakdown disinfection by-product precursors, organic, or inorganic drinking water contaminants through normal biological processes. It is a complex process and the biological mechanisms at work are not completely understood. Following or concurrently with biological treatment, filtration and subsequent disinfection treatment are needed to remove and inactivate the biomass.

In some conventional surface water filtration treatment plants, to reduce organic matter, GAC filter media is sometimes used in-place of traditional sand or anthracite media. GAC media provides high surface area that can be used to promote biological activity in the filter bed that can effectively reduce disinfection by-product precursors prior to the disinfection process.

In recent years, a few groundwater biological treatment plants have come on-line for the removal of inorganic and organic chemicals (such as nitrate, perchlorate and some organic chemicals.) At these treatment plants, biological reactors are used to create an anoxic environment (depleted of dissolved oxygen) with fixed or fluidized media beds, along with an electron donor (acetic acid is the most commonly used) and nutrients, that are necessary to facilitate the biological breakdown of contaminants to harmless constituents. For example, bacteria that convert ammonia to nitrite (nitrosomonas) can convert nitrate (NO_3^-) present in drinking water to nitrite (NO_2^-) with nitrogen gas (N_2) as the final product that can be released into the atmosphere. The same group of bacteria is also effective in converting perchlorate (ClO_4^-) biologically to chlorate (ClO_3^-), chlorite (ClO_2^-) with chloride (Cl^-) and oxygen (O_2) as the final products.

Biological treatment has the potential of becoming a cost-effective treatment technique due to its capability of addressing multiple contaminants at once and the cost saving related to the lack of a treatment residual that requires disposal. However, the complexity of biological treatment makes it unsuitable for many public water systems that lack the necessary technical, managerial, and financial capabilities to procure and operate this type of treatment.

7.5.6 POU/POE Treatment

In some cases, drinking water treatment methods such as point-of-use (POU) devices or point-of-entry (POE) devices may be appropriate for small water systems to use to provide safe drinking water at individual homes, businesses, or apartment buildings. Such water systems may not have the financial resources, technical ability, or physical space to own and operate centralized treatment plants.

POU devices are utilized at specific plumbing fixtures in a building/residence (for example at the kitchen faucet), treating only the water flowing from that fixture, and POE devices are installed in the water supply line just outside a building/residence, treating all water before entry. POU treatment is applied to reduce levels of certain groups of organic chemicals and inorganic chemicals and many other contaminants. However, POU treatment cannot be applied to microbial contaminants, volatile organic chemicals or radon. POE treatment is applied to reduce levels of organic and inorganic contaminants, turbidity, microorganisms including cysts, and many other contaminants. The same technologies used in treatment plants for community water systems can be used in POU/POE treatment.

The State Water Board adopted regulations for the use of POU/POE treatment in articles 2.5 and 2.7 of chapter 15 of division 4 of title 22 of the California Code of Regulations. The regulations impose specific conditions on the use of POU and POE devices to achieve compliance with drinking water standards. Only PWS with less than 200 service connections can use POU and POE devices, and only if the PWS demonstrates to the State Water Board that centralized treatment would be economically infeasible and the PWS has applied for financial assistance. An eligible PWS must submit to the State Water Board for approval a treatment strategy, operations and maintenance program, and monitoring program. Not unlike centralized treatment, POU/POE treatment requires ongoing maintenance, inspection, and both source water and effluent monitoring after installation. If the PWS is a community water system, a public hearing must be held to determine whether there is substantial community opposition to the use of POU or POE treatment. To be deemed in compliance with Safe Drinking Water Act requirements, the system must ensure that each building and dwelling unit has a POU or POE treatment device installed.

POU and POE treatment may be an attractive option for some small water systems to return to compliance; however, there are several factors that the water system should consider. Customer participation can be a major challenge to water systems selecting a POU compliance program because the water system must be able to access the household or place of business of each customer to install, test, and routinely maintain the POU device.

Guidance on the use of POU and POE by water systems is available from several sources:

A POU guidance document developed by the California Department of Public Health is available to assist water systems considering POU. This document is available here: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/pou/CaPOUCompliance-Final-03-2013.pdf

USEPA has produced two reports:

- "Investigation of the Capability of Point-of-Use/Point-of-Entry Treatment Devices as a Means of Providing Water Security," (February 2006) and
- "Point-of-Use or Point-of-Entry Treatment Options for Small Water Systems," (April 2006),

7.6 OVERALL ESTIMATED COST OF COMPLIANCE

Since the publication of the 2015 Safe Drinking Water Plan, one new primary drinking water standard with new MCL and monitoring requirements was adopted under the California SDWA: 1,2,3-trichloropropane (2017). Cost estimates for compliance with the MCL will be summarized in this section.

7.6.1 1,2,3-Trichloropropane

1,2,3- Trichloropropane (1,2,3-TCP) is a man-made chlorinated hydrocarbon. Historically, 1,2,3-TCP has been used as an industrial solvent, cleaning and degreasing agent, and paint and varnish remover. It has also been found as a component in soil fumigants. Since the 1950s, agricultural use of soil fumigants as pesticides and nematocides was prevalent in the United States. The presence of 1,2,3-TCP found in drinking water sources is attributed to various industrial and historic pesticide uses and leaching from hazardous waste sites. 1,2,3-TCP is predominately found in groundwater sources although it has also been detected in surface waters.

The estimated cost of compliance with the 1,2,3-TCP MCL was associated with monitoring and treatment. A total of 289 water sources were determined to be out of compliance affecting 103 water system. The total estimated annualized cost including monitoring and treatment was $33.9 million. A complete discussion of the estimated cost of compliance can be found as part of the 1,2,3-TCP rulemaking file at: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/SBDDW-17-001_123TCP_MCL_oal.html

7.6.2 Operation and Maintenance Costs Issues

Disadvantaged communities served by small water systems often struggle due to the lack of an adequate rate base and the lack of economies of scale. In addition to the usual operations and maintenance (O&M) costs of running a small community water system, some systems serving economically disadvantaged communities also require treatment. For many of these systems, the need to install, operate, and maintain a sophisticated treatment system requires a high degree of management oversight, financial capability, and technical capacity. Many small systems do not have these resources. A tradeoff between safe and affordable drinking water is unacceptable in view of California’s Human Right to Water policy. Often a desirable solution is consolidation with another water system, since that approach broadens the rate base and optimizes economies of scale. However, consolidation is not always feasible.

All treatment systems require upfront capital costs. Grant funding for capital costs is often available to a system serving an economically disadvantaged community if it can demonstrate an ability to afford ongoing O&M costs. The most common contaminants affecting groundwater sources of drinking water are arsenic and nitrate. The most common treatment systems for nitrate removal are ion exchange (IX) and reverse osmosis (RO). (Biological and chemical reduction methods may also be used for nitrate but are not commonly used in California, especially by small water systems.) The most common treatment systems for arsenic removal are adsorptive media, manganese dioxide media with the addition of ferric salts for oxidation and filtration, and RO.

Ongoing O&M costs for arsenic and nitrate treatment are especially high for several reasons. First, advanced levels of operator certification and proficiency are required for successful treatment, and costly sampling may also be required to ensure effectiveness of treatment. In addition, many treatment technologies use significant amounts of energy, generating large utility bills. Furthermore, many treatment technologies generate significant volumes of contaminated resins/media or brine waste (“residuals”) that are often not suitable for disposal at the local wastewater treatment plant and must be hauled off for proper disposal at a hazardous waste disposal facility, at significant costs. Finally, the on-going costs to purchase treatment system materials (chemicals, media, or resins) tend to be particularly high. Taken together, these treatment-related costs can surpass the community’s ability to pay, precluding them from providing safe drinking water to their residents. Although there are readily-available and affordable water treatment devices on the consumer market such as under the counter RO and IX units that are effective in removing arsenic and nitrates, the responsibility for providing safe drinking water still resides with the public water system. An example of how O&M costs for treatment of chemical and radiologic contaminants can affect public water systems of different sizes is the cost to comply with the 1,2,3-TCP MCL. The State Water Board notes a great disparity in its estimation that, on average, the annual cost of compliance for small water systems per service connection (less than 200 services connections) is $609 while the average annual cost per service connection for large water systems (greater than 200 service connections) is $25. Clearly, many small water systems do not have the economies of scale which help keep cost per service connection affordable.

7.7 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

For all contaminants that have MCL, there exist methods of treatment to achieve compliance. Almost all large- and medium-sized water systems that need treatment to meet an MCL have installed or are in the process of installing the necessary treatment systems. However, small water systems still face challenges in funding the installation and maintenance of necessary treatment facilities.

Funding for continued operations and maintenance can be problematic for small water systems since operational costs have traditionally been paid by the ratepayers of the PWS. With their small rate base and frequent disadvantaged community status, small water systems find it difficult to establish rates adequate to cover these operational costs. Many federal and state financial assistance sources are not available for operations and maintenance costs. Under these programs, water systems must demonstrate sufficient financial capacity to afford the operations and maintenance costs before they receive funding for capital costs of new treatment facilities. The lack of a sustainable revenue source to fund operations has been a major impediment to the construction of treatment facilities for small, disadvantaged systems, and the resulting incidence of continued noncompliance with drinking water standards among small water systems. Legislation signed by the Governor in 2019 (Chapter 120, Statutes of 2019, (SB 200)) makes available funding for operation and maintenance costs. This new funding source will help improve access to safe and affordable drinking water for disadvantaged communities served by small water systems.

Recommendations

7-1 Given that the high O&M costs of treatment for chemical and radiologic contaminants are unsustainable for many small water systems particularly those serving disadvantaged communities, the State Water Board will seek to implement different solutions to providing safe drinking water such as consolidation with larger water systems.

7-2 With the increase challenges in operating facilities that treat multiple contaminants, the State Water Board recommends special training programs to ensure operators are equipped to operate such facilities .

References

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CHAPTER 8 SUSTAINABILITY OF CALIFORNIA'S DRINKING WATER SYSTEMS

Sustainability often refers to the ability of public water systems to be operated and maintained to meet all statutory and regulatory requirements across the range of operating conditions. There are multiple challenges to the sustainability of public water systems. These include the small size of many of the community water systems, which leads to their inability to afford adequate staff and revenue to operate and maintain their systems; lack of "Technical, Managerial and Financial capacity" (TMF), which describes the skills and resources required to operate and maintain a public water system, and other outside challenges that put pressure on a system's ability to be resilient, including climate change impacts and lack of adequate source capacity.

Several key initiatives in the legislature and at the Water Boards continue to encourage and support efforts to move toward sustainability of all public water systems. These key initiatives are discussed in this chapter.

While this chapter focuses on public water systems, especially community water systems, other drinking water systems such as state small water systems and self-supplied individuals (through domestic wells, etc.) also need to ensure their sustainability. This chapter provides an overview of some of the challenges in water systems being sustainable, and provides recommended solutions to continue to move the needle toward ensuring that all water systems are sustainable in their efforts to provide safe water to all Californians.

8.1 PUBLIC WATER SYSTEM ORGANIZATIONAL STRUCTURES

The different governance structures have important implications for sustainability (details on the various organization structures are described in Chapter 2). For example, governmental structures impact legal requirements of each type of public water system and may result in multiple oversight agencies. Legal requirements such as budgeting, rate setting, board educational training, control of boundaries and planning, and public meeting notices are different based on the type of public water system and may affect sustainability.

Estimated Numbers of Public Water Systems by Type:

As of December 2018, there were approximately 2,900 community water systems and 4,500 non-community public water systems. UC Davis researchers, Kristin Dobbin and Amanda Fencl, have been engaged in reviewing and estimating the number of water systems by governance type. Table 8-1 below are excerpts from their September 2019 work, which can be found at California WaterBlog.

Table 8-1: Community Water Systems by Governance Types

Water System Type	Number of CWS	Median population served	Number of CWS with violations	Average Number of violations per CWS[6]
All CWS	2,895	287	854	2.27
Publicly Owned CWS	1,166	2,984	295	1.92
City[1]	317	22,795	80	1.43
County[2]	183	350	55	3.08
Joint Powers Authority	12	109,254	0	—
Independent Special Districts[3]	566	1,885	132	1.8
State and Federal[4]	88	2,200	28	2.36
Privately Owned CWS	1729	126	559	2.51
Investor Owned Utility	220	1,695	39	1.49
Mobile Home Parks	375	108	124	2.3
User Owned Utilities[5]	652	124	218	2.34
Other private systems	482	79	178	3.36

1. City includes: 315 City and 2 Special Act District
2. County includes: 77 County Service Area; 46 Maintenance District; 27 County Waterworks District; 12 County Sheriff; 11 County Dept. (excluding sheriff); 8 Special Act District; 2 Resort Improvement District
3. Independent Special District includes: 185 Community Services District; 165 County Water District; 53 Public Utility District; 51 Irrigation District; 34 Special Act District; 32 California Water District; 31 Municipal Water District ; 6 Sanitary District; 3 Municipal Utility District; 3 Water Conservation District; 2 Resort Improvement District; 1 Resource Conservation District
4. State and Federal includes: 38 Federal; 50 State
5. User Owned Utilities include: 582 Mutual Water Company; 70 Property / Homeowners Associations
6. Violation occurred between 2012-2018

Based on Table 8-1, the governance types have different rates of violations. For example, “other private systems” show an increase rate of violations compared to City or Investor Owned Utilities.

8.2 FACTORS IMPACTING WATER SYSTEM SUSTAINABILITY

Many factors affect the long-term sustainability of water systems. A prevalent factor in water system sustainability is small size, which causes a lack of economies of scale. Without an adequate number of ratepayers, small public water systems cannot easily afford large capital investments, such as repairing infrastructure or adding treatment technologies.

In California, 90 percent of the water systems in violation serve less than 500 service connections, according to the State Water Board's 2019 Annual Compliance Report. Long-standing violations of the Safe Drinking Water Act, source contamination issues, and source capacity failures are clear indications of unsustainable water systems. In addition to not having an adequate number of rate payers among whom expenses can be distributed, many of the small systems also serve communities that are economically disadvantaged. Some communities also try to keep their artificially rates low, but in doing so are unable to maintain infrastructure. All of these are key factors in long-term unsustainability.

The State Water Board and other researchers are currently seeking to identify those factors that correspond most directly to water system unsustainability or increase their risk of becoming unsustainable in the future. More information on the risk assessment work is discussed in Section 8.7 of this chapter.

8.2.1 Small System Size; Inadequate Technical, Managerial and Financial (TMF) Capacity

As previously discussed, small system size is a critical factor hindering sustainability. Small systems require rates based on the full complement of assets, equipment, and personnel needed to operate a public water system in compliance with Safe Drinking Water Act requirements, yet by definition they lack a large rate base to pay for these costs. This lack of economies of scale is a formidable barrier to sustainability, particularly in disadvantaged communities. Many systems are extremely small; approximately 18 percent of community public water systems in California serve less than 25 service connections.

As shown in the Figure 8-1 below, there are 1,475 community water systems with less than 100 service connections (SC) in California. This accounts for 51 percent of the 2,884 community water systems. Of the 519 community water systems supplying less than 25 service connections, it is estimated that half are mutual water companies, homeowner associations, or mobile home parks. The lack of technical, managerial and financial capacity is more prevalent in these small water systems than large water systems due to their inability to: (1) afford full-time paid management staff, (2) attract board members with utility experience, and (3) implement water rates that include planned infrastructure replacement.

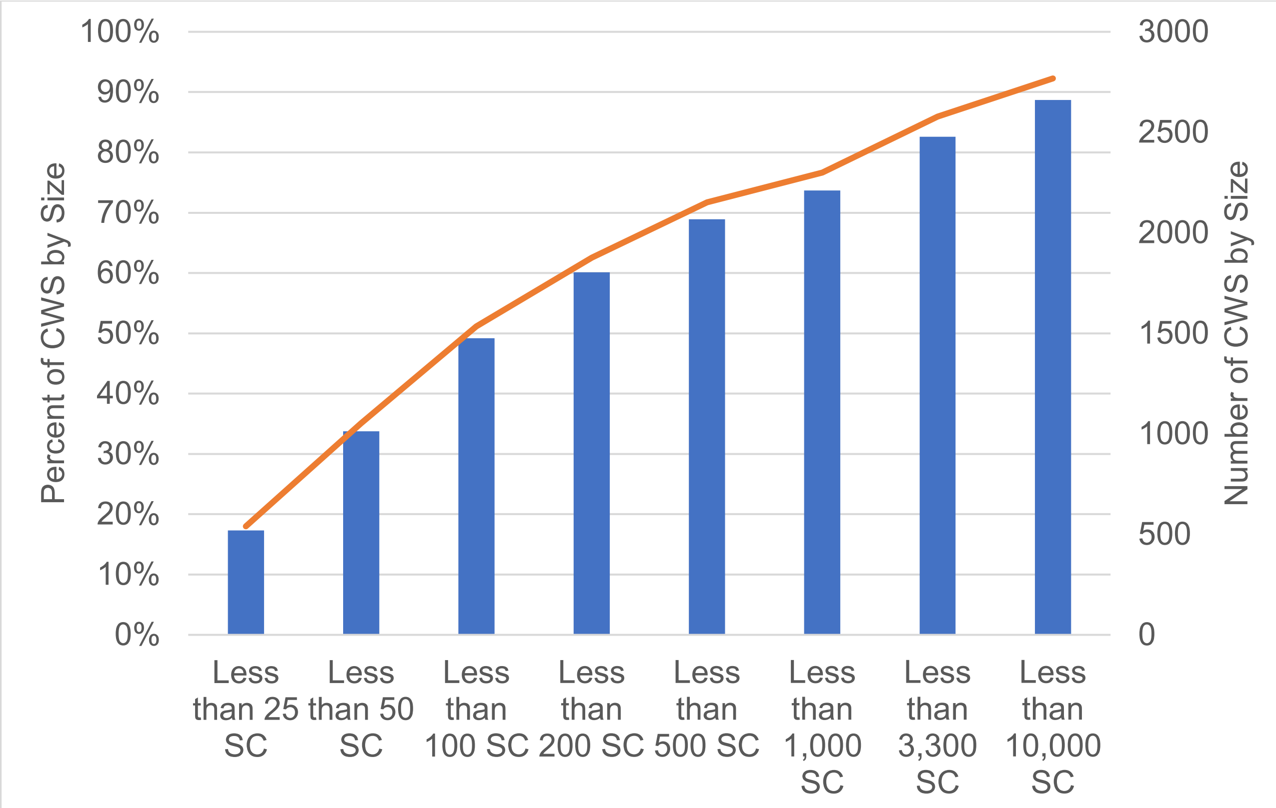

Figure 8-1 Number and Percentage of Community Water Systems by Size

Since the late 1980s, when water systems with less than 200 service connections were transferred from County regulatory jurisdiction to State regulatory jurisdiction, there has been an increase of water quality requirements such as new maximum contaminant levels (MCL) or more restrictive primary drinking water standards. However, there has been no corresponding increase in detailed managerial and financial capacity expectations. The State Water Board is seeking ways to increase the technical, managerial and financial capacity of water systems, with a significant focus on those water systems that are remote or will have a large enough rate basis to be sustainable if assistance is provided. One example of this effort is the financial dashboard created by the University of North Carolina's Environmental Finance Center for community water systems in California between 500 and 3,000 service connections. The financial capacity dashboard is a pilot study seeking to support water systems. The dashboard can be found at the following website:

https://efc.sog.unc.edu/resource/california-small-water-systems-rates-dashboard

8.2.1.1 Technical Capacity

Most drinking water regulations in California are focused on the area of technical capacity. These include requirements for monitoring, operations, such as treatment, and ensuring adequate disinfection of the distribution system and control of disinfection byproducts, and operator certification regulations. The more sophisticated the system, including the need for water treatment, the higher level of operation certification that is required. State Water Board staff and technical assistance providers have a long history of providing significant technical support to small water systems. Technical capacity limitations are typically seen in smaller public water systems as opposed to larger water systems with highly paid full-time and professional water treatment operators.

Most smaller water systems rely exclusively on contract operators or volunteers. Contract operators provide oversight to many of these small systems with varying success. While some contract operators are extremely knowledgeable, others are significantly less professional than their utility counterparts and may take on excessive numbers of water systems to make a living wage, resulting in inadequate service. To counter excessive numbers of water systems relying on the same operator, Texas, in their Rule 290.46 subsection (e) 5 B and D, limits the number of operator hours per water system for certain treatment types. Other states, such as North Carolina, in their 15A NCAC 18D.0701 *Operator in Responsible Charge,* limit the number of water systems a contract operator can maintain per license.

Currently, there is a need in California for more operators. Many of the water operators are reaching retirement age with few replacements. In rural communities, there may only be a small number of these contractors available so there are no viable alternatives to poor quality operators. Outreach to high schools and veterans' affairs groups, providing internships and other training initiatives are needed to put these opportunities in front of potential workers and create economic opportunities in disadvantaged communities.

As noted above, there are currently no regulations that define adequate technical capacity. Technical capacity metrics are being considered as part of the Needs Assessment Process, further discussed in Section 8.7, and are considered as part of the Risk Assessment framework.

8.2.1.2 Managerial Capacity

Managerial capacity is more difficult to define than technical or financial capacity. At its core, it means the capacity to run a water system. It includes setting a budget; increasing fees when necessary to support the operation and maintenance of the system; hiring and retaining necessary staff; and overall management of the system. In part, what is sufficient managerial capacity will depend on what is required by the water system structure. For example, mutual water systems are run by a board. Private water systems, on the other hand, may just have one person that is the owner and operator.

Small water systems tend to lack managerial capacity compared with larger water systems. One problem that we have seen for small water systems that are governed by volunteer boards is the inability to attract and retain new board members, as aging board volunteers retire. Without a sufficient number of board members, these small water systems cannot properly function due to lack of a legal quorum.

Like technical capacity, key to having good managerial capacity is having sufficient funding. Without sufficient fees, systems are unable to hire and retain professional water system managers. Although water systems are required by regulations to only hire certified water treatment and distribution operators, there is no similar requirement for who can manage a water system or any criteria that sets out the minimum amount of education and experience that such a person should possess. Specialized knowledge in asset management planning, contracting procedures, budgeting and accounting procedures, along with a minimum criteria that all public water systems must possess, such as adequate reserves, emergency procedures and contingency plan, and insurance, could be a potential subject for future regulations.

Increased training in the skills and knowledge necessary to create managerial capacity is being provided from the Division of Drinking Water staff and through technical service providers; however, training alone cannot overcome lack of interest in participation on Boards, or provide the funding necessary to hire professional managers. Although physical or managerial consolidation with larger water systems with managerial capacity is a good solution, sometimes that option is not available. Putting an administrator or a court appointed receiver in place to run a water system may be a temporary fix, but it is not a long-term solution.

Funding availability to small water systems is also often affected by the water systems' lack of managerial capacity. Loans and grants are not available to a public water system if it fails to properly form its governance structure, implements water rates without meeting the required processes, cannot provide past tax filings or financial records, or has failed to maintain its active corporate status with the California Secretary of State. Resolving these issues can be time-intensive, expensive (for example, paying back taxes or hiring sufficient legal help), and can result in water systems being unable to access financial assistance until these managerial issues are resolved.

One potential way to address managerial capacity is to require and make available low-cost training to water system managers and have defined requirements regarding budgeting procedures and asset management to ensure that a water system is well run. Managerial capacity metrics are being considered as part of the Needs Assessment Process, further discussed in Section 8.7, and are considered as part of the Risk Assessment framework.

8.2.1.3 Financial Capacity

Financial capacity is probably the most important element of sustainability, because many of the problems encountered by water systems are caused by a lack of adequate funding. Financial capacity planning is key, specifically planning to generate the income necessary to address the water system's current expenses and anticipated expenses such as infrastructure replacement.

Some water systems are barely able to cover current expenses, and so are not even able to plan for future needs. In its 2015 Drinking Water Infrastructure Needs Survey and Assessment completed in March 2018, USEPA estimated that approximately $51 billion dollars will be required in California over the next 20 years for drinking water infrastructure, including $31.7 billion for transmission and distribution systems. Graph 8.2, on the following page, shows the break-down of USEPA's reported 20-year drinking water infrastructure needs for California.

