Sustainable Water Strategies for California

Water Leaders Class of 2016

WATER EDUCATION FOUNDATION

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Acknowledgments

The Water Leaders Class of 2016 would like to express our sincere appreciation to the Water Education Foundation (WEF) for providing us this unique opportunity. We also would like to express our gratitude to the individual mentors for the time they spent with us and for sharing their decades of hard-earned experience. We also owe a great debt to our employers for their support and encouragement to participate in this program and represent them in the Water Leaders Class. Finally, we would like to thank the members of the WEF and supporters of the William R. Gianelli Water Leaders Program, without whose generosity this program would not be possible.

Executive Summary

Strategies for Achieving Water Sustainability was written by the Water Leaders Class of 2016 to address the various challenges and water issues in California. The report explores 24 strategies for achieving sustainability in the areas of water supply, demand-side management, laws and governance, funding, public education and data.

Sustainability is an extensive and evolving topic and this report in no way covers every aspect of the issue. For the purpose of this report, sustainability will be defined as that which meets the needs of the present without compromising the ability of future generations to meet their own needs (*Our Common Future*, 1987).

Water Supply

A balance of supply and demand is imperative to accomplishing water sustainability. Water resources in California are very diverse in terms of sources, seasonality and how the supply varies from year to year. In addition, effects from anticipated climate change, ongoing water quality issues and aging infrastructure add to the complexity of our state's water supply and its conveyance abilities. The following strategies can help achieve sustainability in our water supplies:

- Statewide implementation of snowpack-measuring technologies that focus on measuring whole watersheds instead of single point-specific measurements.
- Develop and implement a statewide asset management plan for water infrastructure that can be executed through grant funding incentives for water agencies and regulatory requirements for water agencies that own infrastructure systems.
- Diversification of supplies through developing new water sources (recycling, re-use, desalination, etc.) and making strategic improvements to current delivery and underground storage systems.

Demand Management

Meeting the water demands in California is challenging. A changing climate and increased populations statewide are already altering current demands on water resources. The following strategies and policies could help to meet current and future water demands:

- Increase water efficiency within populated urban areas through active code-based and price-effect conservation in an effort to change consumer behaviors to reduce water usage.
- Optimize regional and local water supplies through local governments by strengthening ordinances, streamlining permitting of regional projects and development of direct potable use of recycled water as outlined in the updated California Water Action Plan.
- Improve agricultural water-use efficiency through continued financial incentives for farmers and agribusinesses.
- Continue to prioritize policies and incentives that provide disadvantaged communities with resources to achieve and maintain an adequate water supply.

Laws and Governance

The history of water resources development in California is filled with decades of acrimonious political debates, shifting policies and countless lawsuits. Recent drought conditions in the state have heightened public interest in water usage and in turn have spurred numerous legislative actions. However, because California's water rights system is notoriously complex, it is very challenging, both politically and legally, to enact legislation that results in widespread changes to the laws and governance structures that determine how water resources are used.

Strategies discussed in the Law and Governance section focus on policies that encourage the sustainable use of water without requiring wholesale changes to the existing system for managing water. These include:

- Incentivize voluntary agricultural water-use reduction programs amongst senior water rights holders during periods of drought to reduce diversions while avoiding contentious and time-consuming curtailment processes.

- Expand access to California water markets through continued efforts to increase transparency of water pricing and by reducing permitting and transaction costs for certain categories of transfers.
- Increase collaboration between state and federal agencies to develop permitting processes for water resource projects that reduce delays created by overlapping jurisdictional boundaries and duplicative requirements.

Funding

Funding the development and management of California's water system is a continuous challenge. Public agencies must create funding sources within the strict limits on their ability to levy taxes, fees and charges on water users, leaving major areas of water management in the state underfunded. Addressing fiscal challenges will likely require multiple approaches; the following are possible strategies in the area of funding:

- Establish low-cost lifeline rates in disadvantaged communities through revenues generated from higher-income households, mirroring the model used within the energy sector.
- Encourage collaboration amongst varying agencies in watershed planning and management to enhance cost-effective use of limited funds.
- Allow local governments more freedoms in raising revenue for watershed-based management, such as allowing watershed scale improvements to be included in benefit assessments or usage of a uniform parcel tax funds for watershed enhancements.
- Leverage use of the United States Army Corps of Engineers (USACE) federal planning process in directing federal funds for multibenefit water projects.
- Other areas of funding worth exploring include: increase use of public-private partnerships; modifying Proposition 218 and Proposition 26; and use of cap and trade funds on water resources.