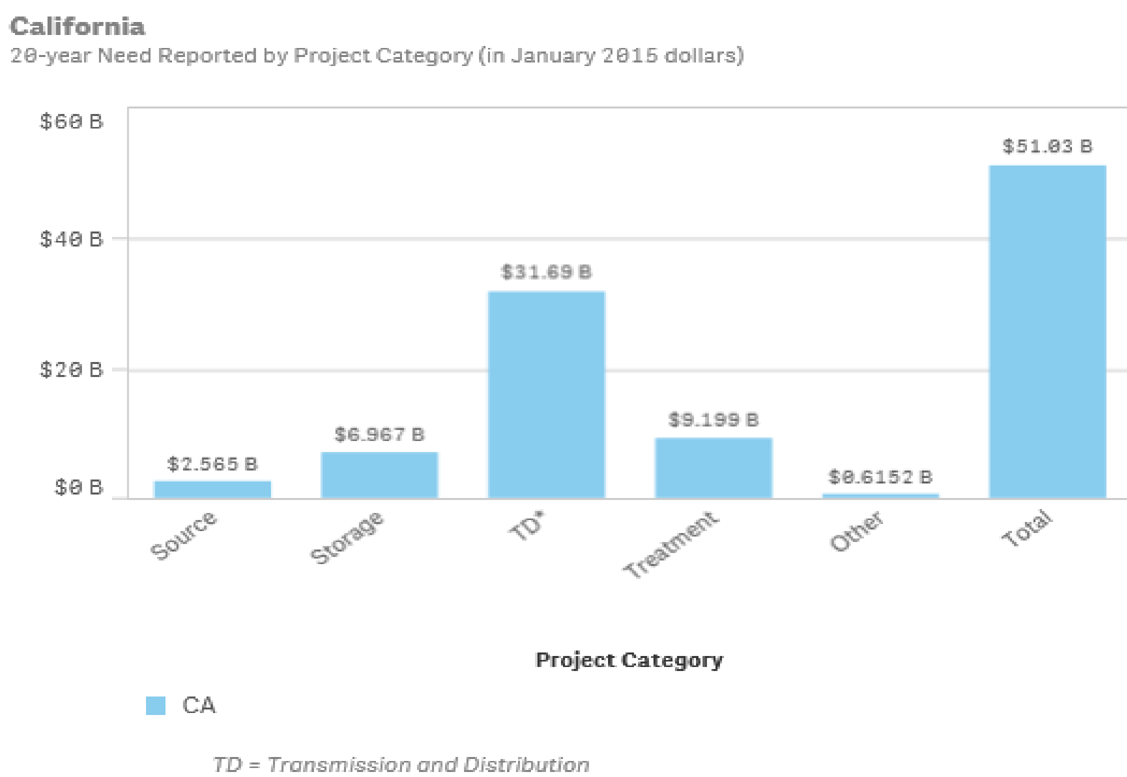

Figure 8-2 USEPA Estimated 20-Year Drinking Water Infrastructure Needs

Although failure to address infrastructure needs can result in worse problems, it is often daunting to address infrastructure needs. For example, pipelines and storage tanks that leak result in a loss of water and potentially water pressure, which can result in bacteriological contamination within the distribution system. However, in addressing the problems, water systems need to try not just to address what is at issue today, but also plan for the problems of tomorrow. For example, when replacing worn out pipelines, water systems may need to consider whether to increase pipe size to accommodate future growth and address the needs of fire-fighting capacity. Similarly, water systems must consider source redundancy, potentially creating an intertie to adjacent systems or drilling additional wells, particularly for those regions historically subject to drought. The State Water Board recognizes that funding these projects will be one of the biggest challenges over the next few decades, particularly for small water systems.

Currently, there are a wide range of financial capacity regulations for public water systems depending on their governance structure. This ranges from in-depth fiscal reviews by the CPUC for Class A investor owned utilities to no active regulatory oversight for mutual water companies and mobile home parks. Although the California Corporations Code requires that mutual water companies maintain a financial reserve to fund repairs and replacement of its infrastructure, that an annual budget be adopted, and a certified public accountant conduct an annual review of the financial statement, there is no entity that actively oversees these requirements. (Ca. Corp. Code §14301.3 and 14306.) Historically, the State Water Board has not been given the authority to review or enforce these financial requirements and has very limited staff with expertise in these areas. While LAFCO can request this information through a municipal service review, there is no mechanism to ensure that these regulations are being implemented.

In 2018, the State of Ohio required all its water systems to submit asset management plans and set rate structures in accordance with the asset management plans to ensure that financial planning is completed and ensure water system governance decisions are made with full understanding of the cost of water. The State of Washington requires that community and non-transient non-community water systems provide planning documents, of varying complexity depending on the size of the water system at least every 10-years. These plans include financial and capital improvement plans that are reviewed by State regional planners to determine if the financial plans are adequate to address the needed infrastructure and reserve requirements. Other states utilize financial capacity dashboards like those created by the University of North Carolina, Chapel Hill's Environmental Finance Center to compare affordability, cost recovery, conservation and bill comparison across the state. As previously mentioned, the State Water Board recently completed a pilot study of financial capacity dashboards for California's community water systems between 500 connections and 3,300 service connections. The dashboards can be found at the following website:

https://efc.sog.unc.edu/resource/california-small-water-systems-rates-dashboard

Section 116375 (g) of the Health and Safety Code gives the State Water Board authority to adopt regulations regarding minimum acceptable financial assurances to submit as a demonstration of its capacity to provide the ongoing operation, maintenance, and upgrading of the water system, including compliance and contingencies. For privately owned systems not regulated by the CPUC, it also provides the State Water Board authority to include additional financial capacity requirements including but not limited to financial assurances "in the form of trust fund, surety bond, letter of credit, insurance, or other equivalent financial arrangement acceptable to the department." Financial capacity metrics are being considered as part of the Needs Assessment Process, further discussed in Section 8.7, and are considered as part of the Risk Assessment framework. As these metrics are further developed and correlated to failing systems, additional regulation in this area may be appropriate.

8.2.2 Climate Change and Other Hazards

8.2.2.1 Climate Change

State Water Board's Resolution No. 2017-0012 required a comprehensive response to climate change. Climate change is affecting and will affect different regions in different ways. According to the California Department of Water Resource's Climate Change website, climate change will result in more extreme weather events and changes in seasonal timing of precipitation. Water quality impacts that are anticipated to directly affect drinking water supplies include enhanced droughts, more frequent and intense fires, intense rainfall events and flooding, and harmful algal blooms due to a combination of warmer waters and erosion.

Drought Impacts

Mitigating droughts in small water systems should focus on reducing the number of public water systems (including state small water systems and domestic water users) through a variety of means including extension of service, consolidations, regionalization, and partnerships. While planning and resource development are critical components of resiliency, many small water systems do not have the permanent staff or the rate base needed to create sustainable water systems, even with technical support to assist in creating drought plans and/or State funding to provide capital improvement mitigation measures. Drought assessment cannot be done in isolation, issues such as future contaminant regulation, migration of contaminant plumes or inadequate managerial and financial capacity may also result in the failure of small systems.

If implemented without coordination and long-term planning, well-intentioned drought resiliency funding efforts designed to support small water systems may actually act as a barrier to consolidation efforts and long-term sustainability. Small systems with newly funded well sources may be more hesitant to fund physical interties. Technical assistance to develop contingency plans may be appropriate to ensure conservation if a drought occurs prior to consolidation or interties being constructed, but capital improvement funds should be focused on long-term solutions. Further, small water systems that are too far from other water systems to physically connect should be mandated to evaluate partnerships opportunities with other nearby large water systems, including but not limited to, managerial consolidations and mutual aid assistance opportunities.

Small water systems with less than 1,000 service connections often do not have the capacity to develop water shortage contingency plans. A better alternative for water resiliency improvement for these small systems is to establish minimum resiliency measures for infrastructure improvements and enact regulations to require the actions below, and allowing time to come into compliance.

1. Participate in CalWARN or other equivalent mutual aid organization. (1 year)
2. Adopt a drought conservation, communications and enforcement policy, including coordination with the county, that will go into effect when water supply vulnerability/risk thresholds are met. These actions may be incorporated into other emergency response plans. (2 years)
3. Secure a back-up power source and test quarterly to ensure continuous operations in case of power outage. (2 years)
4. Implement monitoring systems sufficient to detect production well groundwater levels. (5 years)
5. Have at least one back-up source of water that meets current water quality regulations and meets average day demand. For small water systems, physical interties with a neighboring water systems to meet this need should be encouraged over new well or surface water sources wherever possible. If necessary, additional time should be allowed for the implementation of interties to ensure a more sustainable solution. (5-10 years)
6. Implement service connection metering and monitor for pipe leakage. During periods of water supply vulnerability, monitor customer water use. (10 years)
7. Have source and distribution system capacity to meet fire flow requirements (general requirement for all new development and infrastructure improvements).

Recognizing that vital resiliency improvements will require additional funding; the State should seek to secure additional and expanded capital funding sources. The State Water Board should identify funding needs for implementation of resiliency projects and incorporate those needs into its Needs Assessment and Fund Expenditure analysis and prioritization processes for existing, new and expanded funding sources. Several of the issues discussed above are further developed in the subsequent subsections.

In Chapter 656, Statutes of 2017, (SB 606), signed into law in October 2017 and Chapter 15, Statutes of 2018 (AB 1668), signed into law on May 2018, the California Department of Water Resources (DWR) was directed to identify small suppliers and rural communities at risk of drought and to develop recommendations to the Governor and Legislature for improving drought contingency planning. The State Water Board has been collaborating with DWR on these efforts and provided the above recommendations to DWR for inclusion in their report. The State Water Board is also incorporating the results of DWR's analytical drought prioritization into our Needs Assessment efforts.

Disaster planning information for fire response is provided in Chapter 11.

8.2.2.2 Source Contamination

As noted above, source contamination is a significant factor affecting long-term sustainability. Contamination may be naturally occurring or from unauthorized discharges by responsible parties. The need to treat source water causes long-term financial burdens on the water system. The State Water Board completed a study of sources of contamination in groundwater in its January 2013 Groundwater Information Accessibility and Identification of Communities Reliant on Contaminated Groundwater–AB 2222 report. The AB 2222 report identified the principal contaminants found and discussed regional trends. The table below from the AB 2222 report shows the number of active community water systems in which a principal contaminant was detected (on two or more occasions above the MCL, 2002-2010. The Figure 8-3 also shows whether the source was naturally occurring or anthropomorphic.

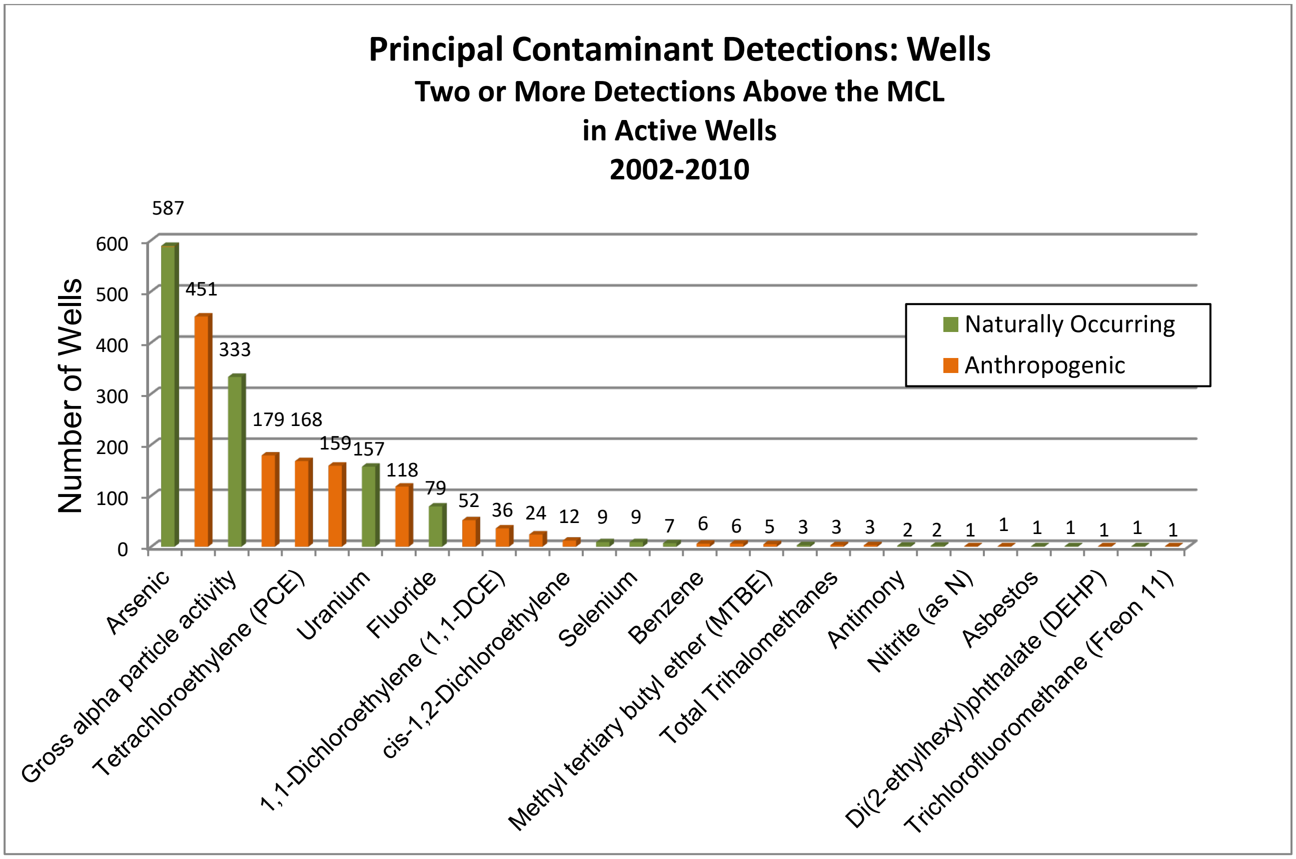

Figure 8-3 Contaminants Detected (on two or more occasions above the MCL) 2002-2010

It is important to note that an MCL for 1,2,3-trichloropropane was not adopted at the time of the report. For sources of manmade contamination, finding the responsible party for the contamination and requiring cleanup of the contaminant or payment for treatment, will help water systems meet the goals of providing both safe and affordable water.

As a result of Chapter 120, Statutes of 2019, (SB 200), the State Water Board will annually produce water quality hazard maps beginning in 2021 that will allow for planning agencies, water systems, and community members to access water quality information that is applicable to their area. GIS mapping tools related to water quality hazards in groundwater can be found at the following website:

https://www.waterboards.ca.gov/water_issues/programs/gama/online_tools.html

8.2.2.3 Reliance on a Single Groundwater Source:

Approximately one-third of all community water systems in California rely on only one groundwater well. This is equivalent to approximately 1,050 community water systems state-wide. These water systems are subject to potential water outages during sustained droughts and well casing failures. If they also lack adequate storage or are unable to rapidly get replacement parts, they may also be susceptible to water outages during an event as simple and common as a pump failure.

In 2006, California Code of Regulations Title 22 Section 64554(c) was adopted to require that all new community water systems have two wells at the time of permitting to become a new public water system. However, there is no requirement that existing community water systems or non-community water systems, such as schools, have two sources. With the impact of climate change and increasing potential for drought, it is desirable for existing water systems to have a redundancy in sources including interties to other water systems, or additional groundwater well.

8.2.2.4 Water Loss and Meters:

Worsening droughts will increase pressure on water systems to decrease water loss, particularly when source capacity is limited. Current State Water Board regulations (Section 64561 of Title 22 of the California Code of Regulation) require meters on all water sources, and urban water suppliers (those that have more than 3,000 service connections) are required to install municipal and industrial meters by 2025 (Water Code Section 527). However, community water systems serving less than 3,000 service connections do not have requirements to install domestic and industrial meters. Public water systems serving less than 3,000 service connections represent approximately 86 percent of California's community water systems. Community water systems serving less than 3,000 service connections represent approximately 765,000 water service connections state-wide and a population of 2.8 million. This means that these small systems are not able to readily detect water loss.

Smaller water systems are also likely to have some of the highest water loss rates due to the poor condition of their aging distribution systems and the difficulty in generating revenue to cover distribution replacement costs. This results in difficulty in both identifying water loss and properly allocating and defining water rates. Water meters are also often a hurdle to consolidation, particularly when one water system has meters while the other does not. Residents without meters often do not want to install them due to fear of increased rates, while customers with meters feel that those without meters will waste water. In order to address these issues, legislation is needed to create a requirement for all service connections to be metered in all public water systems, creating greater equity and shared responsibility for this scarce natural resource.

8.2.2.5 Pipelines and Storage Designed for Fire Flow:

In 2008, Section 64573 of Title 22 of California Code of Regulation was added to require a nominal diameter of at least 4-inches. Prior to then, smaller pipeline sizes were common for public water system mains, particularly in small water systems. The estimated maximum capacity of a 4-inch pipeline at low water system pressures is approximately 240 gallons per minute, which still typically does not provide adequate fire flow. Current water storage regulations set out in Section 64554 (a), require that all water systems have enough water storage to meet the water system's maximum day demand. However, there are no requirements that fire suppression, or collaboration with local fire codes, be included in storage design. From a practical perspective, the State Water Board attempts to collaborate on requirements with local fire professionals, however it is critical that fire demand be incorporated into storage and pipeline capacities in order to address the increase fire concerns brought on by climate change.

Furthermore, drinking water funding typically prevents grant funds from being used to expand pipelines for fire flow. Thus, newly installed replacement pipes still lack proper fire flows. Given the increase in fires across California in the past few years, legislation to help address this funding limitation is needed to concurrently address both safe drinking water and fire suppression seem appropriate.

8.2.2.6 Mutual Aid Agreements and Emergency Planning:

Many small water systems lack formalized mutual aid agreements and some counties lack a Local Hazard Mitigation Plan (LHMP). LHMP ensure that during disasters or prior to disasters federal aid will be available. The federal Disaster Mitigation Act of 2000 requires an approved LHMP to be eligible for hazard mitigation funding. Hazard mitigation funding can be used for improvements such as an emergency intertie. Hazard mitigation funding is 75 percent grant with a 25 percent match when the public water system is not economically disadvantaged; economically disadvantaged water systems obtain 90 percent grant. Public water systems can either participate in the development of the counties LHMP or develop their own.

Additional LHMP information is available at: https://www.caloes.ca.gov/cal-oes-divisions/hazard-mitigation/hazard-mitigation-planning/local-hazard-mitigation-program

8.2.2.7 Water Rights and Allocations Complexity:

Water rights and water allocations in California are legally complex. This complexity provides challenges in understanding water availability, which can interfere with consolidations and water partnerships. Water systems may be concerned that any change of service area or review of their existing water right allocations may result in decreases of their current water rights or that wells previously assumed to be groundwater will be reclassified as surface water underflow. While larger water systems have legal staff that can address these complex issues, small water systems often do not have these resources.

Droughts are expected to be more prevalent as a result of climate change. As such, it will become more important for there to be clarity about the water that is available to each public water system; what its priority for that water is; and more flexibility on changes to the areas of use so that water partnerships are not hindered, particularly in times of drought when water partnerships can be permanently developed. It will also be important for drinking water systems to provide transparency and specificity on what water rights are available so that new development can be regionally planned to allow growth in appropriate areas and limited in those where source capacity is insufficient.

8.2.2.8 Small Water Systems' Abilities to Adapt to Future Regulatory Changes:

As previously discussed in detail in Chapter 4, small water systems account for the vast majority of water system violations. As new MCL are created, it will continue to be a struggle for small water systems to meet new regulatory requirements, including installing additional treatment, where necessary. In 2018, 1,2,3-TCP MCL compliance was required. In the near future, a new MCL for hexavalent chromium is also expected, as well as revisions to the total coliform rule, lead and copper rule and cross-connection control requirements. As discussed in Chapter 3, PFOA, PFOS, 1,4-Dioxane, microplastics are other examples of constituents of emerging concern that potentially will result in new maximum contaminant levels that could impact small water systems by requiring expensive treatment installation and expensive on-going monitoring and reporting. In order to permanently decrease the number of water quality violations as a whole rather than piecemeal and system by system, each time there is a violation, significant effort is needed to focus on addressing regional planning and consolidation, when possible, in areas where contamination or limited source capacity is known or anticipated to be present.

8.3 WATER PARTNERSHIPS

As discussed in the previous section, there are many small systems that may be able to provide safe and affordable water, but probably not both for the long-term given all of the challenges discussed in the previous section. In order to support these small communities and ensure safe and affordable water to all Californians in the long-term, the State Water Board supports water partnerships, including consolidation, whenever feasible. Water partnerships can take many forms including: mutual aid agreements, local resource sharing, physical consolidation, managerial consolidation, and regionalization, as described on the State Water Board's Water Partnership website. Consolidation is the joining of two or more water systems, which includes, usually but not always, a smaller system being absorbed into a larger water system. Regionalization is a process where several local public water systems work together to form a combined public water system, or where several public water systems are subsumed into one large water system.

8.3.1 Voluntary Consolidation

Water partnerships often require the collaborative efforts of many parties including the

State Water Board's Division of Drinking Water and Division of Financial Assistance, County Environmental Health programs, technical assistance providers, receiving and subsumed water systems, and in some cases, agencies with water rights or allocation authority, LAFCO and the CPUC. Due to the need to coordinate multiple agencies approvals, consolidation efforts often take multiple years. During that time, the initial cause of the immediate concern may have been temporarily mitigated; and therefore, the system may not show as being in violation on the State Water Board's Human Right to Water website. Nevertheless, it is important to implement permanent solutions, such as consolidation, and not rely on temporary fixes. Long-term solutions, though sometimes are more costly initially, but typically pay off when compared to the long-term costs without implementing the proposed solution.

8.3.2 Voluntary Water Partnerships

Recognizing the time intensive nature of water partnerships and the new mandatory consolidation authority provided by SB 88, the State Water Board was granted the authority to hire two water partnership coordinators in 2016 to begin tracking water partnership metrics in 2017. Chapter 120, Statutes of 2019 (SB 200) provided funding for an additional 13 positions to assist with water partnerships.

Over 100 voluntary water system consolidations have occurred since 2017. The details of these and other voluntary consolidations and water partnership statistics, their funding sources and the larger water system that they consolidated with can also be found on the State Water Board's Consolidation Statistics website and in Appendix 13.

The work of large water systems and counties to actively support water system consolidations to ensure safe drinking water for their communities and throughout the state should be widely shared so that others will have both role models and understanding of how successes were achieved. To this end, the State Water Board has invited several groups that have been outstanding in this area to share their experiences in Appendix 11.

8.3.3 Mandatory Consolidations

Since the initial passage of SB 88 through November 2020, the State Water Board has initiated 19 mandatory consolidation actions. Of those, one mandatory consolidation with an order, Pratt Mutual Water Company with the City of Tulare, has been fully connected and completed. Nine of the 19 water systems agreed to voluntarily consolidate prior to an administrative order. Ceres West Mobile Home Park consolidation was completed voluntarily after initiating the mandatory consolidation process, and two water systems could not be required to mandatorily consolidate because they were not a disadvantaged community. For the remaining 7 water systems for which mandatory consolidation was initiated, mandatory consolidations efforts are moving forward. However, two of the mandatory consolidations with Rosemond Community Service District were hampered by the long-term need to provide funding for water rights transfers. Two mandatory consolidation orders were issued in 2018 to the City of Bakersfield for consolidation with South Kern Mutual Water Company and Old River Mutual Water Company. The mandatory consolidation orders were petitioned by the City of Bakersfield, who then later asked the State Water Board to put those petitions into abeyance while they continued to try to work out the details of a plan for consolidation. Information on the status of each mandatory consolidation can be found on the State Water Board's Mandatory Consolidation or Extension of Service for Disadvantaged Communities.

The consolidation of the Pratt Mutual Water Company is unique compared to other mandatory consolidation projects because the pipeline necessary to connect Pratt to the City of Tulare was already constructed at the time the consolidation was ordered by the State Water Board. The City of Tulare had previously approved the consolidation project but had decided not to move forward with the consolidation after the construction of the pipeline. Due to these special circumstances, this mandatory consolidation project did not require going through any of the usual processes, including determination of disadvantaged status, a feasibility study showing consolidation was cost-effective, submittal and processing of funding applications, California Environmental Quality Act (CEQA) review, ensuring adequate water rights, engineering design, and construction. The project was not subject to these steps because they had been completed prior to the construction of the pipeline. Other mandatory consolidations do require these steps, meaning that the process is lengthy and resource-intensive. While mandatory consolidations can order the receiving water systems to provide water service, as currently structured the statutes do not change the timeframes associated with creating funding agreements, nor is there anything to specifically require that the receiving large water system cooperate with the State Water Board and submit the needed documents necessary for the creating the funding mechanism to support the consolidation.

One concern regarding consolidations is the potential for increased rates in the consolidated system. This is not, however, always the case. For example, prior to consolidation with the City of Tulare in 2016, Pratt Mutual Water Company's single-family residential service connections paid a flat rate of $35 per month. In 2016, the City of Tulare charged a flat base rate plus variable usage rate for single family residential service connections. The flat base rate was $20.52 plus usage per hundred cubic feet. The City of Tulare's bills range from $24.57 to $38.47 for six hundred cubic feet and twenty four hundred cubic feet, respectively. In 2009, California Municipal Statistics, Inc. reported a median household income of $30,268 for the Pratt Mutual Water Company, deeming them a severely disadvantaged community. The water rate Pratt Mutual Water Company was expected to pay after consolidation was approximately 1.5 percent of the median household income. The resulting monthly water bill for the Pratt Mutual Water Company customers is approximately the same as it was prior to the consolidation.

Voluntary consolidations with two willing water systems for State-funded disadvantaged community projects take approximately four to ten years to complete, depending on their complexity. Required steps and typical associated times for consolidation projects are listed in Table 8-2 below. This work significantly affects the speed at which consolidations can occur.

Table 8-2: Consolidation Steps and Estimated Timeframes For State Water Board Funded Consolidation Projects

Step Number	Approximate Time (months)	Typical Actions
1	0-6	Determination of disadvantaged community status. A door-to-door survey is often required to be completed by a technical assistance provider due to limitations in the census tract data.
2	9-36	Submittal of a complete Planning Application by the small water system. This often requires a technical assistance contract workplan be written and approved to support the application process. Typically, the process takes less than one year if no significant issues are found. However, issues such as the public water system not being in good standing with the franchise tax board, not having established or adequate water rights, or not being a properly formed legal entity can lead to delays. Many small water systems do have these complications.
3	6-9	Planning Application review and development of a legally binding funding agreement by the State Water Board
4	12-36	Perform Planning Activities, including subcontracting an engineering firm to evaluate alternatives, prepare engineering designs and specifications, review the project through the various agencies (LAFCO, cities, and counties) and CEQA review.
5	12-24	Submittal to the State Water Board’s Division of Financial Assistance of a Complete Construction Application by the receiving (larger) water system. The Division of Financial Assistance typically does not typically provide funding for the construction project to the subsumed water system because the larger water system will be responsible for the long-term operation and maintenance of any future infrastructure once the subsumed system is dissolved. This process is typically approximately one year but can be longer if the project is not a high priority for the larger water system and/or they lack adequate staff or political will to support a timely application.

Step Number	Approximate Time (months)	Typical Actions
6	6-9	Construction Application processing by the Division of Financial Assistance and development of a legally binding construction funding agreement, which may require legal review and approval by the water systems.
7	12-24	Bidding and performing construction work

The Office of Sustainable Water Solutions in the Division of Financial Assistance, using funding from State funded propositions and SAFER can expedite Steps Numbers 2 and 3 in some consolidations by having technical assistance providers do planning and engineering work and aid in submittal of the construction application. When State funds are not available, the typical Drinking Water State Revolving Fund (DWSRF) processes above would be more typical.

As noted previously, while mandatory consolidation allows the State Water Board to order consolidation if a water system is not willing, it does not change any of the funding requirements or the time it takes to complete these steps. It also does not specifically require the receiving water system to apply for or accept grant funds in Step No. 5 and 6 above, which is often a low-priority project for large water systems. This is why being able to appoint an administrator to a water system to assist with a mandatory consolidation may help keep the process moving forward. However, finding and appointing an administrator does take additional time.

Health and Safety Code Section 116682 requires additional procedural steps prior to mandatory consolidation orders being issued, which can result in delays. Prior to issuing an order for consolidation, the State Water Board must provide at least six months for the water systems to negotiate voluntary consolidation or other means of providing an adequate supply of safe drinking water. During that time, the State Water Board must consult with the local government, LAFCO, or if applicable, the CPUC. During this time, the State Water Board also must provide technical assistance and work with the water systems to develop a financing package and consider the affordability of the anticipated monthly rates. At least one public meeting is required to be held at the beginning of the process in the affected communities.

If a voluntary consolidation is not negotiated, additional public meetings and findings are required to be made to issue an order. These findings include a determination that a community is disadvantaged, that the consolidation is appropriate and technically and economically feasible and an effective and cost-effective means to provide an adequate supply of safe drinking water, which may require preparation of engineering and feasibility studies, and that concerns regarding water rights and water contracts of the subsumed and receiving water systems have been adequately addressed.

Once these findings are made and an order is issued, more work has to be done, including determining compensation to the receiving water system for any capacity lost as a result of the consolidation or extension of service, payment to LAFCO of its standard fees, and payment to the owners of any privately owned subsumed water system for the fair market value of the system. After issuance of the order, that order may be petitioned to the State Water Board. All of these requirements are important to ensuring that consolidations are well thought out and do not result in additional significant burdens to the subsumed and receiving water systems and their rate payers; however, they add significant time to the process.

While mandatory consolidation is an important tool for addressing unsustainable water systems, it is only applicable to disadvantaged communities, which is defined in the Health and Safety Code 116681(f) and in Water Code Section 79505.5, as those communities "with an annual median household income that is less than 80 percent of the statewide annual median household income." Therefore, the water systems on the Human Right to Water website that do not serve disadvantaged communities cannot be issued mandatory consolidation orders.

8.3.4 Barriers to Consolidation and Regionalization Efforts

Consolidation and regionalization efforts are the cornerstone of dealing with the problems of small water systems. The State Water Board is proceeding as expeditiously as possible, however, there are still barriers to consolidation and regionalization. The largest concern that small water systems typically express regarding potential consolidation is concern over higher rates, although concerns of local governance of drinking water supplies, tax and land use implications between cities and counties over annexation, and other factors still exist.

While larger water systems have better economies of scale, and therefore tend to be able to spread costs over a larger number of people, small water system water rates often have not included costs to cover infrastructure replacement and therefore are artificially low; consequently, their infrastructure is often in poor condition. Thus, the comparison of the rates between large and small systems is sometimes not directly equivalent, and although the larger water system rate may in some cases be higher, the water system is more often in compliance and sustainable. In order to make rates reflective of actual costs of operating and maintaining a sustainable water system, a standardized method to evaluate the real cost of operating and maintaining a water system needs to be developed, which would assist the State Water Board in helping water systems understand their true costs over time and determine when consolidation would be a better option for a struggling small system.

Two possible options for helping systems understanding the real cost of operating and maintaining a sustainable water system include: (1) requiring publicly available asset management plans from each water system with rates in accordance with appropriate or standardized depreciation schedules such as legislation recently adopted in Ohio (Ohio Revised Code Section 6109.24), (2) requiring publicly available financial dashboards for water systems such as those prepared by the Environmental Finance Center at University of North Carolina for all water systems. Regardless of the real cost for operating, solutions will be needed to support low-income residents who cannot afford higher water rates. As previously discussed, Drinking Water Needs Analysis included a pilot study for financial capacity dashboards for water systems in the range of 500 to 3,300 service connections. With the passage of SB 200, the State Water Board will be evaluating additional tools. The State Water Board has begun to collect rate data. Moving forward, the State Water Board will be able to track the rate changes over time. This information will allow the State Water Board to perform a rate study and better understand the financial impact to customers after a consolidation has occurred.

Different governance types can also present consolidation barriers due to the vastly different technical, managerial and financial capacity for public water systems. For example, small water systems may not have anyone with the necessary skills to apply for funding, oversee infrastructure upgrades necessary for consolidation, or maneuver through all the legal requirements to comply with all the relevant State and local requirements, such working with LAFCO to change boundaries. In contrast, large professional organizations such as cities and inventor owned utilities have lawyers, accountants, engineers and well-trained fully dedicated operators on staff.

Other significant barriers to consolidation and regionalization efforts also include the high cost of infrastructure and service connection fees for small non-disadvantaged communities and the need for large distribution infrastructure upgrade projects for larger water systems to provide service to additional customers. Other states have tried to address these issues in various ways. For example, the Washington State Intended Use Plan (page 20) allows 50 percent principal forgiveness and 1 percent interest for the remaining loan for consolidation projects with disadvantaged community and non-disadvantaged community consolidations with well-run municipalities. Oregon has Sustainable Infrastructure Planning Projects which give a 100 percent forgivable loan funding up to a maximum of $20,000 per project. Oregon’s program prioritizes PWS less than 300 service connections, whether or not they serve a disadvantaged community and non-disadvantaged community systems. Feasibility studies, asset management plans, system partnership studies, reliance plans, water rate analysis, etc. are all eligible projects. (See Oregon Intended Use Plan, page 7). In September 2020, California finalized its intended use plan to include grant eligibility for up to 75 percent of the costs of a project to address public health related issues in small non-disadvantage communities, including consolidation as an alternative. It is hoped that this will help address water systems with lower numbers of connections that may not otherwise have been able to afford consolidations.

There are other barriers that may impact the State Water Board's goal of decreasing the number of small water systems with poor technical, managerial and financial capacity through consolidation and regionalization. For example, even though it is not in line with the intentions stated in the America's Water Infrastructure Act of 2018 that recommends consolidation, federal funding is based on the number of public water systems instead of the State's population, which creates a disincentive to lessen the number of water systems. Therefore, the State Water Board will get less federal funding for staff from the USEPA for reducing the number of small, unsustainable systems.

8.3.5 Sustainable Groundwater Management Act (SGMA) and Water Partnerships

SGMA provides a new opportunity to encourage water partnerships and increase stakeholder involvement in groundwater planning and management. SGMA empowers local agencies to form Groundwater Sustainability Agencies (GSA) to manage basins sustainably and requires those GSA to adopt Groundwater Sustainability Plans (GSP) for crucial groundwater basins in California. Each GSP must, among other things, identify how it will achieve the sustainability goal of the basin, and one component of the sustainability goal must be avoiding undesirable results. When determining what water level declines or water quality degradation could constitute an undesirable result, State Water Board staff strongly recommend that GSA reach out to domestic well users and public water systems as part of both the analysis and the discussion of what constitutes an undesirable result. If that evaluation by the GSA indicates any proposed allowable decline in groundwater levels or degradation of water quality could constitute a significant and unreasonable impact, the GSA has options beyond enhancing supply or reducing demand for avoiding undesirable results. The GSA could consider developing or implementing a well mitigation plan to replace or repair domestic or drinking water system wells impacted by groundwater level declines or install treatment systems to address water quality impacts. The GSA could also support expansion of public water system boundaries to include communities served by private wells or consolidation of smaller drinking water systems dependent on at-risk wells with larger public water systems. Water partnerships efforts may include: (1) providing financial assistance, particularly for low-cost intertie projects that are adjacent to larger systems, (2) working with County Planning agencies to ensure that communities served by at-risk wells are annexed into the service areas of larger water systems to limit barriers to future interties, and (3) facilitating outreach and introductions between small water systems and owners of domestic wells and larger water systems to assist in developing future partnerships.

8.4 ADMINISTRATORS

Although the State Water Board had the authority to contract with an administrator to provide administrative and managerial services to disadvantaged community water systems since September 2016, without a funding source, no administrators were appointed until the passage of Chapter 859, Statutes of 2018, (AB 1577) and Chapter 449, Statutes of 2018, (SB 862), which required the State Water Board to appoint the County of Los Angeles to be the administrator for Sativa Water District and provided funding for the administrator.

Sativa – Los Angeles County Water District (previously Sativa Water District) had serious technical and managerial capacity problems as demonstrated by its repeated failure to comply with water quality monitoring and reporting regulations, its inability to timely address its source and storage capacity issues, and its inability to plan and implement routine water system maintenance activities, which resulted in a brown water problem, which occurred because of elevated manganese levels in the distribution system.

The Legislature passed AB 1577 as emergency legislation in September 2018. The legislation directed the State Water Board to appoint an administrator for the Sativa Water District. SB 862, also passed in September 2018, budgeted $200,000 dollars to provide for administrator services for the water system. On October 31, 2018, the State Water Board concluded that the Sativa Water District had consistently failed to provide its customers with a reliable and adequate supply of pure, wholesome, healthful and potable water, and ordered the Sativa Water District to accept full administrative and managerial service, including full management and control by the County of Los Angeles.

Funding budgeted under SB 862 for the administrator was insufficient to cover the County of Los Angeles' costs of operating the water system. The assumption that the administrator would be able to utilize the Sativa Water District's revenue to cover the operations cost did not materialize. Sativa's customers were paying a flat rate of $75 per month. Upon appointment of the administrator rates remained the same, which resulted in a budget deficit each month. The County of Los Angeles discovered that the water system had failed to maintain financial records. It had negative cash-flow and no available reserves. Other unexpected costs included the need for a large team of legal, accounting and operations experts as there were existing litigation suits pending.

The County of Los Angeles approved a $1.4 million line of credit to get the water system on stable financial footing. The County expects that it will cost $8 million of the County's funds by the time the sale of the water system to a nearby private company is completed. Mr. Dan Lafferty, the Deputy Director of Los Angeles County Public Works shared his experiences during the 3rd Needs Analysis Workshop. For more details, Mr. Lafferty's presentation slides and the webcast recording (beginning at hour 4:52) can be found on the State Water Board's Needs Analysis webpage. Some of the lessons learned include that administrators are a very time intensive process requiring a wide range of expertise and that it would have been best to maintain Sativa as a separate water system to limit the County's liability and streamline procurement of services.

SB 200 provides funding to allow for use of administrators. Section 116686 of the Health and Safety Code required the creation of an administrator policy handbook which outlines the process of appointing an administrator. The Administrator Policy Handbook was adopted in September 2019. The Administrator Policy Handbook and other related administrator efforts such an Administrator FAQ and the list of water systems where the State Water Board is currently undergoing the administrator process is provided at the SAFER Program Water System Administrator website. Additionally, the website also has Request for Qualifications (RFQ) for Administrators. The State Water Board intends to obtain a candidate pool of willing administrators across the State to pull from as necessary. The RFQ process is a continuously rolling application process.

To date, one of the most significant challenges seen to the administrator process is the lack of liability protection for municipal water systems and others that may be willing to act in an administrator capacity but are hesitant to do so because of liability concerns.

8.5 PREVENTION OF NEW UNSUSTAINABLE WATER SYSTEMS (SB-1263)

Chapter 843, Statutes of 2016 (SB 1263) went into effect on January 1, 2017 to prevent the formation of new unsustainable water systems. One of the requirements of the new regulation was the creation of a preliminary technical report as part of the permitting process. This step requires new domestic water supply applicants to review the feasibility of being annexed, connected to, or otherwise supplied domestic water by an existing adjacent community water system. Once that step is taken, an application for a permit to operate a public water system must demonstrate TMF and source capacity. (H&S. Code §116540; CCR, Title 22 §64554.) Health and Safety Code section 116540 (c) also required that impacts such as climate change, contaminant migration and other potential impacts to water system sustainability be considered in the permit review process. SB 200 further modified that section to authorize the State Water Board to deny the permit of a proposed new public water system if it determines that consolidation is a feasible alternative.

SB 200 also requires that local primacy agencies consult with the State Water Board prior to permitting new public water systems; and prevents the use of hauled water as a water source for new residential development.

The State Water Board updated external guidance for new domestic water supply applicants provided on its Permits for Water Systems website, as well as provided training for staff on this important issue. The State Water Board now reviews all preliminary technical reports that are received prior to a new domestic water supply permit application. When proposed public water systems are near existing systems, the Division of Drinking Water often tries to facilitate negotiations between adjacent water systems and potential new water systems for service.

The State Water Board has had success implementing the process of requiring the preliminary technical report and in requiring that no hauled water be utilized as a source. In the cases of proposed new community water systems, the law has been able to help support an earlier and more thorough review of some critical technical, managerial, and financial capacity elements. For example, in 2017, a new health center in Fresno County proposed construction adjacent to an existing public water system with known uranium contamination. Through the preliminary technical review process required by SB 1263, the proposed health center compared the costs of becoming a separate water system, including treatment costs, against the cost of consolidating with the neighboring existing public water system. The State Water Board facilitated discussions between the two parties and a will-serve letter by the existing public water system was issued on August 1, 2018.

However, there continue to be challenges related to preventing new unnecessary water systems from forming. Because development in many counties is an important source of revenue, and housing is a recognized need in California, there is a strong incentive to allow the creation of new water systems even where new development cannot connect to existing services. In some instances, connecting to existing services may not be technically feasible. However, even where a pipeline to hook up to a city's water system is nearby, if the property is located outside the City's service area, a City can decline to serve the development. For example, a City's pipeline was located across the street from a proposed non-community water system that planned to serve industrial uses, but had arsenic and nitrate issues. The industrial facility had a history of non-compliance with various County regulations, including providing water without a water supply permit and was shut-down due to the many violations. When the proposed water system requested connection to the City via a pipeline that was across the street, the City denied access to the water on the grounds that it was technically outside its sphere of influence. However, the City also noted that they historically disagreed with the County's land-use decision in permitting an industrial facility so close to the City. Because the proposed water system was legally denied water service by the City because it was outside of the City's LAFCO designated sphere of influence, even though the pipeline was across the street, the State Water Board had to conclude that water service by the City was not "feasible," even though it was across the street. Further legislative definition of what is deemed "feasible" would provide clarity for these types of situations. For example, California's Plumbing Code Section 713 requires public sewer be installed whenever it is available within 200 feet. While there is no such requirement for drinking water.

Another unintended consequence of the SB 1263 law has been an increase in the number of state small water systems that are being created to side-step public water system rules. By limiting the number of service connections and people being served, a water system falls outside of State Water Board jurisdiction, which is 15 service connections or 25 or more people served six or more months of the year. For example, in 2018, a new mobile home park development in San Joaquin county split its distribution system in two and provided two separate well sources (one to each distribution system), so that the mobile home parks would not technically fall into the public water system category. There is currently no statute that prevents these actions, although that is clearly not the intent of the legislation. The State Water Board is documenting issues that arise with the implementation of this legislation in the event for future legislative modifications are necessary.

Other challenges to the prevention of unsustainable small public water systems include LAFCO's mandate to protect agricultural land from being encroached upon. While this is a laudable goal in California, one of the unintended consequences is the creation of badly needed farm labor housing being denied water service from nearby cities due to LAFCO policies. Instead, some County LAFCO propose that new public water systems be formed because they are concerned about uncontrolled growth if a pipeline to an existing system is created. The result is that growth continues to happen to serve farm labor housing, but results in the formation of many small fragmented water systems that lack economies of scale and often adequate fire protection. Regions where community members are opposed to growth, but development pressures are high, such as Monterey, Sonoma and San Luis Obispo Counties, should negotiate this through enforcement of the General Plan process, not via the formation of fragmented water supply.

The State Water Board believes that more engagement with County and State land-use planners is necessary to develop region or county-wide drinking water plans that eliminate the formation of new, small public water systems and state small water systems unless a larger, well-funded entity will be responsible for the water system, thereby still ensuring the ability to create needed affordable housing. Additionally, drinking water supplies should be a mandatory part of the County General Plans and require an assessment of all water supplies not just the large municipal supplies that are typically the focus of any water section. It is interesting to note that the uniform plumbing code requires that a proposed building is required to be connected to a public sewer when it is located within 200 feet of an existing sewer. The State Water Board also supports more authority for LAFCO to deny any type of new public water system, including mutual water companies, mobile home parks and neighborhood associations within City boundaries or within the sphere of influence of any municipality serving drinking water.

8.6 STATE SMALL WATER SYSTEMS AND DOMESTIC WELLS

In California, state small water systems (SSWS), defined in Health and Safety Code section 116275 (n) as serving 5 to 14 service connections and less than 24 people, are under the jurisdiction of the local health officer of each California county. Permit and water quality requirements for SSWS are found in Sections 64211 through 64217 of the CCR, Title 22 and are not as stringent as regulations for public water systems. The State Water Board has estimated that there are approximately 1,350 SSWS in California, based on numbers provided by each County. However, there may be other unaccounted for SSWS. Estimates for the number of SSWS per county are provided in Table 8-3.

Table 8-3: State Small Water Systems by County

County	State Small Count
Monterey	278
Kern	116
Riverside	95
Santa Clara	64
Sonoma	56
Santa Barbara	47
Santa Cruz	45
Tulare	31
El Dorado	30
San Bernardino	28
Siskiyou	28
Mendocino	27
San Joaquin	27
San Luis Obispo	26
Ventura	26
Fresno	23
Merced	21
Trinity	21
Plumas	20
San Benito	19
Stanislaus	19
Lake	18
San Diego	18
Butte	16
Contra Costa	16
Tehama	16
Shasta	15
Yuba	15
Humboldt	14
Inyo	14
Madera	14
Sutter	14
Modoc	10
San Mateo	10
Solano	10
Napa	9

County	State Small Count
Los Angeles	8
Placer	8
Sierra	8
Colusa	7
Mariposa	7
Sacramento	7
Tuolumne	7
Amador	6
Kings	6
Alameda	5
Glenn	5
Lassen	5
Yolo	5
Marin	4
Nevada	4
Mono	3
Orange	2
Imperial	1
Alpine	0
Calaveras	0
Del Norte	0
San Francisco	0
Total	1,354

Assuming the maximum of 24 people in each state small water system, approximately 32,000 people in California are served by SSWS. There is currently no state-wide locational or boundary information of the SSWS, so it is difficult to determine the magnitude of need related to these systems. Water Foundation and Rural Community Assistance Corporation (RCAC) are currently collecting information and water quality data for SSWS statewide. The information collected as part of this effort is being utilized for evaluating the state of drinking water for these systems.

Residences supplied by domestic wells fall under the jurisdiction of county environmental health programs. Water quality requirements, if any, originate from local ordinances because the Legislature has not imposed any statewide requirements. There are also individual homes where residents rely directly on surface water such as lakes, streams, and irrigation ditches. Residences supplied by domestic wells may not be aware that contaminants such as arsenic and uranium are naturally occurring and present in many regions of California. Homes supplied by surface water sources are particularly vulnerable to acute bacteriological issues as the filtration process to make surface water safe for consumption is particularly challenging.

The United States Geological Survey published a report estimating that approximately 1.3 million people rely on domestic wells for drinking water in California. The State Water Board's Division of Water Quality, in collaboration with other partners, is developing maps of regions in the state that are impacted by the most widespread chemical contaminants encountered and shows the number of domestic wells approximated in each 1 by 1 square mile. This data will be utilized as part of the Drinking Water Needs Analysis to look at potential options, including consolidation with nearby water systems, and cost estimations to implement these options. The numbers for individual homes relying on surface water sources has not been studied to our knowledge.

While neither SSWS nor domestic wells are under the regulatory jurisdiction of the State Water Board, they still represent approximately 1.6 million people, roughly 4 percent of California's population. Moreover, the Human Right to Water (HR2W) recognizes all California's as having the human right to safe, clean, affordable, and accessible water without limitation. SSWS and domestic wells were included in the mandatory consolidation order authority in Chapter 871, Statutes of 2018, (AB 2501). The State Water Board has funded consolidation projects that include SSWS and/or domestic wells. Examples of two of these projects in Tulare County, East Porterville and Monson Water System, can be found on the State Water Board's Water Partnership Success Stories website.

The State Water Board will continue to work toward solutions for SSWS and domestic wells, particularly those impacted by contamination or water supply issues where there is need and funding is available. The State Water Board will make every effort to include SSWS and domestic wells into existing consolidation projects for public water systems; however, it should be noted that consolidation efforts face similar timeline and challenges similar to other consolidation projects. Furthermore, addition of SSWS and domestic wells to consolidation projects often slow the process because each resident must be informed about what their water quality results mean, is provided evaluation of their individual situation with respect to LAFCO boundaries/fees, etc., and the funding activities involved. Therefore, it is necessary to have either easier to access to separate funding sources for SSWS and domestic well owner consolidations, or be prepared that SSWS and domestic well owners may not be included in some projects, so as to balance the need to provide a more expedited consolidation process for the small public water systems.

As part of the State Water Board's Drinking Water Needs Analysis, domestic wells, and to the extent that data is available, SSWS are being included to understand where they may be impacted by contamination, and how public water systems may be impacted by the need to include domestic wells and SSWS in future growth, particularly in the San Joaquin and Salinas Valleys. The goal is to provide an initial point to understanding areas of concern, associated costs, and a possible mechanism for regional planning. SB 200 requires County Environmental Health Departments to submit water quality data for SSWS and domestic wells to the State Water Board from January 1, 2014 to the present and then provide that data on an ongoing basis.

The State Water Board is required to create maps that display contamination location information and the location information of domestic and SSWS wells, and indicate areas that may be at-risk for contamination. The aquifer risk map compiles the source water quality above the respective MCL and depicts a map of relative risk to the contamination in certain areas. The aquifer risk maps will be made available to the public and updated annually. This information will provide a better understanding of water quality risk, combined with other factors like accessibility and affordability, and future fund expenditure plans can attempt to address the areas where greatest risks and needs are located. Information on how the aquifer risk maps were developed was presented during the October 9,2020 Aquifer Risk Map Methodology.

8.7 DRINKING WATER NEEDS ANALYSIS

The State Water Board received funding authorization under Budget Act of 2018 (SB 862) to perform a Needs Analysis regarding the state of drinking water in California. The Needs Analysis results help inform the State Water Board's long-term planning processes going forward, including numbers and locations of potentially unsustainable water systems and to better define needed funding amounts.

On January 11, 2019, the State Water Board assembled a workshop of experts and researchers as part of its initial state-wide Drinking Water Needs Analysis, to summarize common indicators of at-risk water systems that may impact long-term water system sustainability. Two additional public workshops were also completed in 2019 to gather stakeholder input regarding domestic wells and SSWS and cost analyses, respectively. Stakeholder input from these workshops was utilized to develop a Needs Assessment scope of work. A contract for the Needs Assessment was subsequently awarded to the University of California, Los Angeles (UCLA) in September 2019.

Simultaneously as the UCLA Needs Assessment contract was being developed, California approved SB 200 in July 2019. In addition to new funding options, the legislation required that the annual SAFER Fund Expenditure Plan be "based on data and analysis drawn from the drinking water Needs Assessment..." (Health and Safety Code Section 116769(b)). This annual requirement and funding source resulted in the Division of Drinking Water creating a Needs Analysis Unit that is responsible for the ongoing development of these efforts.

The State Water Board's Needs Assessment consists of three core components:

- **Risk Assessment**: Identifying public water systems, tribal water systems, state small water systems, and regions where domestic wells consistently fail or are at-risk of failing to provide adequate safe drinking water.

- **Cost Assessment:** Determining the costs related to the implementation of interim and/or emergency measures and longer-term solutions for systems in violation and at-risk systems. Solutions may include, but are not limited to, water partnerships, physical and managerial consolidations, administrators, treatment facility additions or upgrades, distribution system repairs or replacement, and/or point of use/point of entry treatment. The cost assessment also includes the identification of available funding sources and the funding gaps that may exist to support interim and long-term solutions.
- **Affordability Assessment:** Identifying community water systems that serve disadvantaged communities that must charge their customers' fees that exceed the affordability threshold established by the State Water Board in order to provide adequate safe drinking water.

Figure 8-4 Needs Assessment Components

The State Water Board's Needs Analysis Unit in the Division of Drinking Water is leading the implementation of the Needs Assessment in coordination with the DWQ, DFA and UCLA.

Overall, the Needs Assessment contract with UCLA consists of two core Elements:

- **Identification of Public Water Systems in Violation or At-Risk**: focuses primarily on developing and evaluating risk indicators for community water systems up to 3,300 service connections and non-transient non-community water systems, due to the large number of historical violations associated with these smaller systems.