Public Education

Increasing public education and understanding of how water resources are used and managed in California is imperative to achieving a sustainable future. Competing interests and the

complexity of the issues makes communications and messaging difficult, but the following are strategies that should be explored:

- Implement watershed-focused curriculum in K-12 education programs, integrating traditional ecological knowledge.
- Improve messaging around sustainability to focus on outreach that appeals to an individual‘s personal and social identities.
- Enhance understandings of sustainability through organizational inreach.
- Engage citizen science groups across the state.

Data

Despite an abundance of data, there is a shortage of *useful data* on water resources in California. Government agencies face policy hurdles that hinder their ability to incorporate more effective data in the decision-making process. In addition, intense debates often erupt over how data should be used in making policy decisions that impact water users and the environment.

Progress is underway to improve and establish widely accepted standards for California water data; however, these protocols need to balance standardization with adaptability. Possible strategies within the realm of water data to achieve suitability include the following:

- Employ visualization to present data on California’s water system in a way that is relatable to nonspecialists.
- Establish data standards to facilitate quality control of collection methods and analysis and easy transfer of data amongst interested parties.
- Engage and harness the data technology sector as a source of innovation in water management tools.
- Shift data collection responsibilities from regulators to independent entities in order to improve trust between regulators and stakeholder groups.

Conclusion

A common thread throughout the strategies presented in this paper is capitalizing on the engagement of local stakeholders: citizen scientists, farmers, tribes, students and others. By putting more responsibility in the hands of local water regulators, managers and users, California can achieve many of the sustainability goals highlighted in the strategies above, such as improved water data transparency and access, greater understanding of watershed science and processes, broader restoration of critical habitat, and improved water-use efficiency at various scales. That said, there also are exigent needs that must be addressed by state and federal governments to encourage sustainability, including: investing in infrastructure repair, refining permitting processes and supporting the expansion of water markets. These strategies were developed by a diverse group of water stakeholders and reflect our vision for a sustainable water future in California.

1 Introduction

This report was prepared by the William R. Gianelli Water Leaders Class of 2016, sponsored by the Water Education Foundation (WEF). The Water Leaders Class of 2016 is comprised of 18 experienced professionals from diverse fields spanning public, private and nongovernmental sectors. The class was challenged to address the following topic: ***Strategies for Achieving Water Sustainability***.

Throughout the year-long program, the class researched various strategies that are either in exploratory phases or are currently being implemented, and prioritized those that could most effectively be expanded and implemented statewide. Each Water Leader also was assigned to a mentor who provided valuable guidance and insight on the topic of sustainability. In addition, Water Leaders participated in numerous educational tours and informational executive briefings organized by WEF.

Achieving water sustainability in a state as large and complex as California is no easy task. It will take a multifaceted approach to meet the scope and magnitude of specialized needs across this diverse state. Sustainability is an extensive and evolving topic, and this report in no way covers every aspect of the issue. For the purpose of this report, sustainability is defined as that which meets the needs of the present without compromising the ability of future generations to meet their own needs (*Our Common Future*, 1987).

Each section in this report reflects an area of importance in discussing water sustainability in California; water supply; demand management; laws and governance; funding; public education; and data. All sections provide specific background on the challenges within the scope of that area and then suggest various strategies for achieving water sustainability.

2 Water Supply

2.1 Background

Sustainability in California, in the context of water resources, depends upon the balance of supply and demand. Maximizing a safe and reliable supply that can be replenished year-to-year is equally as important as conserving water and minimizing the amount of water we use. In this section, the Water Leaders briefly address some of the main topics related to California's water supply, including supply sources, water quality, seasonality, climate change and aging infrastructure. While this is by no means an exhaustive discussion of the issues facing a sustainable supply of water in California, the topics discussed in this section are some of the leading concerns for California's water supply future, and the most applicable to achieving a sustainable future. The Water Leaders present this section both to identify some potential strategies specific to a sustainable supply in California, as well as to give context and background to some of the other strategies discussed in this paper.

Supply Sources

California – on average – receives approximately 200 million acre-feet of water per year from a variety of sources. Of that 200 million, only 40-50 percent of that water supply is available for consumptive use; the remainder is returned to the environment through evaporation, vegetation, natural crop uptake, deep aquifer storage and return to wetlands. Approximately 80 million acre-feet – on average – is left for consumptive use, which is categorized into various source types, including environmental, local, state, federal projects and groundwater ("California Water Plan Update 2013," 2014). **Figure 2-1** shows a graphical representation of the sources of California's water.