- **Cost Analysis for Interim and Long-Term Solutions**: developing a model to estimate the costs related to both necessary interim and/or emergency measures and longer-term solutions to bring systems into compliance and address the challenges faced by at-risk water systems. This element also includes the identification of available funding sources and the funding gaps that may exist to support interim and long-term solutions.

These two UCLA Contract Elements of the Needs Assessment are providing the SAFER Program with foundational methodologies for evaluating drinking water risk for public water systems and domestic well users and estimating the cost to ameliorate these challenges. Moving forward, the Needs Analysis Unit will be updating the Needs Assessment regularly to support the implementation of the SAFER Program. The results of the Needs Assessment was used to help prioritize public water systems, tribal water systems, state small water systems, and domestic wells for funding in the Safe and Affordable Drinking Water Fund Expenditure Plan; direct State Water Board technical assistance; and to develop strategies for implementing interim and long-term solutions.

Updates, event notices, and reference material can be found on our Needs Analysis website.

In 2020, the Needs Assessment work continued with multiple webinars and whitepapers detailed below:

- April 17, Risk Assessment webinar
- July 22, Risk Assessment webinar and Whitepaper
- August 28, Cost Estimate webinar and Whitepaper
- October 13, Risk Assessment Indictor webinar and Whitepaper
- October 30, Finance Dashboard webinar
- November 20, Cost estimate webinar and Whitepaper,
- December 14, Risk Assessment webinar and Whitepaper

8.8 ENGAGEMENT UNITS

In addition to the Needs Analysis Unit, the State Water Board has created Northern California and Southern California Engagement Units. These units are specifically designed to support water systems on the HR2W and are at risk of failing to provide adequate safe drinking water, identified through the Needs Assessment process. These units have a specialty in assisting in consolidations, both voluntary and mandatory, and the appointment of administrators. They also review preliminary technical reports required by SB 1263. The staff are located in District Offices throughout the State to facilitate increased community engagement and engage technical expertise from the district offices.

8.9 CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Although much progress has been made in the past five years on drinking water sustainability and additional tools are being provided with the passage of the Safe and Affordable Drinking Water Fund, much remains to be done. The State Water Board is providing the recommendations below to help move the State forward sustainably towards the HR2W goals.

Most drinking water violations come from water systems serving less than 500 service connections, and approximately 72 percent of the community water systems have less than 500 service connections. Thus, there are approximately 2,500 community water systems with less than 500 service connections. These systems are clearly limited by economies of scale; but many are also limited by technical, managerial, and most importantly, financial capacity. In order to ensure long-term sustainability and decrease hurdles to consolidation and implementation of regional projects, public water systems must ensure that rates reflect proper infrastructure replacement based on industry best practices and that the financial capacity of each water system is directly comparable to other water systems with different governance structures through universal financial capacity metrics. These universal financial capacity metrics must be publicly available to ensure transparency.

The State Water Board recommends increasing financial capacity through setting regulatory requirements, implementing additional inspection procedures, and by creating publicly available financial capacity metrics. The State Water Board plans to utilize the Needs Analysis to initiate financial review of community water systems that show marginal technical, managerial and financial capacity, and to begin creating dialogue and discussion about the infrastructure replacement planning needs and future developments of the Fund Expenditure Plan. It is anticipated that when infrastructure costs are included in small water system rates, that the water rates may be unaffordable for some portion of the population. Therefore, consolidation, regionalization, and other affordability tools (see Chapter 9) may be necessary to bring water rates down for these residents.

With respect to global climate change, the State Water Board recommends that all existing community water systems with one well source be required to have an additional well source, or an intertie to another public water system, to mitigate both future droughts and as redundancy for well failure. Additionally, it is recommended that individual meters be required on all public water systems, not just urban water suppliers, and that minimum fire flow requirements for pipelines and storage capacity be incorporated on a statewide basis to deal with the increase in fires and that drinking water funding not be limited so as to exclude pipeline capacity necessary to provide fire protection. It is also recommended that domestic well owners, SSWS, and small public water systems participate in the SGMA processes.

With respect to consolidations, the State Water Board plans to continue to actively pursue voluntary consolidations and mandatory consolidation orders when necessary. This is a primary mechanism to achieve sustainability for those water systems that may otherwise be at–risk due to future changes such as climate change, new regulations, loss of volunteer board members and general technical, managerial and financial capacity limitations. Given the large number of violations affecting water systems with less than 500 service connections, it is also recommended that mandatory consolidation authority be expanded to non-disadvantaged communities that are less than 500 service connections that have been in violation of a primary maximum contaminant level for more than 3 years. It is also recommended that a state funding source, after 2030, be dedicated to public water system consolidations and 3rd party administrators that can oversee consolidation projects so that many of the limitations of federal funding sources, which can slow and limit funding projects, are alleviated.

While pursuing consolidations and water system sustainability, it is important to not continue to allow the creation of new small water systems that are likely to have TMF problems in the future. Looking forward, the State Water Board recommends that changes be made to SB 1263 to clarify its intent with respect to SSWS and requiring clear technical, managerial and financial capacity for all new water systems. Other states, and other California programs such as landfills, have specific requirements for long-term financial capacity such as proof of credit worthiness and escrow accounts holding. PWS should have to meet similar requirements.

The State Water Board also believes that more engagement with County and State land-use planners is necessary to develop County-wide drinking water plans that eliminate the formation of new small public water systems and state smalls unless a larger, well-funded entity will be responsible for the water system for the long-term, thus ensuring the ability for any small system to provide safe and affordable drinking water. The State Water Board supports more authority for LAFCO to deny any type of new public water system, including mutual water companies, mobile home parks and neighborhood associations within City boundaries and within the sphere of influence of any municipality serving drinking water.

In summary, the sustainability and safety of California's public water systems will be determined by our ability to create partnerships and to physically or managerially consolidate or regionalize water systems to create greater economies of scale. This must be done through greater clarity of expectations and transparency of the financial capacity of existing public water systems and through dedicated funding sources to help water systems overcome the multitude of barriers in achieving these goals. Shifting focus away from short-term fixes to long-term regional partnerships, the long-term will also require a comprehensive plan for preventing the formation of new unsustainable water systems through collaboration between local and state-wide planning agencies, agencies with authority over public water systems, and stringent technical, managerial and financial capacity requirements and review of consolidation potential.

Recommendations

8-1 Require easily accessible and publicly available information regarding technical, managerial, and financial status for all public water systems, regardless of governance types.

8-2 Increase financial capacity requirements, potentially including asset management plans (or similar documents) and requirements to increase rates to meet those asset management plan requirements, as well as provide for adequate reserves, accounting policies, and insurances.

8-3 Expand the financial capacity dashboards to include all public water systems to increase transparency and accessibility of infrastructure needs and water rates.

8-4 Limit the number of water systems a contract operator can maintain per license, similar to North Carolina’s requirements to ensure that minimum levels of service are maintained.

8-5 Requirements for minimum pipeline size and storage tanks requirements to meet fire demand, and/or collaborate with local fire authorities, in drinking water regulations, in order to deal with the demands of the changing climate.

8-6 Water systems to be part of a mutual aid agreement, and all Counties to prepare a Local Hazard Mitigation Plans that address water system needs, including but not limited to identifying feasible water system interties and PWS vulnerable to fire due to inadequately sized pipes.

8-7 Create a comprehensive and publicly available website that summarizes the source capacity and water rights for each public water system.

8-8 In collaboration with the Division of Water Rights, identify barriers and consider whether greater flexibility is needed to modify existing water rights to ensure continued operations during or after emergency events.

8-9 Widely publicize the successes of large water systems or counties that actively support voluntary water system consolidations and regionalization partnership, ensuring safe drinking water for their current communities and their community at large. Perform outreach to notify large systems of smaller water systems that are in their immediate service area.

8-10 Investigate ways to expedite funding for consolidation projects, through technical service providers, administrators, and/or direct payment of connection fees to a receiving water system for a subsumed water system immediately adjacent that may not currently be in violation of drinking water standards, but have TMF failures.

8-11 Expand mandatory consolidation authority to address all public water systems under 500 service connections that have exceeded a primary MCL for longer than three years, not just those that serve disadvantaged communities.

8-12 Provide liability protection for municipal water systems and others that may be willing to act in an administrator capacity but are hesitant to do so because of liability concerns.

8-13 Clarify the intent of SB 1263 on what is considered feasible to deny a public water system permit. The State Water Board recommends that feasible be defined as within 200 feet of another public water system's distribution pipeline or if it is greater than 200 feet but is cost-effective based on an evaluation of 30-year operation and maintenance costs, and regardless of whether the system is within the public water system's sphere of influence.

8-14 Increase engagement with County and State land-use planners to develop County-wide drinking water plans. Plans could be done through required water sections of existing documents such as County General Plans, or other more specific drinking water plans.

8-15 Information regarding SSWS, including water quality data and boundaries, should be publicly available on a single website location for better understanding and greater transparency of any issues regarding these water systems and so they can be included in regional planning efforts.

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CHAPTER 9 DRINKING WATER COST AND AFFORDABILITY

9.1 HUMAN RIGHT TO WATER

Public policy has focused on the right of Californians to have access to high quality drinking water. Chapter 524, Statutes of 2012 (AB 685) established as state policy that every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking and sanitation purposes. Furthermore, Health and Safety Code Section 116270, subdivision (a) states: “Every citizen of California has the right to pure and safe drinking water.”

California’s Human Right to Water law refers to drinking water that is affordable. Affordability of water is directly related to access to water and is an essential component of the Human Right to Water (HR2W). High water rates that are essential for indoor use can make water unaffordable to certain segments of California’s population, disproportionately affecting residents of disadvantaged communities or low-income households regardless of overall community status. The efforts to ensure affordable drinking water to all Californians are ongoing.

The Pacific Institute report, “Assessing Water Affordability, A Pilot Study in Two Regions of California,” August 2013 states, “Water rate affordability is a central element to water access. Cost makes water excludable and inaccessible to those who cannot afford it. Water affordability is also a major concern to public welfare, safety, and security.”

9.2 OVERVIEW

The monthly cost of water is of obvious importance to consumers – not only directly-billed customers, but also tenants who pay for water costs indirectly through rent. For community water systems, the overall budget is dependent on the generation of revenue from billings. The customer’s bill depends on both the rate structure and the amount of water used. The discussion in this chapter pertains only to community water systems. It does not discuss the cost of water for other types of public water systems such as non-community systems and non-transient, non-community systems, as these types of water systems do not typically bill customers for water usage.

As water rates increase, customers have some ability to reduce water usage to reduce the impact of a rate increase. As an example, a rate increase of 10 percent could result in an increase in a monthly bill of 5 percent, if the customer is able to reduce usage sufficiently. However, there are limits in the ability of customers to reduce their usage. Similarly, utilities have learned through experience that there is some uncertainty with projecting revenues under various rate increase scenarios. This is especially true under drought restrictions when the public has shown the ability to make substantial reductions in water usage.

Related to the cost of water, the affordability of water can be considered at both the household and community level. The impact of this expense for households and communities varies depending on numerous factors including housing costs, other utilities, medication, and family needs. The high cost of these basic needs means that cost increases for any single need, such as water, can force families to make difficult and risky tradeoffs which could harm their health and welfare. Affordability is difficult to define and quantify and it has an inherent subjective element.

Chapter 662, Statutes of 2015 (AB 401), required the State Water Board to develop a plan for funding and implementation of a Low-Income Water Rate Assistance Program. Where 30 percent of the state's population or 13 million households are low-income and earning less than 200 percent of the Federal Poverty Level. The statewide plan is called: Recommendations for Implementation of a Statewide Low-Income Water Rate Assistance Program (AB 401 Report) and it was submitted to the California Legislature on February 2020.

Despite water rates that are rising, drinking water provided by community water systems remains a relative bargain compared to the option of purchasing bottled water. Water provided by public water systems is tested to very high standards and is generally very safe to drink. In contrast, bottled water only needs to meet USEPA standards and furthermore has been found to contain high levels of microplastic.

9.3 SOURCES OF REVENUE

9.3.1 Rates and Other Charges

Water rates make up most of the systems' available revenues. In addition to the price of water served, the customer pays fixed costs or charges for being provided a potable water supply through a water system. These can include connection fees, assessments, standby fees, and property taxes from which revenues are used by the utility to pay for annual operations, maintenance and to repay debt.

9.3.2 Non-rate revenue

Some water systems have additional revenue collected via special assessments, surcharges and taxes paid separately (such as via the property tax bill). Some systems derive revenues from income other than rates or assessments. For example, some systems can rent space on their water towers to cell phone companies. Although generally limited, these revenues are flexible and can be used for a variety of expenditures.

9.3.3 Sustainability of Revenue

A fundamental concern for all community water systems is whether current rate structures, along with any existing system reserves, are adequate to enable systems to operate and maintain the water system in a sustainable way. In general, community water systems in California are not funding infrastructure replacement at a rate that is adequate to ensure the future condition of the facilities. This results in a growing gap between infrastructure needs and the revenues and reserves needed to pay for these needs.

Water rates generally provide a stable source of ongoing revenues for water systems. However, economically disadvantaged households may struggle to pay bills including water bills (or rent, which often indirectly pays for drinking water). In most large or medium-sized systems, there is a large rate base that includes many households that are not economically disadvantaged, such that revenues are generally sustainable. In contrast, sustainability of revenue is often challenging for small systems serving disadvantaged communities. The affordability of water, and shut-offs of water service for nonpayment, are addressed later in this chapter.

9.3.4 Uses of Revenue

9.3.4.1 Ongoing Operational Costs

Water systems must continually spend their revenue to operate the system and provide customers with safe and clean drinking water. These expenditures include operational costs; maintenance costs; water quality monitoring cost, and for contaminated sources, cost of treatment – which can be substantial. In addition, some water systems have to purchase water from wholesalers to meet their supply needs.

9.3.5 Replacement Costs – Reserves

The physical infrastructure of water systems can be extensive and can include pipes, valves, treatment systems, wells, storage facilities and other components. This physical infrastructure deteriorates over time and must be periodically replaced. Most system infrastructure components remain in service considerably past their expected life expectancy. Only upon failure or unacceptable water quality or service are they considered for replacement.

9.3.5.1 Debt Services

Systems often fund their capital improvements – such as for the replacement of aging infrastructure – through borrowing. The larger systems may issue bonds, and many systems borrow from sources such as the Drinking Water State Revolving Fund. Repayment of debt can be a significant source of expenditure for water systems, especially if they have taken seriously the replacement of aging infrastructure. More information on financing available to water systems is detailed in Chapter 10.

9.3.5.2 Low-Income Rate Assistance (LIRA) Programs

Publicly owned systems are subject to Proposition 218, which requires that property related fees for water service not exceed the proportional cost of service attributable to the property and that the revenues derived from such fees not exceed the funds required to provide the property related service. Publicly owned water systems struggle to reconcile the funding of LIRA programs by water rate revenues with these constitutional cost-of-service requirements and, as a result, instead fund LIRA programs from non-rate revenues. In practice, these limitations mean that only large publicly-owned systems with access to non-rate revenues, such as lease revenues or voluntary donations, and privately owned systems, which are not subject to Propositions 218 or 26, are able to provide some type of affordability assistance.

9.4 WATER SYSTEM COST FACTORS

Water systems need to factor in their rates the requirements to meet fixed costs of water and variable costs of water. Variable costs are expenses that fluctuate based on the amount of water produced such as energy, chemical costs, labor, and gasoline for vehicles. Fixed costs are costs that are incurred regardless of the volume of production, such as employee salaries and infrastructure financing costs to maintain treatment facilities and the distribution system or to build a treatment plant or new well. As conservation becomes more prevalent, rates will have to increase to make up for the lower consumption.

9.4.1 Governance Types

The governance type has an impact on water costs. As described in Chapter 2, community water systems (CWS) can be either publicly- or privately-owned. Publicly owned CWS include cities, counties, and special districts. Privately-owned systems include investor-owned utilities regulated by the California Public Utilities Commission (CPUC), as well as other privately-owned systems. This group includes mutual water companies, mobile home parks, employee housing such as farmworker housing, apartments, condominium developments, and other facilities owned by individuals or partnerships, but not subject to most of the CPUC's rate setting requirements. Chapter 8 includes a breakdown of the numbers of systems by governance type.

System governance type is significant for several reasons, including the fact that publicly owned systems are subject to constitutional requirements limiting their use of revenues. According to the California Legislative Analyst's Office, "In general, the intent of Proposition 218 is to ensure that all taxes and most charges on property owners are subject to voter approval. In addition, Proposition 218 seeks to curb some perceived abuses in the use of assessments and property related fees, specifically the use of these revenue-raising tools to pay for general governmental services rather than property related service." (California Legislative Analyst's Office, December 1996). As previously discussed, privately-owned systems' rate structures are not subject to Proposition 218, so some use rate revenues to fund LIRA programs. Privately-owned systems regulated by the CPUC must go through the CPUC when setting water rates.

9.4.2 System Size

The system size also has a significant effect on water costs. All systems incur costs for operators, energy, maintenance, monitoring and testing, etc. While large systems can spread these costs over a large number of customers, small systems have the same categories of expenses but fewer customers. Therefore, small systems inherently lack economies of scale, as discussed further below.

9.4.3 Source of Water

The water source(s) used by the water system also have a significant impact on costs. Variation in the water quality of the source and the type of treatment that may be required impacts cost. Surface water sources require extensive treatment and may also entail significant costs to purchase the water from wholesalers. Groundwater sources may or may not require treatment, but they entail ongoing expenditure for electricity to operate pumps.

Many of the findings of the 1991 Morgan and Mercer survey, a survey to determine the cost of drinking water conducted in 1990 for the 1993 Safe Drinking Water Plan, appear to remain valid today. Specifically, that survey found that: “Overall, treated surface water is the most expensive source of supply for California consumers. The cost to provide treatment to groundwater is very similar, at only two percent to three percent lower. This is due to the high capital cost to construct water treatment facilities and the high ongoing costs to operate and maintain these facilities. With surface water, all water delivered to customers must be treated, whereas for groundwater, if treatment is provided due to chemical or microbiological contamination, it is usually on a source by source basis; few utilities that use groundwater are required to provide treatment on all wells serving their system. Of the utilities using surface water, almost all will also have groundwater sources that are used as emergency sources or to buffer seasonal or peak day demands.”

9.4.4 Geographic location; Local and Regional Conditions

Geographic setting can have an outsized effect on water costs. Much of Southern California is classified as desert, whereas much of Northern California receives abundant rain and snowfall. There are large aqueducts that import surface water supplies from Northern California and the Eastern Sierras to the Central Valley and Southern California areas. This results in additional costs for these supplies. The costs of water supply vary accordingly.

Other geographic impacts include water quality variations. Anthropogenic contaminants, discussed in Chapter 4, such as 1,2,3-trichloropropane, tend to be detected in particular regions of the state and may increase the cost of water for systems in those regions.

9.5 RATE DESIGN

9.5.1 Elements of Rate Design

Water systems need to factor in their rates the requirements to meet fixed costs of water and variable costs of water. Variable costs are expenses that fluctuate based on the amount of water produced such as energy, chemical costs, labor, and gasoline for vehicles. Fixed costs are costs that are incurred regardless of the volume of production, such as employee salaries and infrastructure financing costs to maintain treatment facilities and the distribution system or to build a treatment plant or construct a new well.

Water systems that use only flat or variable rates can see the revenue from their rates greatly fluctuate due to various factors such as weather and drought. Systems that set their rates to a combination of Flat Base Rate and Variable Usage Rates are better able to handle changes in consumption that impact revenues. The Flat Base Rate can address the fixed costs while the usage rates can address the variable costs.

Water systems have continued to develop a variety of rate structures to best meet their needs. The most common of these rate structures include the following:

1. Flat base rates. A flat rate usually based on pipe or meter size.
2. Variable base rates.
3. Uniform usage rate; a metered rate based on a uniform quantity charge for water.
4. Variable usage rate; a metered rate where the water rate charges are based on a "tiered rate," with different rates for different ranges of consumption during a billing period.
5. Flat base rate and variable usage rate combination.

Some rate structures include other factors, such as additional charges for homes in higher elevations or for larger lot sizes.

Note that rate designs that encourage conservation (numbers 2 through 5 above) require that customers have water meters. A lack of water meters prevents the water system from sending significant price signals to customers, resulting in less incentive to conserve water during droughts.

9.5.2 Rate-setting Process

There are two steps to the establishment of appropriate water rates. The first step involves determining a rate structure that will provide the necessary revenue in an equitable way. The second step involves gaining approval of the rate structure. The process for approving rate increases is different for public agencies than for private entities. For public agencies, there is a public review and input process under Proposition 218. Private entities may need to obtain approval by the California Public Utilities Commission.

For public agencies, gaining ratepayer acceptance through the public review process can be a challenge. Good communication, transparency, credibility, and trust are essential elements of the process. The cost of deferred maintenance has been seen to create very difficult situations and, eventually, high water rates for communities. The failure to set aside adequate reserves to pay for the maintenance and eventually replacement of facilities can result in the need for very high water rate increases, which can be rejected by the ratepayers.

9.5.3 Rate-setting Process - Proposition 218

Both Proposition 218, which was approved by voters in 1996, and Proposition 26, approved by voters in 2010, impact the ways in which water systems may collect funds from ratepayers. Proposition 218 imposes substantive and procedural restrictions on taxes, assessments, fees, and charges "assessed by any agency upon any parcel of property or upon any person as an incident of property ownership." (Cal. Const., art. XIIID, § 3(a).) Under Article XIIID of the California Constitution, the "fee or charge imposed upon any parcel or person as an incident of property ownership" must not "exceed the proportional cost of the service attributable to the parcel." (Cal. Const., art. XIIID, § 4(a).) Proposition 218 also added article XIIIC, which restricts the authority of local governments to impose taxes by requiring voter approval of all taxes.

In 2010, voters passed Proposition 26, which expanded the reach of XIIIC's voter approval requirements by broadening the definition of "tax" to include "any levy, charge, or exaction of any kind imposed by a local government." (Cal. Const., art. XIIIC, §1(e).) The definition contains numerous exceptions for charges or assessments, which generally implement pre-Proposition 26 case law that distinguish between taxes and regulatory fees. (*City of San Buenaventura v. United Water Conservation District* (2017) 3 Cal.5th 1191, 1210, (quoting *Sinclair Paint Co. v. State Bd. Of Equalization* (1997) 15 Cal. 4th 886, 874 that in general "taxes are imposed for revenue purposes, rather than in return for a specific benefit conferred or privilege granted.") In addition to falling into one of the exceptions, to be exempt from the voter approval requirements, the government must also show that the amount of the charge is "no more than necessary to cover the reasonable costs of the governmental activity," and "the manner in which those costs are allocated to a payor bear a fair or reasonable relationship to the payor's burdens on, or benefits received from the governmental activity." (Cal. Const., art. XIIIC, §1(e).) Charges subject to Proposition 26 are not limited to those fees or charges imposed on parcels or persons "as an incident of property ownership." (*City of San Buenaventura*, 3 Cal. 5th at 1208 ["not all fees associated with obtaining water are property-related fees within the meaning of article XIIID"].)

Under Proposition 218, "[n]o local government may impose, extend, or increase any general tax unless and until that tax is submitted to the electorate and approved by a majority vote." (Ca. Const. Art. XIII C, §2(b).) Similarly, a two thirds voter approval is required before a local government may "impose, extend, or increase any special tax." (Ca. Const. Art. XIII C, §2(d).) There are also voter approval requirements for property-related fees and charges; however, these voter approval requirements are not applicable to levying fees for water service. Section 6 of Article XIII expressly exempts water service charges from the voter-approval requirement for other property-related fees and charges. (Cal. Const., art. XIII D, § 6, subd. (c) ["Except for fees or charges for sewer, water, and refuse collection services, no property-related fee or charge shall be imposed or increased unless and until that fee or charge is submitted and approved by a majority vote of the property owners of the property subject to the fee or charge or, at the option of the agency, by a two-thirds vote of the electorate residing in the affected area"].) Instead, fees or charges for water service can be challenged by a majority protest procedure under Proposition 218, and by the initiative process (*Bighorn-Desert View Water Agency v. Verjil*, 39 Cal. 4th 205; *Howard Jarvis Taxpayer Assoc. v. Amador Water Agency* 36 Cal.App.5th 279, mod. 37 Cal.App.5th 164a; *Morgan v. Imperial Irrigation Dist.* (2014) 223 Cal.App.4th 892, 910 (holding that protest procedure required by Section 6 of Article XII does not require each rate tier to have its own separate protest procedure.)

This has affected the steps that the State Water Board takes to provide financial assistance to water systems for capital projects. Before the State Water Board enters into an agreement to fund a new treatment system, it ensures that the water system is able to pay for the ongoing operation and maintenance of the system, and when a loan is provided instead of a grant, that it has a sufficient source of income to pay back the loan. This could require that the system raise its fees. If a fee increase is needed, the State Water Board waits until the fee has been increased and survived the majority protest proceedings before it enters into the funding agreement. The court in *Paradise Irrigation District v. Commission on State Mandates* (2019) 33 Cal. App. 5th 174, noted a presumption that local voters give appropriate consideration and deference to a government board's judgments about the rate structure needed to ensure a public water agency's financial solvency, and that board members will give appropriate consideration and deference to the voters expressed wishes for affordable water service. There the court found that such an arrangement does not revoke water systems' legal authority to levy fees necessary to comport with state water laws, but instead is a "power-sharing arrangement." (*Id.* at 194-195.) Nonetheless, there have been situations where the fees have successfully been raised, only to later be rolled back by the initiative process.

In addition to challenges to rate increases by majority protest procedure, challenges to rates have also been based on the rate structure, arguing either that the rate exceeded what was necessary to fund the government activity or the costs were not proportional to the payor's burden on, or benefit from, the governmental activity. (See *Plantier v. Ramona Mun. Water Dist.* (2019) 7 Cal. 5th 372 [finding that challenges based on proportionality requirement do not have to comply with administrative remedy in subdivision (a)(2) of section 6 for protest over imposition of increase in rates prior to filing suit].) For example, in *City of San Buenaventura*, *supra*, the California Supreme Court found that groundwater pumping charges imposed to fund a local agency's groundwater conservation and management services, such as replenishing groundwater stores and preventing the degradation of the groundwater supply, had to be both "no more than necessary to cover the reasonable costs of the governmental activity," and "bear a fair or reasonable relationship to the payor's burden on or benefit received from the governmental activity." (*City of San Buenaventura* 3 Cal. 5^{th} at 1214; see also *City of Palmdale v. Palmdale Water District* (2011) 198 Cal.App.4th 926 [finding that Water District failed to demonstrate that its water rate structure met the proportionality requirement because it charges a few irrigation users a vastly disproportionate share of the Water District's costs.].)

These constraints on ratemaking impact water systems' abilities to fund programs to assist low-income rate payers. Such programs could not charge some rate payers a higher amount for their water service in order to support other low-income rate payers that are low-income. A program could be supported by voter-approved tax, however. The court in *Capistrano Taxpayers Assn., Inc. v. City of San Juan Capistrano* (2015) 235 Cal.App.4^{th} 1493, noted that above-costs rates could be imposed, but they would have to be submitted to the electorate and approved by the people in a vote. "There is no reason, for example, why a water district or local government cannot, be consistent with Proposition 218, seek the approval of the voters to impose a tax on water over a given level of usage…" (*Id.* at 1515.)

9.6 INFRASTRUCTURE NEEDS / ASSET MANAGEMENT PLAN

Rates collected by water systems include any revenues to be set aside for infrastructure reserves. The current and projected amount of reserves is one major factor in determining the funding gap that may exist for infrastructure replacement. The second major factor in evaluating the adequacy of reserves is having adequate information on the current state of the physical facilities with respect to their expected lifespan. These factors, taken together, provide the basis for an asset-management plan document.

There is not currently a regulatory requirement that all public water systems in California develop an asset-management plan. Other states have requirements for asset-management plans, most notably Ohio, which adopted a requirement for asset management plans for all public water systems effective in 2018.

In order to estimate national infrastructure needs, the United States Environmental Protection Agency (USEPA) conducts the Drinking Water Infrastructure Needs Survey and Assessment (DWINSA) every four years. The USEPA DWINSA is the best available information on the national needs of community water systems to meet the requirements of the Safe Drinking Water Act. This survey is not designed to include other infrastructure needs such as system expansion and upgrades that are not directly related to meeting

Safe Drinking Water Act requirements.

Table 9-1 below shows the results of the DWINSA for 1994 through 2015. During the last 20 years of the survey the needs of California water systems has increased by 2.7 times.

Table 9-1: Comparison of 20-year National Need in Billions (January, 2015 dollars)

Year	National Need	California Need
1995	$253.6	$18.8
1999	$250.9	$29.1
2003	$419.4	$42.2
2007	$423.7	$49.4
2011	$428.6	$49.7
2015	$472.6	$51.0

Given the aging infrastructure and increase in the number of regulated contaminants, water systems must ensure that their water rates reflect the true cost of water and that they can communicate this information clearly to their communities. Financial planning should include creating asset management plans and the ability to increase rates to meet those asset management plan requirements, as well as provide for adequate reserves. If the needed rate structures are unaffordable for some portion of the population, then finding ways to expand rate bases or decreasing overhead through water partnerships or low-income assistance may be necessary. Good water system governance decisions can only occur when water system governing entities and management have a full understanding of the financial needs of their water system.

9.7 WATER RATES / RATE SURVEYS

Water costs vary significantly from system to system based on a variety of factors. There is some general variation in cost from region to region across the state. The water usage and cost data gathered by the State Water Board for 2017 are summarized based on the ten primary hydrological regions of the state. These regions and corresponding water usage data are shown in Table 9-2 below. The information in this table is based on data provided by community water systems via the Electronic Annual Report (EAR) document. The data includes information from more than 90 percent of the community water systems in California. The average monthly water cost across the 10 regions results in an average monthly cost of $73 statewide.

Table 9-2: Water Usage and Monthly Cost Data for the Ten Primary Hydrologic Regions

Region	Average Per Connection (gallon per day)	Average Monthly Cost per Home
Central Coast	217	$76

Region	Average Per Connection (gallon per day)	Average Monthly Cost per Home
Colorado River	323	$51
North Coast	208	$48
North Lahontan	287	$35
Sacramento River	313	$63
San Francisco Bay	220	$96
San Joaquin River	359	$50
South Coast	293	$73
South Lahontan	283	$65
Tulare Lake	486	$68
Average of Regions	310	$73

For a broader perspective on the variation of rates over time, a comparison of current data with data from previous versions of the Safe Drinking Water Plan was performed. In both the 1991 and 2015 Safe Drinking Water Plans, the cost of water was compared across six regions of the state. However, these six regions do not fully align with the 10 hydrological regions that are currently used for the analysis. Therefore, a comparison by regions of the current regional data with the regional data used in the previous reports is not feasible. However, it is possible to compare the average monthly cost of water statewide from the two previous reports. Table 9-3 provides that comparison. Between 1991 and 2012 (11 years) there was a 59 percent increase in the statewide average, and between 2012 and 2017 (5 years) there was a 21 percent increase in average monthly water bills.

Table 9-3: Statewide Average Monthly Bill by Year (1991 and 2012 values were adjusted to 2017 dollars)

1991	2012	2017
$37.84	$60.09	$72.75

The Table 9-4: compares the cost of water over these same time periods for various system sizes. Costs have been adjusted to 2017 dollars, and water usage of 1200 cubic feet per month.

Table 9-4: Average Monthly Water Rate by System Size - Service connections

Year	Small (<200 service connections)	Intermediate (200 to 999 service connections)	Medium (1,000 to 9,999 service connections)	Large (>10,000 service connections)
1991	$47	$40	$39	$37
2012	$68	$57	$57	$56
2017	$95	$70	$80	$76

9.7.1 Other Data Sources on Water Rates – AWWA Surveys

It is important to consider other sources of information on water rates since every data set has limitations related to the quality and completeness of the data sets. One other good source of rate data is cost of water information from the periodic surveys conducted by the California-Nevada section of the American Water Works Association (AWWA). The most recent survey completed by AWWA was for calendar year 2017. The AWWA survey is a voluntary survey with fewer reporting systems than are reported to the Division of Drinking Water via the EAR process. The average cost per region obtained through the Division of Drinking Water analysis were largely consistent with the results published in the 2017 AWWA California/ Nevada Water Rate Study. The AWWA rate study is available at: https://ca-nv-awwa.org/canv/downloads/2018/CA-NV_RateSurvey-2017_final.pdf

9.7.2 Survey Data Gaps and Limitations

It is important to recognize that the information on water rates were obtained through voluntary survey questions; consequently, there is a large data gap for statewide water rates. Estimates of the number of systems that provided reliable water rate data range from 478 (AB 401 Report) to 1,158 (Revised OEHHA Framework). Of the total of approximately 2,900 community water systems in the state, these figures correspond to about 16.5 percent and 40 percent, respectively, meaning that reliable water rate data are not available for 60 percent to 83.5 percent of the state's community water systems. Large systems were more likely to provide reliable and accurate water rate information than were smaller systems.

This has resulted in a biased data set for water rates. Since OEHHA has found that water rates are generally higher for smaller systems than for larger systems (OEHHA Revised Framework), overall water rates in California are likely higher than indicated by the tables above. However, larger systems serve a very high percentage of California residents, so the average cost paid per resident is only slightly affected by the data bias. Nevertheless, the lack of water rate data for small systems significantly limits the state's understanding of the burdens posed by high water rates on communities served by small systems.

9.7.3 Average Rates and Current Trends

There are many factors for the variance in water rates locally, regionally and across the state. In addition, there are factors that contribute to the overall increasing cost of water. Some of the major factors include:

- Increases in cost associated with producing water such as electricity, chemicals, etc.
- Court action regarding water allocations of Colorado River waters resulting in a decrease in California's allotment has required utilities throughout Southern

California to switch to more costly sources of water and to promote water conservation measures.
- Costs associated with replacing infrastructure as components originally brought into service 25 to 75 years ago (distribution pipes, storage tanks, treatment plants, wells, etc.), reach the end of their useful life.
- Improved drinking water standards have caused many water systems to add treatment facilities, increase treatment chemical use, or improve their existing treatment facilities. Many also incur treatment residuals handling costs.
- Local water shortages and cyclical drought conditions trigger the need to develop additional sources of supply.

Regulations established at both the state and federal level have required increased monitoring of chemical and microbial contaminants. Improved analytical methodologies have allowed for the detection of chemicals at much lower concentrations and identified new microorganisms of health concern. These improved methods require more sophisticated instrumentation and result in increased monitoring cost.

9.7.4 Water Rates - External Factors

9.7.4.1 Wholesale Prices

As California's water supplies are increasingly strained, the wholesale price of water may increase, and systems must pass this added expense along to their customers.

9.7.4.2 Drought/Climate Change

Climate change is causing increased drought in California. Water conservation and drought affect water rates, particularly depending on the water rate structure. There are both direct and indirect costs associated with water conservation and drought. While water conservation conserves a scarce resource -- whether in response to state mandates, drought, or climate change concerns -- it also reduces water sales and revenues in systems with metered rates, usually at a level that is not directly proportional to a corresponding reduction to the costs of providing service. The tiered/inclined rate structures increasingly used by water systems (lower rates for less consumption) tend to reduce revenues. Conservation can result in a utility's need to raise metered rates to cover fixed costs that are not directly related to the volume of water used by customers.

9.7.4.3 Other Impacts

The COVID-19 pandemic has had numerous impacts, including financially affecting water systems. Historically, water systems may stop providing water services for non-payment; however, on April 2, 2020, the Governor issued Executive Order N-42-20 prohibiting shut offs of water service to residences and critical infrastructure sector small businesses for non-payment. Due to the pandemic, customers may not be able to afford their water bill, thereby reducing the amount of revenues water systems receive to cover expenses. To better understand the financial impacts, the State Water Board is collecting data on water system finances and household water bill debt accumulation.

9.7.5 Infrastructure Replacement & Improvement

In many systems, water rates have been kept low by deferring expenditures for needed maintenance and replacement of water treatment facilities and distribution systems. This has resulted in many systems facing the need for replacement of outdated or severely deteriorated infrastructure such as leaking mains and deficient storage capacity.

9.7.6 Small System Considerations

Even though smaller water systems currently have some of the highest water rates for drinking water in the state, the small systems generally still have an inadequate rate structure to provide for system replacement needs and improvements to meet new drinking water standards. Although the current cost of water is higher in smaller water systems than in larger water systems, this does not equate to better quality water or service. In most cases, small systems are in poor physical condition, and this in turn results in a higher rate of noncompliance. In other words, smaller water system customers are paying more and receiving less than customers in large water systems.

If small- to medium-sized systems continue to charge insufficient water rates, noncompliance will increase due to a failure to plan for and implement rate structure changes to replace deteriorating infrastructure without significant outside financial help. Without a rapid reassessment of the adequacy of existing water rates, almost all water systems in California will be faced with source, quality, storage, and distribution issues that impact the ability to provide safe water.

9.7.7 Future Trends in Water Rates

The water industry has experience with the challenges of accurately forecasting revenue as water rates are adjusted. During the drought years of 2014 through 2016, many water systems in California adopted water rate increases and surcharges designed in part to encourage conservation. In some cases, these higher rates resulted in lower overall revenue than projected, due to decreased demand. Water systems have learned that adjusting water rates can have unanticipated impacts on actual revenues.

Based on the noted factors including more stringent regulations, increased costs of treatment, climate change, water conservation, location of water sources, and deteriorating infrastructure, the future cost of providing drinking water can be expected to increase beyond inflation rates that affect prices in general. Water utilities are primarily governed on a local level such that rates are based on local conditions of source, water availability, size, and local water quality issues.

In general, large water systems and most medium-sized water systems will be able to deal with these cost increases given their economies of scale. However, for small water systems, particularly those that serve disadvantaged communities, the increasing costs may be insurmountable. Although many small water systems making infrastructure improvements or installing treatment to meet drinking water standards can receive financial assistance through grants to construct these capital improvements, they may not have the financial capacity to operate the system, particularly sophisticated treatment facilities needed to address contaminants such as arsenic and nitrate. In general, many small water systems may not be viable in California, and consolidation and regionalization may be the only option for many existing systems.

9.8 AFFORDABILITY OF WATER

9.8.1 Human Right to Water Considerations

Affordability is one of the major components of the state's policy declaring the HR2W. The increasing cost of water directly impacts the amount paid each month by each household for water. The impact of this expense for households and individuals varies based on numerous factors that mostly fit under the category of 'Affordability'. Consideration of affordability is complex in that affordability is in large part subjective, depending largely on both household and community socio-economic factors.

To address affordability more fully, the following over-arching work is underway within CalEPA:

1. OEHHA – Achieving the Human Right to Water (August 2019 Public Review Draft Report),
2. State Water Board – Options for Implementation of a Statewide Low-Income Water Rate Assistance Program (Pursuant to SB 401).

Considerable work has also been done to assess affordability at the household level. For example, the Pacific Institute report showed that, while at the community level the cost of water service may be considered affordable, those households whose income is below the median level of the community are paying a higher percentage of their income for water service and, therefore, are unlikely to be able to afford that cost. The report also found that this situation was not just confined to households in small disadvantaged communities but was also associated with households served by water systems in the metropolitan areas. In addition, other researchers (Teodoro et al.) have proposed different measures of household-level affordability, including an effort to capture impacts of other expenses such as housing costs on a household's ability to afford water service, as well as a measure that captures the length of time needed to work at the prevailing minimum wage to afford water service.

In addition to water costs discussed above, other costs to the consumer are more difficult to assess because they are "hidden" or intangible costs. As an example, if a water utility serving a residence is not in compliance with all regulations, including drinking water standards, the Department of Housing and Urban Development or private lenders may deny mortgage financing to the potential borrowers. All customers served by that system could experience difficulties in selling their homes until the water system returns to compliance with drinking water standards. What financing that is available may be at a higher rate or require a larger down payment, due to the increased risk to the value of the property. In addition, problems with source quantity, storage capacity, or distribution piping can result in increased premiums for fire insurance. The ability of a water system to address such issues is related to size, with smaller systems requiring more time to respond and make repairs or corrections.

9.8.2 Role of Consolidations

As noted above, system consolidations can be an effective method of improving water affordability for a water system's consumers. Consolidations can be either physical or managerial. With managerial consolidation, individual water systems remain physically independent of each other, typically maintaining their own rate structure and water source. However, the systems typically share an administrator, engineer, accounting staff, meter readers, grant managers, plant operators, electricians, mechanics, and vehicle and insurance pools. By sharing the overhead, the systems all have access to key services when needed and for as long as needed. This helps water systems to keep rates affordable while providing high quality staff and resources.

9.8.3 Water System Shutoffs

A significant issue for water system customers is water service shutoffs. Shutoffs for lack of payment pose a risk to the human health of affected consumers. In 2018, the Legislature passed, and the Governor approved, the Water Shutoff Protection Act (Chapter 891, Statutes of 2018 (SB 998)). The Water Shutoff Protection Act requires a public water system that supplies water to more than 200 service connections to have a written policy on discontinuation of residential water service, and imposes procedural limits on discontinuations of service, including minimum delinquency times, notice requirements, and restrictions on shutoffs to customers that cannot afford to pay their bills and for whom a shutoff would pose threat to life or health and safety.

According to the State Water Board's AB 401 Report, "some data has been collected in the State Water Board's 2018 Electronic Annual Reporting System (EAR) regarding the prevalence of water shutoffs following the passage of the Water Shutoff Protection Act. The data reported by about 500 of the state's largest CWS suggest that there are at least 250,000 drinking water service shutoffs of occupied single-family residential accounts annually in the state. Outside of the protections of the Water Shutoff Protection Act, water system customers may be vulnerable to water system shutoffs and the health effects they cause.

9.9 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

There are several factors that affect the cost incurred by water systems, from the water source used to the size of the water system. To cover the cost, most community water systems charge for providing water services. These rates need to cover both current expenses for operating and maintaining the water system and planned future projects, such as pipeline replacements. Water systems will be better prepared to set adequate rates when asset management plans are developed.

Water system cost will continue to increase due to a variety of factors including new regulatory requirements, infrastructure maintenance and upgrades, treatment of contaminated sources, and new water source development to address population growth demands. Small water systems (PWS serving less than 200 service connections) do not have the economies of scale to absorb these costs increases. On average, customers of small water systems pay more for water by approximately 20 percent than those customers served by systems within the three other size groups (intermediate, medium, and large). Even though customers of small water systems pay more for water service, the water rates charged by many small systems are insufficient to fully fund costs for operation and maintenance, reserves, and capital investments. This results in the need for even higher water rates.

The cost of water is unaffordable for a segment of customers, particularly customers served by small economically disadvantaged community water systems. Research has shown there are customers served by public water systems in both urban/suburban areas and rural areas who pay more of their annual income for water service than is considered affordable, based on commonly used affordability criteria. The State Water Board will continue to pursue solutions ensuring all Californians have access to safe, clean, and affordable drinking water.

Recommendations

9-1 Many small water systems have water rates that are too low and some still have flat rates. Each public water system should be required to analyze the adequacy of their rate structure and asset-management plan. For small systems, technical assistance can be provided to assist with this work.

9-2 Options should be developed and evaluated for making drinking water affordable for all low income households, including evaluating the potential for establishing an appropriate water service subsidization program to low-income families and individuals served by a PWS that charges unaffordable rates. As a guiding human right principle, the cost of water should not pose a barrier to access. Assistance should be provided by some means to low-income households that face discontinuation of water service in order to protect human health impacts from shutoffs of water service due to payments in arrears.

References

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Chapter 662, Statutes of 2015 (AB 401) (https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB401)

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State Water Board's "Recommendations for Implantation of a Statewide Low-Income Water Rate Assistance Program" (AB 401 Report) (https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/assistance/docs/ab401_report.pdf)

USEPA Drinking Water Infrastructure Needs Survey and Assessment 6th Edition(https://www.epa.gov/sites/production/files/2018-10/documents/corrected_sixth_drinking_water_infrastructure_needs_survey_and_assessment.pdf)

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CHAPTER 10 FINANCING PUBLIC WATER SYSTEM INFRASTRUCTURE

10.1 METHODS OF FINANCING

Water systems need funds for capital improvements. New or upgraded facilities may be necessary to meet regulatory requirements. In addition, aging water system infrastructure nearing or beyond the end of its useful life must be replaced. In addition to capital cost, water systems should consider the cost associated with the operations and maintenance of the infrastructure for the project to be successful. For example, a water system may secure the funds necessary to install a water treatment facility; however, without the funds to cover the operations and maintenance the facility will be unlikely to continue to provide safe drinking water.

10.1.1 Self-Financing

Self-financing, commonly termed “pay-as-you-go,” is a form of non-debt financing where a water system contributes revenues to a capital improvement reserve fund and the system uses accumulated revenues and other income to pay for system improvements without incurring debt. Very few PWS are able to generate this reserve based on accumulated revenues. This is particularly true for small systems. Reserves, if any, held by small systems are generally insignificant in comparison to capital improvement funding requirements. Because of the low reserves held by existing smaller systems and the limited number of systems that generally maintain a reserve account, self-financing may not be a viable option except under certain circumstances. Self-financing may be viable for capital expenditures if the project may be broken into several phases and constructed individually over time. This can delay compliance with regulatory requirements, however. In addition, constitutional constraints on ratemaking and other sources of revenue may pose obstacles to publicly owned systems wishing to self-fund future capital improvements.

10.1.2 Debt Financing

Capital improvements, as opposed to ongoing operations and maintenance costs, may be financed through long-term debt so that the cost of the project is spread out over its useful life.

Publicly owned systems typically finance capital improvements through the use of revenue bonds or loans. Other financing options may include general obligation (GO) bonds and assessment- or tax-secured financing. Municipal bonds may be issued by public entities as either taxable or tax-exempt, depending on the uses of the bond proceeds (such as project, project beneficiaries, timing of expenditures, etc.). Many publicly owned water systems issue tax-exempt bonds, which result in lower overall debt service obligations on the part of the system than would taxable bonds. The costs associated with bond issuance, including future customer water rate structures, must be considered in determining the feasibility of these mechanisms for financing.

Privately-owned systems may finance capital improvements through revenue-secured loans or bonds.

Debt financing terms may vary. Repayment terms for capital financing typically require repayment over a 20 to 30-year term, not to exceed the useful life of the improvements. Short-term bridge financing may be available to certain systems to cover planning costs and initial construction costs incurred by a system while it structures long-term financing.

10.1.3 Public-Private Partnerships

Public-private partnerships (P3) are sometimes formed to design, build, own, operate, and finance significant capital projects. Whether a true P3 or through an informal arrangement, partnership with a private entity can be a way for a local government to work with the private sector in obtaining financing and/or construction for needed facilities. In particular, a number of city water departments are now being leased to CPUC-regulated, investor-owned, water utilities. For example, California Water Service Company operates two leased water systems for the City of Hawthorne and the City of Commerce.

Participation of a private entity may negatively affect the ability of a public entity to issue tax-exempt revenue bonds. The authorizing statute for P3 may also prohibit use of state funds on a P3 project.

10.2 FEASIBILITY OF FINANCING OPTIONS

Whether a particular financing mechanism is feasible for a system will vary by the type of ownership and size of the water system. Specific benefits or limitations associated with ownership and size are discussed below. Note that many of these financing mechanisms are available only for capital improvement projects and cannot be accessed for ongoing operations and maintenance (O&M) costs.

10.2.1 Publicly Owned Water System Financing

Water systems that are publicly owned, including cities and special districts, may take advantage of tax-exempt bond financing, as discussed above. This results in a lower interest rate than they would pay if they issued taxable bonds. The lower interest rate paid represents a federal subsidy for these projects. Tax-exempt financing requires compliance with federal tax and securities laws, so publicly owned systems issuing tax-exempt bonds must have the resources and expertise to ensure compliance at the time of issuance and during the life of the bonds. Even with lower interest rates, tax-exempt bonds may be more costly than Drinking Water State Revolving Fund financing, discussed below.

Traditional tax-exempt bond financing may be difficult for small publicly owned water systems. A small publicly owned water system may be unable to secure financing because of its credit rating, a lack of resources or expertise, or an inability to generate sufficient revenues or other collateral to repay the bonds. Many systems look to state and federal financial assistance programs.

Publicly owned systems needing capital upgrades may struggle with capital improvement budgeting challenges within their organizations, due in part to rate stress experienced by ratepayers and due to organizational budgeting priorities. In particular, cities, counties, and districts are restricted in their ability to raise rates, which rates would be used to support the long-term debt obligation of the municipality.

10.2.2 Investor-Owned Water System Financing

Investor-owned water utilities have the ability to issue equity stock (common and preferred stock) and to sell taxable bonds. The CPUC must give authorization prior to the issuance of any stocks or bonds of an investor-owned water company. This method of financing capital improvement projects is limited primarily to the large CPUC-regulated investor water systems. The smaller investor-owned systems, which are generally owned by families or individuals, do not issue stock and, like smaller publicly owned systems, lack the rate base to make other financing options usable. CPUC-regulated investor-owned water systems are not able to accumulate reserves, so infrastructure replacement must be financed by incurring debt and recovering costs through obtaining CPUC approval of necessary rate adjustments. Investor-owned utilities may use both short- and long-term financial instruments such as taxable notes and bonds.

Very small investor-owned water systems typically are owned by individuals as sole proprietors or small partnerships. These systems have very few options for funding other than water rates or subsidies from other income sources.

10.2.3 Mutual Water Company Financing

Mutual water companies have the ability to assess members to raise capital. This does not require the approval by members, nor by any outside agency. The amount of the assessment may be limited, however, by the ability of the members to pay. As a requirement to form of a mutual water company by the Department of Business Oversight (which includes the former Department of Corporations), a sinking fund must be established that provides for capital replacement of water facilities at the end of their useful life. This sinking fund, or reserve, is a means to maintain the integrity of the system's existing infrastructure, but may not be available or adequate to fund the costs of future upgrades to address source contamination or other needs that arise after formation of the mutual water company. As a matter of practice, most existing mutual water companies have failed to meet this requirement. Mutual water companies of sufficient size may also use short- and long-term financing instruments such as taxable bonds and notes.

10.3 FINANCIAL ASSISTANCE PROGRAMS

There are numerous state and federal financial assistance programs available to public water systems.

10.3.1 State Water Board Funding Programs

The State Water Board's Division of Financial Assistance administers multiple funding programs to assist water systems with achieving and maintaining compliance with safe drinking water standards. These programs use federal funds and state funds to address the highest priorities of the state's water infrastructure needs. To ensure that government funds are well-spent and do not result in stranded assets, the water system must typically demonstrate, in advance, its ability to self-fund the costs of ongoing O&M.

10.3.1.1 Drinking Water State Revolving Fund Program

The largest Drinking Water funding program the State Water Board administers is the Drinking Water State Revolving Fund (DWSRF) program. Complementary, related funding includes state general obligation bond proceeds from Proposition 1 and Proposition 68, federal disaster-related funds from the Additional Supplemental Appropriations for Disaster Relief Act of 2019, and, in some cases, the Safe and Affordable Drinking Water Fund.

The State Water Board's DWSRF is composed of monies from various sources. These sources include annual federal capitalization grants, general obligation bond proceeds, tax-exempt revenue bond proceeds, local match amounts contributed by certain borrowers, repaid principal and interest on loans made to water systems, and interest earned on all of the foregoing amounts held in the fund. In order to receive a federal DWSRF Capitalization Grant, a state must have statutory authority for the program and must provide a state match. California's current share of the federal DWSRF appropriation is 8.82 percent (the highest allocation of all states, reflecting its large population and resulting infrastructure needs). In order to use general obligation bond proceeds, the State Water Board must comply with certain restrictions in the voter approved bond acts, as well as comply with restrictions set forth by the State Treasurer's Office. In order to use revenue bond proceeds, the State Water Board must comply with federal tax and securities law requirements.

California has implemented the DWSRF program since 1998. The standard interest rate on a DWSRF loan or other financing is one-half the state's GO bond rate. The standard repayment term is 30 years, not to exceed the project's useful life. General eligibility criteria are set forth in the DWSRF Policy, and special incentives are specified in each year's Intended Use Plan, including principal forgiveness allocations and criteria. The standard security terms are set forth in the Credit Appendix to the DWSRF Policy. Typically, loans are secured by enterprise revenues (namely user water rates, charges, and/or surcharges). Total DWSRF funding provided to PWS in executed loans and principal forgiveness funds to date is over $3 billion.

https://www.waterboards.ca.gov/drinking_water/services/funding/DWSRF_Policy.html

10.3.1.2 Safe and Affordable Drinking Water (SADW) Fund

The Safe and Affordable Drinking Water (SADW) Fund through Chapter 120, Statutes of 2019, (SB 200) provides $130 million per year for 10 years to develop and implement sustainable solutions for small systems with violations of drinking water standards. The money may be spent on operations and maintenance costs, cost of consolidating with a larger system, provision of replacement water, funding for administrators to run the small systems, developing and implementing long-term solutions, and costs associated with the implementation and administration of programs under Health and Safety Code section 116765, et seq. Each year's planned expenditures are set forth in an annual Fund Expenditure Plan, which is governed by a policy.

On May 5, 2020, the State Water Board adopted the Policy for Developing the Fund Expenditure Plan for the SADW Fund (SAFER Policy). The SAFER Policy establishes and documents the State Water Board's direction on how the Fund Expenditure Plan will be developed. The SAFER Policy defines key terms; discusses eligible entities and projects; provides an overall funding strategy; includes funding terms, conditions, and how to appeal a funding determination; discusses the required elements of the Fund Expenditure Plan (including how proposed solutions will be identified, evaluated, and prioritized); establishes a petition process for consideration of consolidation orders; and identifies SAFER Program resources..

On July 7, 2020, the State Water Board adopted the first annual Fund Expenditure Plan for the SADW Fund for fiscal year 2020-21. The fiscal year 2020-21 Fund Expenditure Plan's top priorities are: 1) addressing any emergency or urgent funding needs, where other emergency funds are not available and a critical water shortage or outage could occur without support from the Fund; 2) addressing community water systems (CWS) and school water systems out of compliance with primary drinking water standards, focusing on small Disadvantaged Communities (DAC); 3) accelerating consolidations for systems out of compliance, at risk systems, as well as state small water systems (state smalls) and domestic wells, focusing on small DAC; 4) providing interim solutions, initiating planning efforts for long-term solutions, and funding capital projects for state smalls and domestic wells with source water above a primary maximum contaminant level (MCL). The fiscal year 2021-22 Fund Expenditure Plan will be informed by the results of the statewide needs analysis, expected Spring 2021.

Complementary sources of funding include the State Water Pollution Cleanup and Abatement Account, the DWSRF, general fund appropriations, and the funding described in Section 10.3.1.3, below.

https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/safer.html

10.3.1.3 Other State Water Board PWS Financial Assistance Programs

In addition to the Proposition 1 and Proposition 68 funds discussed above as complementary to the DWSRF program, the State Water Board received allocations from these two general obligation bond acts for the purposes of groundwater activities. Under Proposition 1, the State Water Board received an $800 million allocation to make grants to prevent and cleanup contamination of groundwater that serves (or has served) as a source of drinking water. Under Proposition 68, the State Water Board received a $74 million allocation to make grants for treatment and remediation activities that prevent or reduce the contamination of groundwater that serves as a source of drinking water.

https://www.waterboards.ca.gov/water_issues/programs/grants_loans/proposition1/drinking_water_proj_locations.shtml

https://www.waterboards.ca.gov/water_issues/programs/grants_loans/propositions/prop68.html

The Drinking Water For Schools (DWFS) Grant Program was initially allocated and has awarded $9.5 million in grants funds to school districts to improve access to, and the quality of, drinking water in public schools (Round 1). Funds were awarded pursuant to Chapter 29, Statutes of 2016, SB 828, consistent with the DWFS Guidelines adopted by the State Water Board on May 16, 2017. An additional $6.8 million has been authorized for the DWFS Grant Program. Guidelines for this additional funding were approved in June of 2019. Grant funds are expected to be awarded to two nonprofit organizations that will act as Program Administrators. These Program Administrators will work directly with eligible school districts to develop and fund projects for disadvantaged community schools. The priority will be schools with impaired water quality.

https://www.waterboards.ca.gov/water_issues/programs/grants_loans/schools/

The State Water Board also continues to administer funding awarded under Propositions 50 and 84 (Water Code sections 79500, et seq., and 75001, et seq.) Applications for funding from these two sources are no longer being accepted.

10.3.2 Other Governmental Financial Assistance Programs

The State Water Board's Citizen Monitoring Program keeps listings of California based funding sources of all types, including private foundations and corporations, along with contact information, grant project examples, and other pertinent information for funding volunteer (citizen) monitoring projects and related California watershed restoration efforts.

The Department of Water Resources (DWR) administers grant and loan funding associated with legislation and several general obligation bond laws.

Rural Utilities Service, a Water and Environmental Program (WEP) provides loans, grants and loan guarantees for drinking water, sanitary sewer, solid waste and storm drainage facilities in rural areas, cities, and towns of 10,000 or less. Public bodies, non-profit organizations and recognized Indian tribes may qualify for assistance. WEP also makes grants to nonprofit organizations to provide technical assistance and training to assist rural communities with their water, wastewater, and solid waste problems.

US Department of Agriculture's Rural Development Financial Programs support such essential public facilities and services as water and sewer systems, housing, health clinics, emergency service facilities and electric and telephone service. US Department of Agriculture promotes economic development by supporting loans to businesses through banks and community-managed lending pools. It offers technical assistance and information to help agricultural and other cooperatives get started and improve the effectiveness of their member services, and provides technical assistance to help communities undertake community empowerment programs.

US Fish and Wildlife Service offers grants for states and territories, through the Cooperative Endangered Species Conservation Fund (authorized under section 6 of the Endangered Species Act) in a wide array of voluntary conservation projects for candidate, proposed and listed species. These funds may in turn be awarded to private landowners and groups for conservation projects.

The Environmental Grantmaking Foundations directory is a comprehensive list of foundations that support environmental activities and programs. These foundations primarily give grants to nonprofit 501(c)(3) organizations

Watershed Action Grants are conservation funds that aid nonprofit organizations in implementing conservation plans to protect watersheds, improve water quality and promote watershed stewardship.

USEPA Water Infrastructure Finance and Innovation Act (WIFIA) provides long-term, low-cost supplemental loans for regionally and nationally significant water infrastructure projects. USEPA also implements a Drinking Water Infrastructure Grant Tribal Set-Aside program.

10.4 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Since the publication of the 1993 Safe Drinking Water Plan, water costs have, on average, increased about 97 percent within all size groups (range of 75 to 105 percent) according for inflation. Water costs average highest in the Bay Area, Central Coast, and Southern California and lowest in the Central Valley/Agricultural (including Imperial County), Foothill, and Mountain/Desert regions. A number of factors have contributed to the increase in water costs including decades of deferred maintenance for water system infrastructure, upgrades to address emerging contaminants and regulatory requirements, treatment of contaminated sources, and developing new drinking water sources to address water shortages, improve local resiliency, and serve growing populations.

As discussed in Chapter 3, about 80 percent of systems serving more than 10,000 service connections are metered, and only 7 percent of systems serving less than 200 service connections are metered. On average, customers of small water systems (PWS serving less than 200 service connections) pay more for water by approximately 20 percent than those customers served by systems within the three other size groups (intermediate, medium, and large). However, even though customers of small water systems pay more for water service, the water rates charged by many small systems are insufficient to fully fund costs for operation and maintenance, reserves, and capital investments. Their ability to charge sufficient rates is limited due to the lack of economies of scale.

The cost of water is unaffordable for a segment of the customers served by all water systems, but particularly customers in disadvantaged communities served by small PWS. USEPA guidelines suggest that spending under 2.5 percent of household income on drinking water is affordable (4.5 percent for annual water and wastewater spending combined. Research conducted by Elizabeth A. Mack and Sarah Wrase has shown over 11 percent of customers served by public water systems in both urban/suburban areas and rural areas pay more of their annual income for water service than is considered affordable, based USEPA affordability criteria. The State Water Board is committed to pursuing initiatives that ensure safe drinking water is affordable to customers of all PWS.

Over the past two decades a significant investment has been made at the federal and state level to provide funding for water system infrastructure improvements intended to achieve compliance with regulatory requirements. State and federal financial assistance programs have combined to provide hundreds of millions of dollars to eligible water systems. Efforts have been made to use some of these funds to address the needs of small water systems that serve disadvantaged communities. Nevertheless, many small systems serving disadvantaged communities lack the financial capacity to afford ongoing operations and maintenance which, in many cases, prevents them from accessing financial assistance programs for capital improvement projects. Even if treatment is installed, the water system needs to have the technical capability to operate the treatment facility. For these reasons, financial assistance for physical and managerial consolidations is available under the SAFER program.

Recommendations

10-1 Proposition 218 has made it difficult for water systems of all sizes to increase their rates to address critical infrastructure issues. Consumers may not understand the costs associated with new treatment systems and otherwise supplying safe drinking water. The State Water Board will collaborate with the water utility industry, public interest groups, local non-profit organizations and other organizations to develop strategies to educate consumers on the factors that affect the cost of operating a water system.

10-2 As part of its Capacity Development Program, the State Water Board will continue to encourage community water systems to adopt an asset management plan for infrastructure replacement.

References

Chapter 524, Statutes of 2012 (AB 685) (https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120AB685#:~:text=AB%20685%2C%20Eng.,State%20water%20policy.&text=This%20bill%20would%20declare%20that,%2C%20cooking%2C%20and%20sanitary%20purposes.)

Chapter 120, Statutes of 2019 (SB 200) (https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200SB200)

State Water Board Drinking Water State Revolving Fund Program website (https://www.waterboards.ca.gov/drinking_water/services/funding/DWSRF_Policy.html)

State Water Board Safe and Affordable Funding for Equity and Resilience website (https://www.waterboards.ca.gov/water_issues/programs/grants_loans/sustainable_water_solutions/safer.html)

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CHAPTER 11 DRINKING WATER SECURITY, EMERGENCY PREPAREDNESS, STATE WATER BOARD EMERGENCY RESPONSE, AND WATER SYSTEM RESILIENCY

11.1 BACKGROUND

Water System Security, Emergency Preparedness, Response, and Resiliency are interrelated program elements to be considered and addressed by public water systems (PWS). These program elements and concepts are further defined and explored in this chapter. Recent emergency response experience has shown that smaller PWS need better preparation to be able to meet these challenges effectively and protect public health.

Emergency management aims to reduce or avoid the potential losses from hazards, assure prompt and appropriate assistance to damaged materials, and achieve rapid and effective recovery. Emergency managers think of disasters as recurring events with four phases: Prevention/Mitigation, Preparedness, Response, and Recovery. The emergency management cycle, shown in Figure 11-1, illustrates the ongoing process by which all organizations should plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. As a cyclical process, it is never complete. Recovery, even from the smallest incidents, can inform prevention and mitigation.

Figure 11-1: Emergency Management Cycle

PWS facilities serve a critical purpose in emergency response. A functioning and adequate water supply serves to limit property damage, save lives, and speed recovery. The overall goal of these program elements is a high level of vigilance and preparation for emergencies and extreme events. This will reduce the extent of water system problems during such events. The preparation provides the added benefit of improving performance and reliability of water system facilities under normal conditions.

PWS are increasingly affected by emergencies and public health crises. For example, wildfires have grown more severe and the damage they cause to communities is increasing. The COVID-19 global pandemic has had a myriad of impacts on PWS operations. Also, the impacts and response to this pandemic are seen across all aspects of society. Given that the course and trajectory of the COVID-19 pandemic is uncertain, recommendations related to this challenge will be considered and developed during the further preparation and finalization of the Safe Drinking Water Plan.

The State Water Board continues to observe that PWS that are smaller and lag emergency preparedness are not adequately prepared to respond to emergencies. This is in large part a result of lack of adequate management of smaller PWS. To better protect public health, preserve lives and better serve our smaller communities, much more emergency preparedness is urgently needed. This chapter includes several recommendations to bolster emergency preparedness as well as the regulatory program that undergirds this work.

Most communities in California are served by one or more PWS. Depending on the structure of the community and the type of ownership, the boundaries and governance of the PWS may or may not coincide. For example, some PWS serve multiple communities (for example towns and cities). On the other hand, a community may be served by more than one PWS. For example, the community of Paradise in Butte County is served by both the Paradise Irrigation District and the Del Oro Water Company (an investor owned utility).

In recent years catastrophic wildfires have severely damaged entire communities on a scale rarely seen. This has resulted in loss of life, homes, extreme damage to infrastructure and severe disruption to all aspects of life. The California Department of Forestry and Fire Protection classifies past wildfires in terms of size, destruction, and fatalities. In terms of destruction, the following are the top two most destructive wildfires on record occurred in 2017 and 2018 respectively.

Table 11-1: Most Destructive Wildfires on Record

Year	Fire	County	Number of Structures Destroyed	Number of Fatalities
2018	Camp Fire	Butte	18,804	85

Year	Fire	County	Number of Structures Destroyed	Number of Fatalities
2017	Tubbs	Sonoma and Napa	5,636	22

Both of these wildfires resulted in severe destruction to PWS infrastructure including, but not limiting to damage to water storage tanks and water pipes. These wildfires were followed immediately by recovery efforts to return safe and reliable drinking water to customers. In many respects, these communities remain in the long-term process of recovery and rebuilding.

There have been several other destructive wildfires through California over the past few years. Table 11-2 summarizes the California wildfires destruction for years 2015 through 2020, obtained from Cal Fire at: https://www.fire.ca.gov/incidents/

Table 11-2: Wildfire Summary for Years 2015 through 2020

Year	Estimated Acres Burned (acres)	Number of Wildfires	Number of Fatalities	Structures Damaged or Destroyed
2015	880,899	8,283	7	3,159
2016	669,534	6,954	6	1,274
2017	1,548,429	9,270	47	10,280
2018	1,975,056	7,948	100	24,226
2019	259,823	7,860	3	732
2020	4,177,856	9,639	31	10,488

As challenging as recent fire emergencies have been, earthquakes continue to be a major risk for communities and PWS facilities in California. There is a high probability of a major earthquake striking a metropolitan area of the state within the next several decades. A major earthquake of 6.0 or greater could cause widespread damage to PWS facilities and other critical infrastructure.

Climate change brings great challenges to all aspects of society as well as infrastructure. This includes both direct and indirect impacts on PWS. Long term droughts stress groundwater aquifers and diminish surface water supplies, contributing to water scarcity. It is anticipated that fires will occur with greater frequency and intensity, increasing risk to communities and PWS facilities. Larger winter storms and extreme high tides may overwhelm flood management systems and damage water infrastructure at an increasing frequency. Indirect impacts may include further drops in groundwater levels resulting in decreased water supplies and changes in water quality.

During the summer of 2019, California experienced its first season of public safety power shutoffs (PSPS). These are intentional shutdowns of power grids by the power providers in

California with the goal of preventing fires where strong winds, heat events, and related conditions are present. While it is important for power companies to reduce the potential for sparking a fire, PWS depend on having access to power to maintain system operations. When PWS are without electricity there is a potential that they will be unable to provide water to their customers. For example, a PWS with a groundwater well will be unable to pump water unless they have an alternative energy source. The State Water Board tracked and reported out on over 150 PWS experiencing problems, including water outages, during the 2019 PSPS events. In 2020, the State Water Board tracked 13 PWS that issued unsafe water alerts due to PSPS. The PSPS shutoffs will continue to be an ongoing event; however, hopefully, PWS will continue to prepare for these events, diminishing the impacts to customers.

PWS are faced with ongoing threats ranging from vandalism to cyber-attacks. Preparation in these areas has been substantial but additional work is needed. In order to effectively meet these challenges in the future, PWS must continue to improve water system security measures, emergency preparedness, emergency response and water system resiliency, with support and guidance provided by drinking water industry associations and response agencies. There are additional actions that the Water Boards can take to bolster regulatory oversight to ensure that all PWS build resiliency and continue to evaluate risks and adequately prepare for emergencies and disasters.

11.1.1 Challenges Ahead/ Improvements Needed

From these experiences, the State Water Board has identified a number of challenges that need to be addressed to prepare for future emergencies. Section 11.5 summarizes and reviews the role of the State Water Board and outlines recommendations to provide the level of regulatory direction and leadership necessary given the potential magnitude of future disasters and emergencies.

The following are some key areas of program improvement for PWS, responding agencies and the State Water Board:

1. Broader participation by PWS in mutual aid networks is necessary. Currently there are multiple counties that have no water systems participating in mutual aid networks.
2. Additional emphasis must be placed on individual water system preparedness by establishing the legislative authority to the State Water Board and regulatory requirements for PWS to develop Emergency Response Plans.
3. More in-depth evaluation and regulatory focus by the State Water Board on the preparedness of individual water systems for emergencies and groups of neighboring water systems.
4. Additional focus on the key role of consolidation in emergency preparedness and resiliency.

5. The State Water Board must develop its own Continuity of Operations plan to prepare for events that could cause an individual field office to close, hence losing the local support for PWS emergency response and recovery.

11.1.2 Initiatives

The federal government, State of California, and the State Water Board continue efforts to improve water system security, emergency preparedness, emergency response, and water system resiliency. This includes the needs to bolster and expand existing levels of preparedness, while addressing concerns related to overall water system resiliency and climate change. The following initiatives are the foundation of this effort:

Public Health Security and Bioterrorism Response Act of 2002

Terrorism as a water security matter is a national concern. The Public Health Security and Bioterrorism Preparedness and Response Act of 2002 (PL107-188), known as the Bioterrorism Act, was enacted to improve overall national security. Title 4 of the Bioterrorism Act was directed at Drinking Water Security and required USEPA to modify the SDWA to require PWS to improve security. Water system facilities were identified as critical infrastructure in the Homeland Security Presidential Directive 7 (HSPD 7) 2003.

2017 State Water Board Comprehensive Response to Climate Change

Concerned over the effects of climate change and extreme weather events, the State Water Board adopted Resolution No. 2017-0012 – Comprehensive Response to Climate Change, requiring a proactive approach to climate change in all Board actions, including drinking water regulation, water quality protection, and financial assistance.

2017 State of California Emergency Plan

On October 1, 2017, Governor Edmund G. Brown Jr. promulgated the 2017 edition of the State of California Emergency Plan (SEP). The State of California Emergency Plan describes how response to natural or human-caused emergencies occurs in California. The plan is a requirement of the California Emergency Services Act.

2018 America's Water Infrastructure Act (AWIA)

On October 23, 2018, America's Water Infrastructure Act (AWIA) was signed into law. The federal law requires community water systems serving more than 3,300 people to develop or update risk and resilience assessments and to update emergency response plans (ERP). The law specifies the components that the risk and resilience assessments and ERP must address. Community water systems serving a population of 3,300 or more must update their ERP by December 31, 2021, and update their ERP at least once every 5 years thereafter. The State Water Board will ultimately review the updated water system

ERP as part of its regulatory oversight activities.

Chapter 14, Statutes of 2018, (SB 606) and Chapter 15, Statutes of 2018, (AB 1668) Water Conservation and Drought Planning

These laws combined require the Department of Water Resources (DWR) and the State Water Board to establish new requirements for water conservation, water use efficiency standards, and drought planning. These laws also recognize the vulnerability of small water systems and rural communities to drought or other stressed water supply conditions due to limited resources and solutions to water shortage conditions. To address this, the law requires DWR, in consultation with the State Water Board, to develop recommendations and guidance to on how county-wide drought and water shortage contingency plans can be implemented to address planning needs of small systems and rural communities. This work is well underway with the draft publication of the Small Water Suppliers and Rural Communities at Risk of Drought and Water Shortage Vulnerability and Recommendations and Guidance to Address the Planning Needs of these Communities.

2019 Executive Order on Water Resilience Portfolio

Executive Order N-10-19 issued by Governor Newsom directs the California Natural Resources Agency, California Environmental Protection Agency and the California Department of Food and Agriculture to prepare a water resilience portfolio for California. This culminated in the release of the 2020 Water Resiliency Portfolio dated July 2020. This document is available here:

https://waterresilience.ca.gov/wp-content/uploads/2020/07/Final_California-Water-Resilience-Portfolio-2020_ADA3_v2_ay11-opt.pdf

The portfolio contains 142 separate actions to be taken by state agencies, as resources allow. Together, the actions are intended to support California's diverse regions as they work to improve their ability to withstand drought and flood and safeguard reliable water supplies for communities and natural systems. The portfolio actions are organized into four categories:

1. Maintaining and diversifying water supplies,
2. Protecting and enhancing natural systems,
3. Building connections,
4. Being prepared.

This initiative builds on the work completed under the California Water Action Plan, developed at the direction of Governor Brown in 2014 and updated in 2016. That plan identified the risks to California's water resources due to climate change, water scarcity and drought, poor water quality, floods, and supply disruptions. It identified the need for more reliable water supplies and more resilient, sustainably managed water systems that can better withstand inevitable pressures to the system in the coming decades.

11.2 DRINKING WATER SECURITY

PWS facilities have inherent security vulnerabilities that can be reduced and managed but cannot be completely eliminated. Threats to water system security include vandalism, sabotage and terrorism. Security threats can target both physical infrastructure and control/information systems (specifically cyber security).

Community water systems serving greater than 3,300 population were required by the Bioterrorism Act in 2002 to conduct a vulnerability assessment of security threats and threats due to natural hazards and incorporate the findings into their emergency response plans. USEPA recommended that the vulnerability assessments be conducted periodically, and that smaller water systems that were not required to conduct the vulnerability assessment voluntarily do so.

More recently, the federal government revisited the need for PWS to assess their vulnerabilities and update their ERP. In 2018 AWIA was signed into law and it required vulnerability assessments to include a water system resiliency assessment, thus creating a comprehensive risk and resilience assessment for PWS. Community water systems serving a population of 3,300 or more must update their risk and resilience assessments by June 30, 2021 and their ERP by December 31, 2021, and will be required to conduct these assessments and update their ERP at least once every 5 years thereafter.

When a water system detects a potential security breach or identifies a threat, it should gather available information from the incident/site and consult with local law enforcement. In addition, at certain levels of threat, including potential threat to the water supply or water contamination, the water system should consult with the State Water Board to review appropriate actions to address the problem. Timely information, action and decision making is critical to responding to such incidents, and water systems must exercise preparedness to address such threats, as described below in Section 11.3.

All water related security incidents are reported to and tracked by the Water Information Sharing and Analysis Center (WaterISAC). WaterISAC is the Security Network of the Water and Wastewater Sector, established by U.S. water and wastewater sector national associations and research foundations in 2002, in coordination with the USEPA. That same year, it was authorized by Congress in the Bioterrorism Act.

WaterISAC is the only all-threats security information sharing source for the water and wastewater sector. It serves several hundred utilities that provide water and wastewater service to much of the United States. The WaterISAC is funded by member utilities, partners, and stakeholders. Members include local state/provincial and federal agencies;

law enforcement, intelligence and homeland security agencies; consulting and engineering firms; and utility associations, as well as utilities in Canada, Australia and New Zealand. State Water Board staff sits on the Board of Managers of WaterISAC.

11.2.1 Cyber Security

The goal of cyber security is to protect networks, devices, programs, and data from attack, damage or unauthorized access. The ever-evolving capability and sophistication of threats continue to expose the vulnerability of the nation’s critical infrastructure, including the water sector, to cyber-attacks. Cyber security measures must evolve to address new threats that are discovered.

The Cybersecurity and Infrastructure Security Agency (CISA) is the nation’s infrastructure security risk advisor, working with partners to defend against threats and collaborating to build a more secure and resilient infrastructure for the future. CISA provides extensive cybersecurity and infrastructure security knowledge and practices to its stakeholders, shares that knowledge to enable better risk management, and puts it into practice to protect the Nation’s essential resources.

Cyber security has been increasingly important as more PWS rely on Supervisory Control and Data Acquisition (SCADA) systems to help manage and control the operations of water systems from one main control center. These SCADA systems typically include some form of remote access to permit operators to control the systems. These SCADA systems are designed to control a water system operation with minimal operator intervention. This may include opening and closing valves or controlling a sophisticated treatment process. SCADA systems include both hardware and software components which are both susceptible to cyber security threats. The integration of cyber security measures into the design and maintenance of SCADA systems is critical to protect against cyber-attacks. Industry organizations have developed guidance and training for these programs.

The overall security culture for PWS continues to need encouragement, promotion and practice. The American Water Works Association (AWWA) has developed standard ANSI/AWWA G430-09: Security Practices for Operations and Management to encourage its member agencies to cultivate a culture of security and to plan for all-hazards emergencies. Professional drinking water sector associations, USEPA, Federal Emergency Management Agency (FEMA), and the Division of Drinking Water recommends that PWS prepare for all-hazards emergency response and recovery by developing an emergency response plan (ERP), and practice implementing the ERP through tabletop exercises. By doing so, the PWS will develop the capacity to be more resilient in emergency situations.

11.3 DRINKING WATER EMERGENCY PREPAREDNESS AND RESILIENCY

Recent studies by the United States Geological Survey (USGS) anticipate a major earthquake to strike in Southern and Northern California, with a 70 percent and 67 percent chance, respectively, in the next 30 years. USGS predicts a major Atmospheric River Storm (ARkStorm), which can produce an extreme amount of precipitation, will cause flooding throughout California. Any one of these events can cause massive physical damage to the water system infrastructure. Common damage caused by earthquakes includes broken water mains and damage to water storage tanks. Flooding can cause contamination of sources in addition to washing out water mains.

There has been significant effort made in preparation for the possibility of these scenarios. Models have been developed and estimates made for the range of potential damages that will occur. Water systems in both the Bay Area and in Southern California, where earthquakes are most likely to strike, have performed tabletop exercises to ensure that the participating emergency responders and water systems are prepared to respond to possible disaster scenarios. Similar actions are needed by water systems outside of these two metropolitan areas to ensure that they also know what actions are needed in a disaster response.

Surface water supplies are the most vulnerable to contamination, either intentional or unintentional, due to the open availability of the surface water bodies and, often, the transmission canals. Surface water treatment plants, however, are not designed to remove chemical contaminants. Groundwater treatment plants are typically designed to provide specific treatment for the specific chemical contaminants that make up the composition of their water source, but may not be effective in removing other chemical contaminants.

11.3.1 The Role of Emergency Response Plans

The California drinking water statutes have not established requirements for any water system to develop, maintain and exercise an ERP. Hence, the State Water Board is unable to broadly require PWS to develop an ERP. The State Water Board has the independent ability to require PWS to develop a plan to address disaster preparedness on an individual basis related to a past issue or apparent vulnerability to an emergency.

The Federal AWIA has triggered larger water system to develop an ERP to address the findings of the risk and resilience assessment; and requires a review and update every five years. As observed in the years following the implementation of the Bioterrorism Act, many PWS are not keeping their ERP up to date. It is anticipated that the implementation of the AWIA and associated training and guidance will help ameliorate this observation.

Table 11-3 Emergency Response Plans by the Numbers

Population Served	Emergency Response Plan required?	Risk and Resiliency Plan required?	Total Number of PWS in this Size Category
CWS Greater than 3,300	Yes	Yes	662
CWS Fewer than 3,300	No	No	2,222
NTNCWS	No	No	1,497

11.3.1.1 Exercising the ERP

To further develop and increase the effectiveness of preparedness and response efforts to emergency incidents, it is necessary to periodically perform tabletop exercises. These exercises need to be performed by PWS with the participation of all internal and external parties involved in carrying out emergency preparedness, response, and recovery tasks. The Homeland Security Exercise Evaluation Program (HSEEP) provides guidance for developing an effective tabletop exercise. The USEPA also has great tools, guidance and resources, such as their Tabletop Exercise Tool for Drinking Water and Wastewater Utilities (TTX Tool) - https://www.epa.gov/waterresiliencetraining/develop-and-conduct-water-resilience-tabletop-exercise-water-utilities.

11.3.2 Climate Change Resiliency

Extreme temperatures, sea-level rise, extreme weather patterns, increased frequency of disasters (wildfires, floods, debris flows) are all potential threats of climate change. Recognizing these threats, USEPA developed the Climate Resilience Evaluation and Awareness Tool (CREAT), a risk assessment tool that helps PWS identify vulnerabilities and potential mitigation strategies to enable adaptation to these extreme weather events. The assessment includes current and modeled long-term weather conditions, identifying critical assets and their vulnerabilities, developing potential mitigating actions to reduce the impacts of extreme weather events on utility operations, and generating reports on the costs and benefits to assist utilities in communicating risk reduction strategies with stakeholders.

USEPA's CREAT webpage has other resources and guidance for the Creating Resilient Water Utilities (CRWU) initiative - www.epa.gov/crwu/creat-risk-assessment-application-water-utilities. USEPA continues to host and conduct training on CREAT, the CRWU, and awareness of threats from extreme weather events so that PWS can use the tool for resiliency planning. The State Water Board is working with Rural Community Assistance Corporation (RCAC) to provide additional CREAT training for small PWS under the Drinking Water State Revolving Fund technical assistance program.

Cal-Adapt is California's own climate change resource developed by the California Energy Commission – www.cal-adapt.org. It provides a view of how climate change might affect California. PWS can use this information when evaluating the most likely impacts of climate change to their water system. Cal-Adapt offers tools, data, and resources to conduct research, develop adaptation plans and build applications.

11.3.3 Public Safety Power Shutoff (PSPS) Impacts

Under the PSPS, the electric power utilities may proactively turn off power in high fire risk areas to reduce the chances of fire. The CPUC webpage https://ia.cpuc.ca.gov/firemap/ shows those high fire threat areas as established by Rulemaking 15-05-006.

Shutting off the electrical power can have significant effects on PWS, including loss of water supply for the duration of the outage. Loss of electrical power is a vulnerability that is typically included in an ERP. In July 2019 the State Water Board transmitted an email to all water systems calling attention to the PSPS and presenting options for consideration to increase resilience in the face of the PSPS and wildfires. The State Water Board responded by developing Geographic Information Systems mapping applications that integrate and analyze PSPS boundaries provided by power utilities and PWS service boundaries and facility locations to better identify potential PWS affected by the various PSPS that were being implemented or lifted. This allowed staff to provide more effective and efficient response measures to impacted PWS.

11.4 DRINKING WATER EMERGENCY RESPONSE

Due to the need to respond to emergencies both State and Federal agencies have come up with systems to fulfill this need. The Standardized Emergency Management System (SEMS) has existed since 1996 and the National Incident Management System (NIMS) was created in 2004. The backbone of each of these systems is the Incident Command System (ICS). Developed in the 1970s, the ICS has proven to be a highly effective system for responding to a wide variety of multi-jurisdictional incidents nationwide. The utilization of these emergency response systems has allowed various agencies to better collaborate when dealing with an emergency.

11.4.1 Emergency Response Structure

Incident Command System (ICS)

ICS is a standardized approach to the command, control, and coordination of on-scene incident management that provides a common hierarchy within which personnel from multiple organizations can be effective. ICS specifies an organizational structure for incident management that integrates and coordinates a combination of procedures, personnel, equipment, facilities, and communications. Using ICS for every incident helps hone and maintain skills needed to coordinate efforts effectively. ICS is used by all levels of government as well as by many non-governmental organizations and private sector organizations. ICS applies across disciplines and enables incident managers from different organizations to work together seamlessly. This system includes five major functional areas, staffed as needed, for a given incident: Command, Operations, Planning, Logistics, and Finance/Administration. A sixth ICS Function, Intelligence/ Investigations, is only used when the incident requires these specialized capabilities.

California's Standardized Emergency Management System (SEMS)

SEMS is the cornerstone of California's emergency response system and the fundamental structure for the response phase of emergency management and is required by Government Code section 8607, subdivision (a) for managing emergencies involving multiple jurisdictions and agencies. Operated by the California Office of Emergency Services (CalOES), the SEMS system unifies all elements of California's emergency management community into a single integrated system and standardizes key elements, such as ICS, multi/ inter-agency coordination, mutual aid and operational area concepts. SEMS consists of five organizational levels, which are activated as necessary:

1. State Level
2. Regional Level
3. Operational Area Level
4. Local Government Level
5. Field Response Level

National Incident Management System (NIMS)

NIMS is the national emergency management system that all federal agencies use, and all states are expected to use on a national response. NIMS provides a consistent nationwide framework to enable government at all levels to work together to prepare for, prevent, respond to, and recover from the effects of incidents.

Many PWS need training on how to respond under SEMS or NIMS as well as the ICS. This training would include ongoing exercises with other first responders to be fully able to respond in an emergency.

11.4.2 State Water Resources Control Board Emergency Operations

The State Water Board serves as the agency responsible for the evaluation of safety of all public water supplies as the result of a disaster. This authority is established in the California Health and Safety Code, the California Code of Regulations, the Administrative Order (between State Water Board and CalOES), and the California State Emergency Plan. This authority is part of the broader permitting authority of the Division of Drinking Water established under the California Safe Drinking Water Act (SDWA). The SDWA establishes the authority of the State Water Board to take appropriate action to ensure that the water supply is safe, wholesome and potable under all conditions. This includes authority to require notification of the public when the water supply may be unsafe due to an incident.

The 2017 State Emergency Plan outlines 18 Emergency Support Functions with the Water Boards having a role in the following seven functions:

1. Protect human health and safety
2. Protect water quality and environment from hazardous materials
3. Coordinate with and support drinking water and wastewater utilities
4. Coordinate with and support external agencies, partners, and stakeholders
5. Public information and outreach
6. Advise other agencies on drinking water and water quality issues
7. Investigate impairments to water and drinking water quality

Following the 2017 Tubbs Fire, the State Water Board established the Emergency Response Technical Working Group (ERTWG) aimed at increasing the capability of the Water Boards to prepare for and respond to emergency incidents. ERTWG maintains an ERTWG SharePoint site containing coordination activities and work. To further the work of the ERTWG, the State Water Board established the Emergency Management Program in 2019, within the State Water Board's Office of Research, Planning and Performance. The Emergency Management Program develops emergency management tools and resources, coordinates response efforts, and responds to all water emergencies. This includes taking appropriate action during emergencies to ensure that PWS are taking appropriate action to monitor, evaluate and restore their facilities with the goal of continuing to provide safe drinking water. The Emergency Management Program provides support and guidance for all Water Boards staff, stakeholders, and the public prior to, during, and after emergency incidents. The Emergency Management Program also maintains an Emergency Preparedness and Response Toolkit (EmPART) SharePoint site where final documents, guidance, and forms are maintained and utilized.

11.5 DRINKING WATER EMERGENCY RECOVERY

The 2017, 2018 and 2020 wildfires, 2018 debris flows, and 2019 and 2020 PSPS in California illustrate the range of emergency situations that communities and PWS may face. Given the vulnerability of California to major disasters (earthquakes, fires, floods, droughts) along with the community devastation observed over the past six years, there is a heightened sense of urgency for emergency preparedness to develop and ensure resiliency following such events. The PWS play a unique role since water is necessary for both emergency response (for example fire suppression) and recovery (for example providing water to customers returning home). PWS with emergency response and recovery plans in place can save lives, limit property loss and reduce the time required to repair facilities and provide safe drinking water to customers.

PWS impacted by extreme events are subject to a wide extent of damage and severity. In some cases, water outages may last for days and longer. Often PWS may have difficulty in obtaining resources necessary to repair damages, as there is an increased demand for items such as portable generators, backhoes, and service crews, during a disaster. This is exacerbated when the disaster is widespread or multiple disasters are happening at the same time, further limiting available supply. PWS are better able to obtain the necessary resources when they are part of mutual assistance partnerships.

11.5.1 Mutual Aid/Assistance

The development and practice of mutual assistance is critical for emergency response. DDW has encouraged and recommended that all PWS join a mutual aid organization whether local or regional. After Hurricane Katrina, USEPA and AWWA promoted mutual aid/assistance networks as one of the best ways for water and wastewater systems to help each other recover following disasters.

The following are some of the mutual aid organizations in California

1. California Water/Wastewater Agency Response Network (CalWARN). This is a water sector mutual assistance network.
2. The California Utilities Emergency Association (CUEA), with about 60 PWS members along with other utilities and infrastructure organizations.
3. The Emergency Response Network of the Inland Empire (ERNIE),
4. The Bay Area Emergency and Security Information Collaborative (BAESIC),
5. The Water/Wastewater Emergency Response of Orange County (WEROC),
6. The Water Agency Emergency Collaborative (WAEC) in San Diego.

Mutual aid is a critical potential resource for assistance for the many small water systems in California. Mutual aid organizations like CalWARN coordinate among members to find the necessary equipment, materials and personnel support to assist impacted water systems following a disaster.

11.5.2 Costs, Funding, and Reimbursement

PWS that incur costs as a result of an emergency may be eligible for reimbursement from the FEMA and/or CalOES costs. There are specific requirements for documentation that must be met for such expenses to be evaluated for a determination of eligibility. PWS that are able to follow the documentation and reporting requirements associated with the FEMA reimbursement programs will have a better chance of being reimbursed following a disaster. This documentation includes having a Local Hazard Mitigation Plan (LHMP) or being part of a county’s LHMP. Additional information on the LHMP can be found in Chapter 8. Additionally, PWS that coordinate early with CalOES Funding through their local Emergency Operation Centers will have better success navigating requirements for FEMA reimbursement programs including documentation and reporting requirements.

FEMA and partners including the State Water Board have worked to provide improved service to PWS. The work includes the following:

1. Simplifying and clarifying required documentation with improved guidance,
2. Simplifying and easing the tasks by providing tools and guidance,
3. Providing advanced training on FEMA reimbursement programs,
4. Improving the documentation to successfully navigate FEMA and other reimbursement programs.

Recap of 2014-2017 Drought Funding by State Water Board

The Division of Financial Assistance has emergency funding available to help PWS respond to and recover from emergency incidents. This includes funding for emergency bottled water, Clean Water Act cleanup and abatement funds, and the Drinking Water State Revolving Fund. Emergency funds include providing money for projects like hauling water or drilling a groundwater well. **Error! Reference source not found.** shows the projects funded during the drought to provide a key resource for PWS to take action to mitigate drought impacts. The funding was a critical resource for these communities in coping with the drought impacts and providing service.

5.

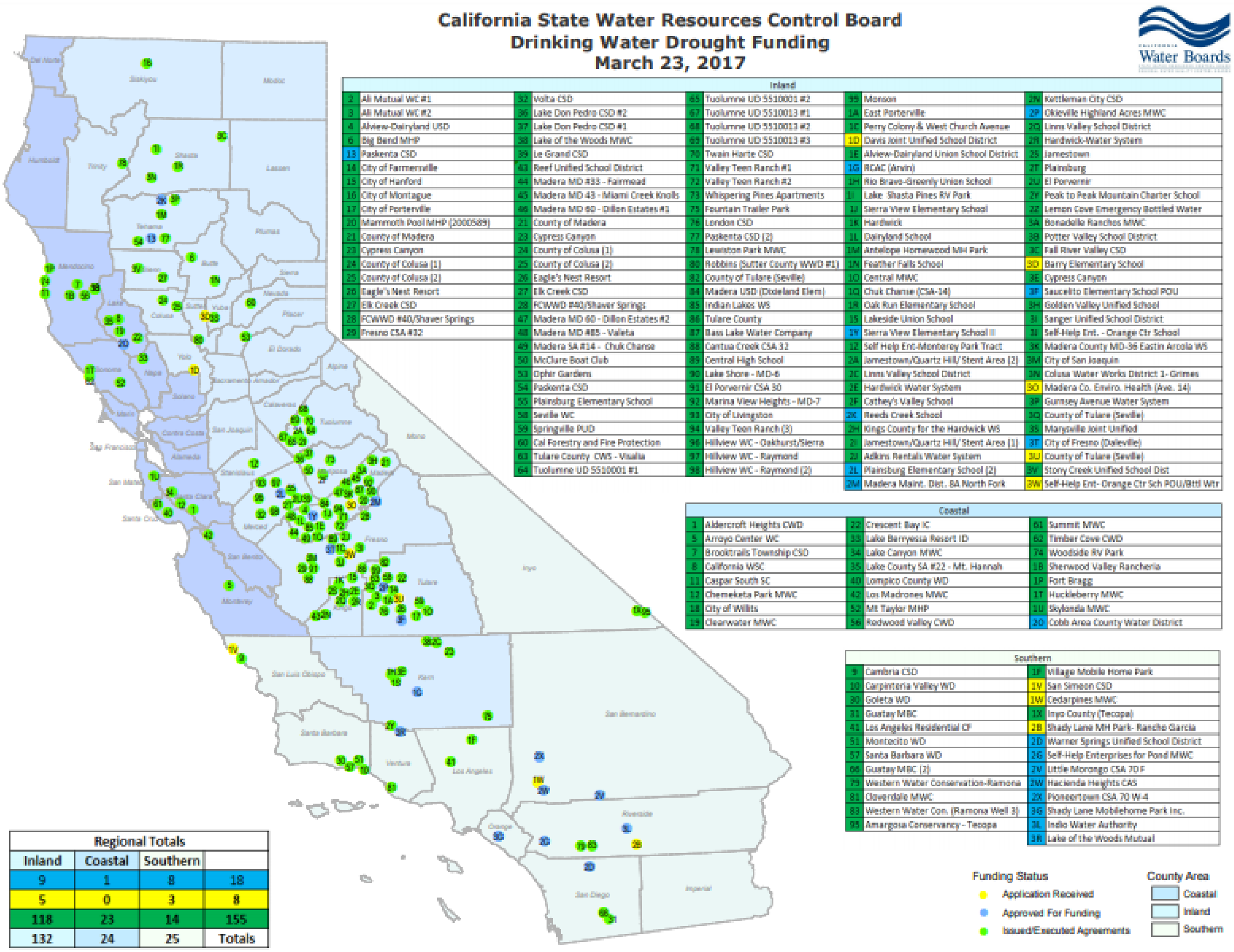

Figure 11-2 Drought Funding Map

The Drought Funding Map is available at:
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/drought/funding_map.pdf

Case Study: The Ridgecrest Earthquake – How Mutual Aid Could Have Sped Recovery

The 2019 Ridgecrest Earthquake Sequence that rocked the Searles Valley area including the communities of Ridgecrest, China Lake, and Trona on July 4th and 5th occurred north-northeast of the town of Ridgecrest, California. A 6.4 magnitude foreshock occurred on July 4 at 10:33 am followed by a magnitude 5.4 and magnitude 7.1 mainshock that struck on July 5 at 4:08 am and 8:19 pm, respectively. This quake was preceded by several smaller earthquakes and was followed by more than 1,400 aftershocks. It was the most powerful earthquake to occur in the state in 20 years. The Searles Mineral Valley Mineral Operations Inc. (Searles), a privately owned water system serving the unincorporated town of Trona experienced the most damage to its water distribution system.

Two key transmission mains delivering water from wells to multiple communities (and industrial facilities) in Trona developed numerous breaks and leaked to the point of dewatering the distribution system. To protect public health, the State Water Board, the Searles and the County of San Bernardino issued boil water notices (BWN). Despite encouraging the Searles to accept mutual aid , the Searles did not accept mutual assistance from CUEA, although they are a CUEA member, nor did Searles join and accept mutual aid from a different organization. The Searles decided to only use its in-house resources and personnel to repair the transmission mains, flush the system, collect samples, get a clearance to lift the BWN, and return the system to normal. It took 12 days for the BWN to be lifted.

The acceptance of mutual assistance might have shortened the time in which the communities were without water and subject to the boil water notice, workers might have been accorded a much needed break, the County and partners and stakeholders may not have needed to expend as much effort on providing bottled water, portable showers, etc. Community water systems must prioritize the restoration of domestic service to their customers in the shortest time possible.

11.5.2.1 Extreme Impacts and Recovery

Another complication seen more frequently is the severe effects of major disasters to the small to medium PWS. The PWS draws its funding and existence from its customers. It is a business that sells or provides drinking water for a fee to pay for the infrastructure, the operations, and the management of the utility. If a major disaster wipes out the majority of that revenue base, it becomes very difficult for the PWS to continue to exist. As illustrated in the experiences at the Camp Fire Incident, challenges abound that complicate the path to recovery. Table 11-4 details the major disasters in California declared by FEMA between 2015 through 2020.

Table 11-4: FEMA Major Declared Disasters in California (2015-2020)

Year	Event	Disaster Number	Counties
2020	California Wildfires	DR-4569-CA	Del Norte, Siskiyou, Shasta, Mendocino, Yuba, Sonoma, Napa, Madera, Fresno, Los Angeles, San Bernardino and San Diego

Year	Event	Disaster Number	Counties
2020	California Wildfires	DR-4558-CA	Trinity, Lassen, Plumas, Butte, Mendocino, Lake, Sierra, Yuba, Nevada, Yolo, Sonoma, Napa, Solano, Tuolumne, Stanislaus, San Mateo, Santa Clara, Santa Cruz, Monterey, and Tulare
2020	Covid-19 Pandemic	DR-4482-CA	Statewide
2019	Severe Winter Storms, Flooding, Landslides, And Mudslides	DR-4434-CA	Del Norte, Humboldt, Trinity, Tehama, Butte, Mendocino, Glenn, Colusa, Lake, Sonoma, Napa, El Dorado, Amador, Martin, Tuolumne, Mariposa, and Monterey
2019	Soboba Band of Luiseño Indians Severe Storms and Flooding	DR-4425-CA	Riverside
2019	Cahuilla Band of Indians Severe Storms and Flooding	DR-4423-CA	Riverside
2019	California Severe Storms, Flooding, Landslides, And Mudslides	DR-4422-CA	San Diego
2018	California Wildfires	DR-4407-CA	Butte, Ventura, and Los Angeles
2018	California Wildfires and High Winds	DR-4382-CA	Shasta, and Lake
2017-2018	California Wildfires, Flooding, Mudflows, And Debris Flows	DR-4353-CA	Santa Barbara, Ventura, Los Angeles, and San Diego
2017	California Wildfires	DR-4344-CA	Mendocino, Butte, Lake, Yuba, Nevada, Sonoma, Napa, Solano, and Orange
2017	Resighini Rancheria Flooding	DR-4312-CA	Del Norte
2017	California Severe Winter Storms, Flooding, Mudslides	DR-4308-CA	Del Norte, Siskiyou, Modoc, Humboldt, Trinity, Shasta, Lassen, Tehama, Plumas, Butte, Glenn, Sierra, Lake, Colusa, Yuba, Nevada,

Year	Event	Disaster Number	Counties
			Sutter, Yolo, El Dorado, Sonoma, Napa, Sacramento, Alpine, Solano, Amador, Martin, Contra Costa, San Joaquin, Calaveras, Tuolumne, Mono, San Francisco, San Mateo, Alameda, Stanislaus, Mariposa, Santa Clara, Merced, Santa Cruz, San Benito, Monterey, Kings, Tulare, San Luis Obispo, and Santa Barbara
2017	California Severe Winter Storms, Flooding, And Mudslides	DR-4305-CA	Modoc, Trinity, Mendocino, Napa, Yolo, Sacramento, El Dorado, Calaveras, Contra Costa, Tuolumne, Mono, San Francisco, San Mateo, Alameda, Santa Cruz, Inyo, San Luis Obispo, Kern, Santa Barbara, Los Angeles, Orange, Riverside, and San Diego
2017	California Severe Winter Storms, Flooding, And Mudslides	DR-4301-CA	Siskiyou, Humboldt, Trinity, Shasta, Lassen, Plumas, Mendocino, Butte, Sierra, Yuba, Nevada, Lake, Sutter, Placer, Sonoma, Napa, Yolo, El Dorado, Sacramento, Amador, Solano, Calaveras, Martin, Contra Costa, Tuolumne, Mono, Alameda, Santa Clara, Santa Cruz, Merced, Monterey, San Benito, Inyo, and San Luis Obispo
2017	Hoopa Valley Tribe Severe Winter Storm	DR-4302-CA	Humboldt
2015	California Valley Fire and Butte Fire	DR-4240-CA	Lake, and Calaveras

Case Study: Paradise Irrigation District - Severe Economic Impacts from Wildfire

In 2018, Paradise Irrigation District served a population of 26,218 through 10,530 service connection in the town of Paradise. On November 8, 2018 the Camp Fire began burning in Butte County. As a result of the Camp Fire, Paradise Irrigation District lost 90 percent of their service connections. This massive reduction in customers resulted in a major loss to their revenue base. In addition to the loss of service connections, volatile organic compounds were detected in the service connections and premise plumbing that remained. Furthermore, there were challenges in coordination of response efforts that had unintended impacts on other efforts, such as debris removal ripping out water lines and causing more leaks, and contractors tapping water lines for dust control but negatively affecting the system pressure. Paradise Irrigation District is working to reconstitute its infrastructure, which requires funding; additionally, funds are needed to continue covering basic operational expenses: salaries, maintenance of remaining facilities, water quality sampling and analysis. All of the difficulties have made it harder for Paradise Irrigation District to return to normal operating conditions.

11.6 CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Emergency preparedness, response, and recovery are critical focus areas for all PWS and society at large. Generally, emergencies take place and have the greatest impact at the local and regional level. Emergency response must be coordinated across all levels of government to be successful. At the state level, the 2020 Water Resilience Portfolio includes the broad category of "Being Prepared" as one of our categories of planned action.

The State Water Board seeks to ensure that the benefits of this initiative are fully realized for smaller PWS and the communities they serve. One key area of focus is emergency preparedness. Many larger PWS have comprehensive programs in place and specific statutory mandates related to preparedness and emergency response plans. However smaller PWS do not have the same resources and statutory mandates.

California history shows that the state needs to plan for emergencies of every type including natural and manmade disasters, and potential terrorist activities. PWS that provide critical water supplies to our communities for drinking and sanitation, support commerce, and provide for an aesthetically pleasing environment, must ensure that those supplies are safe, reliable and resilient in the face of all threats.

Greater emphasis and effort are needed to advance the concept of mutual aid organizations within the drinking water industry. Although there are multiple mutual aid organizations within California, the membership is primarily the large water systems that have resources to share. The small and medium size PWS have not taken advantage of this opportunity and the benefits it would provide. The impact and recovery from the damage caused by disasters could be significantly reduced if all community water systems were members of a mutual aid organization.

Recommendations

11-1 All community water systems should be required to participate via membership in a mutual aid organization with other water utilities.

11-2 A requirement to join a mutual aid organization should be a condition of any state funding contracts.

11-3 Establish statutory requirements for all community water systems to develop, maintain and exercise an ERP.

11-4 As part of Sanitary Surveys, the State Water Board encourages and will verify that PWS serving greater than 3,300 people update their risk and resilience assessment and their ERP and review and update these documents every five years, per the AWIA.

11-5 Build a culture of preparedness. Every segment of water supply, from individual water systems to governance and support associations, must be encouraged and empowered with the information needed to prepare for the inevitable impacts of future disasters.

11-6 PWS should be encouraged to subscribe to and review the intelligence alerts from organizations.

11-7 Ensure water systems are positioned to be able to seek FEMA reimbursement following any disaster that has caused damage to their water facilities by having a Local Hazard Mitigation Plan or being included in a County Local Hazard Mitigation Plan.

11-8 Inclusion of Water Sector Specific position at local EOC. This will provide the necessary support and coordination with other emergencies managers to ensure there are targeted efforts to repair our critical sectors so water can be used for fire suppression tactics and populations can return to safe drinking water when evacuations are lifted.

11-9 Develop focused programs to ensure California water systems are planning and preparing for the impacts of climate change. This may include, but is not limited to, technical assistance providers to develop regionalized training focusing on climate vulnerabilities, funding programs to assist water systems to develop climate change vulnerability assessments and mitigation plans, ensure funding is available for water systems to implement mitigations to develop resiliency to changing climate.

11-10 The water and wastewater systems sector should be consolidated into a single Emergency Support Function under the National Response Framework to improve the efficiency and prioritization of water sector needs during an emergency.

11-11 Establish requirements for water systems to routinely provide accurate and updated water system service areas and legal boundaries to the State Water Board.

11-12 Increase awareness of cyber threats and use of guidelines and assistance from organizations such as AWWA, the CISA and WaterISAC to help PWS improve their cyber security.

11-13 Adoption of cyber security practices by PWS when implementing SCADA systems. Provide ongoing security maintenance and updates to the SCADA system.

11-14 Advance financial planning and investments in water system infrastructure to replace facilities that have exceeded their useful life to make them better prepared for emergencies and disaster recovery.

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CHAPTER 12 2020 IMPLEMENTATION

This third edition of the Safe Drinking Water Plan provides a unique and timely opportunity to chart a course for achieving the promise of safe drinking water for all communities in California. As noted in Chapter 1, the promise of safe drinking water has not been met for numerous communities the promise of safe drinking water has not been met. In too many cases, solutions to drinking water quality standard violations have been delayed for years.

The 2015 Safe Drinking Water Plan (2015 Plan) outlined 32 recommendations in nine areas designed to expand efforts to bring a greater number of public water systems and individuals served by state small water systems or domestic wells into compliance and contribute to realizing the Human Right to Water in California. Many of the recommendations contained in the 2015 Plan have been acted upon by legislative action and/or program action by the State Water Board and stakeholders.

The implementation of the 2020 Safe Drinking Water Plan (2020 Plan) focuses on recommendations necessary to achieve the elusive goals of the Safe Drinking Water Act for all communities in California. The recommendations of the 2020 Plan are aimed primarily at public water systems. However, consistent with the statutory mandate of the SAFER program, there has been a broadening of the focus to include public health aspects of state small water systems and homes/communities served by private domestic wells.

The 2020 Plan contains recommendations grouped in the four thematic areas of Sustainability, Equity/Human Right to Water, Emergency Preparedness and Program Action. These thematic areas are strongly connected and interrelated as shown graphically below. Safe drinking water is now fully recognized as fundamental to healthy communities as the focal point of the overall initiative.

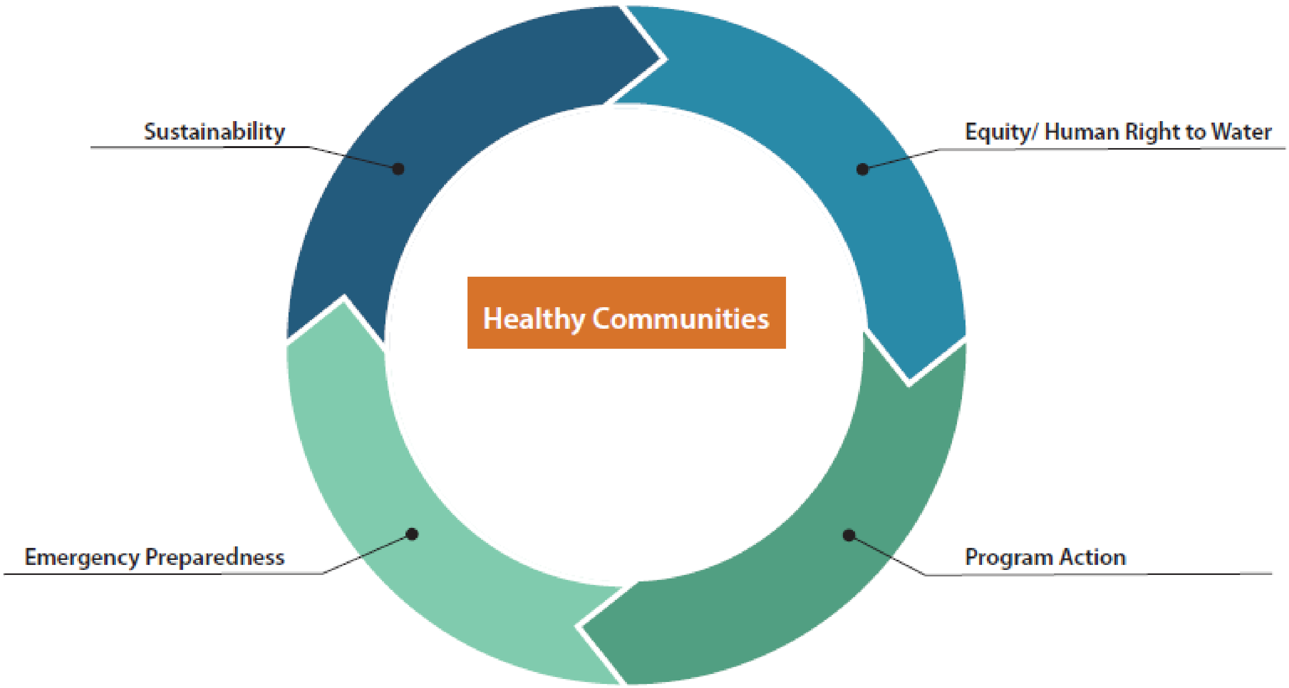

Figure 12-1: 2020 Implantation Thematic Areas

Implementation of the 2020 Plan builds on program elements that have been put in place since the development of the 2015 Plan. These program elements include:

1. **The Safe and Affordable Financing for Equity and Resiliency program.**

   The SAFER program provides both funding and staffing resources aimed to develop and implement projects to resolve drinking water standards violations impacting small, disadvantaged public water systems. The SAFER program has achieved important initial milestones and objectives with the adoption of the initial Funding Expenditure Plan and the development of tools and approaches consistent with the statutory mandates.

2. **Sustainability and Consolidation Initiatives pursuant to statutory authority**

   Recent legislation (SB 1263 and SB 88) provided the State Water Board with important new authorities discussed in this report. SB 1263 established the authority to promote sustainability in the consideration of the formation of new public water systems. SB 88 provided the State Water Board mandatory consolidation authority for disadvantaged communities with water quality or quantity issues to be consolidated by a nearby compliant public water system. These two authorities have been proven useful but not sufficient to fully address the issue of sustainability. To date, most consolidations have been achieved through a voluntary approach, SB 88 provides an important incentive for these solutions. The time required to secure a consolidation remains a significant barrier to providing safe drinking water quickly

3. Increased Focus on the Issue of Affordability

Consistent with the Human Right to Water, and recent legislative authorities (AB 401 and the SAFER program) the State Water Board continues to focus on affordability. The AB 401 Report evaluated water rates and affordability for customers of public water systems to assure the access to safe drinking water. In addition, the SAFER program has developed additional methodologies and approaches to evaluate and consider affordability in the development of sustainable solutions.

4. Public Information and Transparency

The requirement for timely and thorough public information is foundational to the Safe Drinking Water Act and related regulations. Each public water system has specific obligations to provide information to customers especially in the event of a problem. The State Water Board has a policy to promote transparency across all data and information systems. To ensure that this program element is met, additional data systems and enhancements are needed as discussed in this report. These will be designed to promote the timely and transparent availability of information to the public.

Discussion of the Four Thematic areas of Implementation

With the authorities and program elements developed since the 2015 Plan, we have chosen to focus the recommendations of the 2020 Plan around four key program elements as discussed below. These program elements are strongly interrelated. For example, a public water system without adequate technical, managerial, and financial capability is likely not able to meet all statutory and regulatory requirements across the range of operating conditions, is less likely to be able to return to compliance after a violation and, is less likely to be prepared to deal with and recover from an emergency, requiring program action to help address the issues. Many of the 2020 Plan’s recommendations are relevant to more than one of the program elements.

The success in carrying out the 2020 Plan’s recommendations will rely on the efforts of the State Water Board to collaborate with public water systems, stakeholders and the regulatory community and then take actions to identify desired outcomes and achieve common goals surrounding the recommendations. This must be coupled with an increased level of public involvement and education. The following thematic approach is founded on the use of an overall collaborative approach while recognizing that the obligations and authorities of the Safe Drinking Water Act continue to be foundational to success. The promise of safe drinking water for all communities is within our collective reach.

The four thematic areas are as follows with their respective recommendations:

1. Emergency Preparedness

Large emergencies and disasters over the last several years bring this thematic area to the forefront. The list of tragic events includes wildfires, droughts, earthquakes, and flooding. The 2020 Plan includes a host of both specific and general recommendations to increase the level of water system preparedness. We must increase the overall level of preparation and resiliency to protect communities and public health. The current awareness of this issue creates an opportunity for action that is reflected in the recommendations.

12-1 Requirements for minimum pipeline size and storage tanks requirements to meet fire demand, and/or collaborate with local fire authorities, in drinking water regulations, in order to deal with the demands of the changing climate.

12-2 Water systems to be part of a mutual aid agreement, and all Counties to prepare a Local Hazard Mitigation Plans that address water system needs, including but not limited to identifying feasible water system interties and PWS vulnerable to fire due to inadequately sized pipes.

12-3 All community water systems should be required to participate via membership in a mutual aid organization with other water utilities.

12-4 Establish statutory requirements for all community water systems to develop, maintain and exercise an ERP.

12-5 As part of Sanitary Surveys, the State Water Board encourages and will verify that PWS serving greater than 3,300 people update their risk and resilience assessment and their ERP and review and update these documents every five years, per the AWIA.

12-6 Build a culture of preparedness. Every segment of water supply, from individual water systems to governance and support associations, must be encouraged and empowered with the information needed to prepare for the inevitable impacts of future disasters.

12-7 PWS should be encouraged to subscribe to and review the intelligence alerts from organizations.

12-8 Ensure water systems are positioned to be able to seek FEMA reimbursement following any disaster that has caused damage to their water facilities by having a Local Hazard Mitigation Plan or being included in a County Local Hazard Mitigation Plan.

12-9 Inclusion of Water Sector Specific position at local EOC. This will provide the necessary support and coordination with other emergencies managers to ensure there are targeted efforts to repair our critical sectors so water can be used for fire suppression tactics and populations can return to safe drinking water when evacuations are lifted.

12-10 Develop focused programs to ensure California water systems are planning and preparing for the impacts of climate change. This may include, but is not limited to, technical assistance providers to develop regionalized training focusing on climate vulnerabilities, funding programs to assist water systems to develop climate change vulnerability assessments and mitigation plans, ensure funding is available for water systems to implement mitigations to develop resiliency to changing climate.

12-11 The water and wastewater systems sector should be consolidated into a single Emergency Support Function under the National Response Framework to improve the efficiency and prioritization of water sector needs during an emergency.

12-12 Increase awareness of cyber threats and use of guidelines and assistance from organizations such as AWWA, the CISA and WaterISAC to help PWS improve their cyber security.

12-13 Adoption of cyber security practices by PWS when implementing SCADA systems. Provide ongoing security maintenance and updates to the SCADA system.

12-14 Advance financial planning and investments in water system infrastructure to replace facilities that have exceeded their useful life to make them better prepared for emergencies and disaster recovery.

2. Sustainability

For public water systems, the term Sustainability refers to both general concepts and some specific elements including Technical, Managerial and Financial capacity. Chapter 8 explores this topic in detail. Key elements of these recommendations include an ever-increasing emphasis on opportunities for consolidation, developing of Asset Management Plans, ensuring sufficient revenues and the need for water systems to further evaluate the adequacy of their sources (both quantity and quality).

12-15 The State Water Board will continue to encourage large water systems to assist small systems with technical knowledge and implementation, for example optimizing water treatment systems.

12-16 The State Water Board will continue to explore ways to facilitate operator education opportunities particularly for small water system operators and will increase outreach to recruit new operators through high schools, veterans' affairs groups, by providing internships, and other training initiatives.

12-17 The State Water Board will continue to encourage vulnerable water systems, particularly those that rely on only a single groundwater source, to study and improve their reliability. Increase existing community water systems source capacity requirements to include a minimum of two sources, either through an intertie to another water system or an additional well source and ensure backup power supply

12-18 To address and to enable conservation of treated drinking water, to provide information to drinking water consumers, and to improve the management of water systems, the State Water Board recommends legislation require all drinking water systems including state small water systems to install water meters on all service connections in their service area.

12-19 To further address conservation of treated drinking water, the State Water Board will require all drinking water systems, including state small water systems, to document at least quarterly the quantity of drinking water they produce or otherwise delivered to customers, the quantity received by customers (based on customers' water meters), and the quantity estimated to be lost by broken or leaky conveyance and distribution systems. Such documentation shall be provided to the State Water Board annually.

12-20 To provide information that will address drought-related and over-drafting stresses on groundwater sources used as drinking water, at least monthly monitoring of both static and pumping water levels by public water systems, including state small water systems, should be conducted. The results of water level monitoring should be submitted to the State Water Board on a schedule developed that is proportionate to the risk level.

12-21 The State Water Board will continue to promote consolidation and utilize administrator programs, including transient non-community and non-transient non-community water systems, wherever feasible and appropriate. Consolidation is not limited to full or physical consolidation of drinking water treatment and delivery systems, and may include technical, managerial, financial or physical arrangements between water systems.

12-22 With the increase challenges in operating facilities that treat multiple contaminants, the State Water Board recommends special training programs to ensure operators are equipped to operate such facilities .

12-23 Require easily accessible and publicly available information regarding technical, managerial, and financial status for all public water systems, regardless of governance types.

12-24 Increase financial capacity requirements, potentially including asset management plans (or similar documents) and requirements to increase rates to meet those asset management plan requirements, as well as provide for adequate reserves, accounting policies, and insurances.

12-25 Expand the financial capacity dashboards to include all public water systems to increase transparency and accessibility of infrastructure needs and water rates.

12-26 Limit the number of water systems a contract operator can maintain per license, similar to North Carolina's requirements to ensure that minimum levels of service are maintained.

12-27 Create a comprehensive and publicly available website that summarizes the source capacity and water rights for each public water system.

12-28 In collaboration with the Division of Water Rights, identify barriers and consider whether greater flexibility is needed to modify existing water rights to ensure continued operations during or after emergency events.

12-29 Widely publicize the successes of large water systems or counties that actively support voluntary water system consolidations and regionalization partnership, ensuring safe drinking water for their current communities and their community at large. Perform outreach to notify large systems of smaller water systems that are in their immediate service area.

12-30 Expand mandatory consolidation authority to address all public water systems under 500 service connections that have exceeded a primary MCL for longer than three years, not just those that serve disadvantaged communities.

12-31 Provide liability protection for municipal water systems and others that may be willing to act in an administrator capacity but are hesitant to do so because of liability concerns.

12-32 Clarify the intent of SB 1263 on what is considered feasible to deny a public water system permit. The State Water Board recommends that feasible be defined as within 200 feet of another public water system's distribution pipeline or if it is greater than 200 feet but is cost-effective based on an evaluation of 30-year operation and maintenance costs, and regardless of whether the system is within the public water system's sphere of influence.

12-33 Establish requirements for water systems to routinely provide accurate and updated water system service areas and legal boundaries to the State Water Board.

3. Equity/Human Right to Water,

The 2020 Plan includes recommendations designed to address the issue of equity and the State's commitment to the Human Right to Water. The work currently underway within the SAFER program reflects this commitment by specifically targeting disadvantaged communities with ongoing water quality violations and problems. The SAFER program includes robust reporting and transparency that provides a foundation for achieving these recommendations. Within this thematic area, there are recommendation related to the several ongoing initiatives to explore, analyze and develop action related to the issue of affordability.

12-34 To address the potential after-effects of large fires on public water systems' distribution systems with regard to benzene and other VOC contamination, the State Water Board support research on the origins of such contamination, including the effects of fire on pipes and other associated materials, and on ways to prevent an affected distribution system from losing pressure during a fire and being subsequently contaminated.

12-35 Research should continue to be focused on analytical methods used by laboratories for testing of emerging pathogens and CEC, as well as field testing methods for regulated contaminants.

12-36 The State Water Board will consider adopting a regulation for statewide UCMR monitoring for chemicals of public health concern, including NDMA and certain other CEC discussed in Chapter 3, to evaluate the extent of their presence in drinking water supplies. The results of UCMR monitoring will be used in determining whether a drinking water standard (MCL) is appropriate for a particular drinking water contaminant.

12-37 Given that the high O&M costs of treatment for chemical and radiologic contaminants are unsustainable for many small water systems particularly those serving disadvantaged communities, the State Water Board will seek to implement different solutions to providing safe drinking water such as consolidation with larger water systems.

12-38 Investigate ways to expedite funding for consolidation projects, through technical service providers, administrators, and/or direct payment of connection fees to a receiving water system for a subsumed water system immediately adjacent that may not currently be in violation of drinking water standards, but have TMF failures.

12-39 Many small water systems have water rates that are too low and some still have flat rates. Each public water system should be required to analyze the adequacy of their rate structure and asset-management plan. For small systems, technical assistance can be provided to assist with this work.

12-40 Options should be developed and evaluated for making drinking water affordable for all low income households, including evaluating the potential for establishing an appropriate water service subsidization program to low-income families and individuals served by a PWS that charges unaffordable rates. As a guiding human right principle, the cost of water should not pose a barrier to access. Assistance should be provided by some means to low-income households that face discontinuation of water service in order to protect human health impacts from shutoffs of water service due to payments in arrears.

12-41 Proposition 218 has made it difficult for water systems of all sizes to increase their rates to address critical infrastructure issues. Consumers may not understand the costs associated with new treatment systems and otherwise supplying safe drinking water. The State Water Board will collaborate with the water utility industry, public interest groups, local non-profit organizations and other organizations to develop strategies to educate consumers on the factors that affect the cost of operating a water system.

12-42 As part of its Capacity Development Program, the State Water Board will continue to encourage community water systems to adopt an asset management plan for infrastructure replacement.

12-43 A requirement to join a mutual aid organization should be a condition of any state funding contracts.

4. Program Action

The recommendations within this thematic area focus on the need for the State Water Board to further collaborate and take action in concert with public water systems, stakeholders, interested parties, and the public to identify desired outcomes and achieve common goals. These recommendations are founded on the use of an overall collaborative approach while recognizing that the obligations and authorities of the Safe Drinking Water Act continue to be foundational to success. The promise of safe drinking water for all communities is within our collective reach.

12-44 The State Water Board will continue to work closely with DHCD to develop a coordinated strategy to address water quality and water quantity in mobile home parks, special occupancy parks, and employee housing.

12-45 The State Water Board will continue to work closely with LAFCO to help address technical, managerial, and financial issues with small agencies under their purview that operate a public water system.

12-46 The State Water Board will coordinate with local county and city planning departments, LAFCO, and LEHJ, to coordinate elements of the SAFER program and to identify : 1) areas that may be at a higher risk of contamination 2) areas currently developed without safe drinking water to determine where Community Services Districts or County Service Area could be created or where other actions could be taken, and 3) areas where new development or issuance of new building permits should be postponed until safe water is demonstrated.

12-47 Provide authority for LAFCO and/or the State Water Board to deny any type of new public water system, including mutual water companies, mobile home parks, and neighborhood associations within City boundaries or within the sphere of influence of any municipality serving drinking water.

12-48 The State Water Board will report on the effectiveness of the LPA programs annually in the State Water Board's Performance Report and will use this information to track progress and prioritize activities related to LPA.

12-49 To ensure the health and safety of consumers of drinking water from state small water systems, the State Water Board recommends an initial sanitary survey followed by repeat sanitary surveys every five years. In addition, an annual Consumer Confidence Reports should be issued by state small water systems.

12-50 To ensure the health and safety of customers of state small water systems and consumers of their drinking water, the State Water Board intends to explore amending the existing bacteriological quality regulations for such systems to require them to collect and analyze water samples for compliance with bacteriological standards, consistent with 22 CCR section 64423, et seq.

12-51 The State Water Board will explore amending its regulations to require both state small water systems and transient non-community water systems to monitoring and comply with the same monitoring requirements for non-transient non-community water systems. Specifically, nitrate/nitrite, perchlorate and other inorganic chemicals, radionuclides and organic chemical contaminants, consistent with Title 22 CCR section 64432, et seq., section 64442, et seq., and section 64444, et seq., respectively.

12-52 As the existing information systems are modernizations, the State Water Board should develop a strategy and work with those responsible for data submission to ensure future data system transitions occur in a systemic, optimized manner, allowing time for the selection and development of the preferred alternative.

12-53 To facilitate the intake of all water quality via CLIP, the State Water Board intends to pursue revised regulations that will allow the it to specify a data format for water quality submission by laboratories. This new format will include additional quality control elements, resulting in higher quality data that will be of known and documented quality.

12-54 To enhance timely and accurate determination of PWS compliance with drinking water standards, the State Water Board intends complete Phase 3 of the SDWIS/STATE transition plan to implement SDWIS/STATE's extensive compliance decision support tools.

12-55 To enhance public access and ensure transparent, accessible data, public Drinking Water Watch should be further developed in a strategic, planned effort in order to provide meaningful information to the public in an easy to understand format.

12-56 To improve the quality and usability of data collected from the Electronic Annual Report (EAR), the State Water Board intends to redevelop the EAR in a new format for improved data collection, quality control, and usability. Some of the changes will include a single format for all PWS, auto calculated fields, and prepopulated fields from DDW databases.

12-57 To assist in emergency response and enhance access to water data, the State Water Board will use the System Area Boundary Lookup (SABL) to allow continued information accessibility and facilitate easier identification of water system service areas and legal boundaries.

12-58 To meet the growing GIS needs of external and internal users, the State Water Board recommends increasing its GIS resources. This is particularly important for emergency preparedness and response, as well as sustainability.

12-59 To comply with AB 2370, which added Section 1596.7996 to the Health and Safety Code, the State Water Board intends to develop a new data intake system and database to receive and post lead water sample results for monitoring conducted from child daycare facilities on an internet website that is publicly accessible.

12-60 The State Water Board is planning to implement a DDW Data Enterprise System over the next few years to integrate disparate data systems into a single point of access system. This will centralize disparate, non-integrated data systems for ease of data tracking, storage, and management by DDW while incorporating role-based access to facilitate open access to data to improve transparency and accountability.

12-61 A new residential water treatment device registration portal is under development to ensure accurate information is conveyed to the public and other stakeholders regarding these devices which are making health and safety claims. This portal will better facilitate registration, including both new and updates, of residential water treatment devices.

12-62 To be able to identify state small water systems that consistently fail or are at risk of failing to provide an adequate supply of safe drinking water, as required by SB 200, a new data intake portal needs to be developed. The new intake portal will be integrated into DDW's existing data systems in order to streamline data collection while promoting data transparency.

12-63 To meet workload demands, fully achieve legislative mandates, and ensure consistency, ELAP intends to automate processes for the program, laboratories, and proficiency testing providers which will enhance the overall accreditation program.

12-64 Continue to improve SDWIS/STATE reporting by LPA by developing tools to allow reporting through the use of portals and platforms accessible outside of State Water Board firewalls to intake the information for subsequent uploading to SDWIS/STATE.

12-65 Increase engagement with County and State land-use planners to develop County-wide drinking water plans. Plans could be done through required water sections of existing documents such as County General Plans, or other more specific drinking water plans.

12-66 Information regarding SSWS, including water quality data and boundaries, should be publicly available on a single website location for better understanding and greater transparency of any issues regarding these water systems and so they can be included in regional planning efforts.