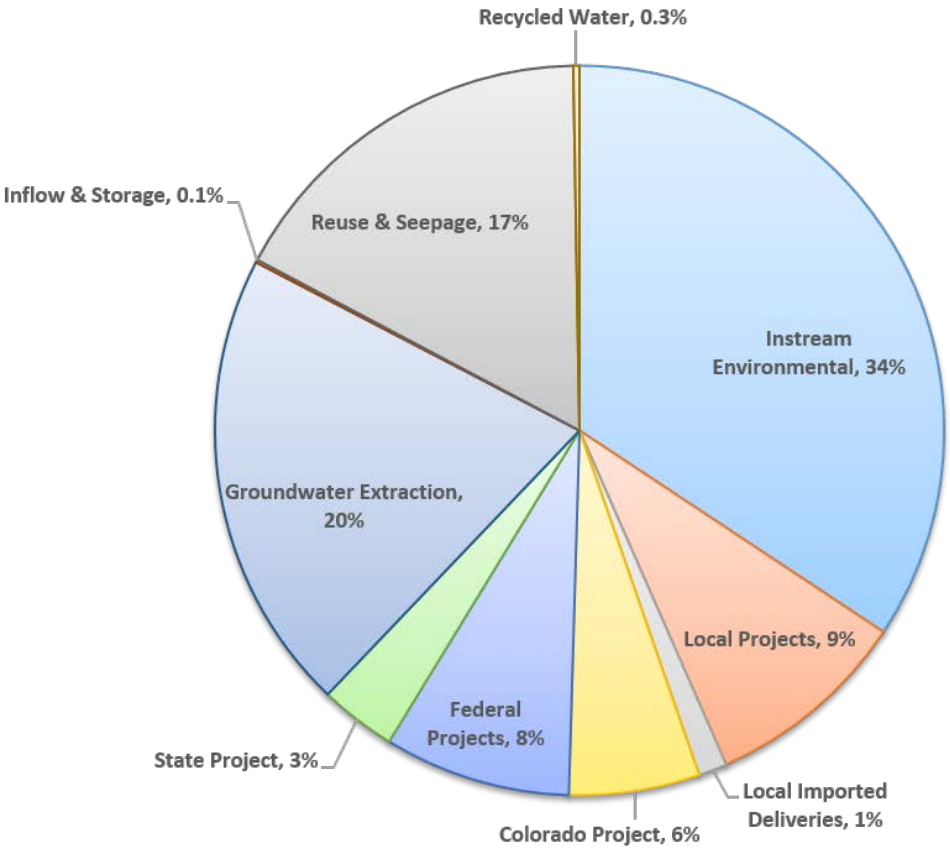


Figure 2-1. California Water Supply by Source ("California Water Plan Update 2013," 2014)

Seasonality and Variability

The availability and sustainability of California's water supply is as much dependent on when the water is available as it is on the amount or source of that water. The climate in California is historically one of feast or famine, with prolonged periods of drought punctuated by periods of water abundance, typically coinciding with the El Niño-Southern Oscillation weather pattern. In addition to these multi-year patterns, water availability also is governed by yearly patterns; water supply from precipitation comes almost exclusively between winter and early spring months. Typically, the majority of rainfall and snow occur in the months of December, January, February and March, with the remaining eight months being relatively dry. California's varied climates have historically been a saving grace with regard to water supply; the snowpack that forms in the

Sierra Nevada mountain range during the winter historically melts in the summer months to provide a supply of water when there is no precipitation. However, recent declines in the amount of snowpack, along with an earlier onset of warmer temperatures have meant that the release of freshwater has occurred sooner and is less abundant, leaving the state without its natural reservoir of water in later summer and fall months. California's system of man-made reservoirs built over roughly the last century has given water managers the ability to temper the release of freshwater from the mountains to the sea, and detain more fresh water for a longer period. In recent years, however, this system has proved to be less than adequate to serve the needs of all of California.

Climate Change

Climate change will increase the impacts of these patterns with longer periods of drought and more intense periods of precipitation (Intergovernmental Panel on Climate Change [IPCC], 2014). This section presents several strategies to address variability in supply and to help offset the effects of climate change. While the complexity of climate change impacts and warming atmospheric temperatures remains to be seen, it is generally accepted that one of the results will be a magnification of extreme weather events (IPCC, 2014). As of October 2016, there have been 12 extreme weather events (four flooding events and eight severe storms) putting 2016 in second place so far for record climate disaster events in one year. However, the cost associated with the four inland flooding events doubled the previous record ("U.S. Billion Dollar," 2016). Over many years, this will mean more pronounced and likely longer periods of drought followed by more intense periods of precipitation. Within a single year, this will likely mean that the rainy season will be shorter and more intense, and that warmer temperatures will begin earlier in the year, leading to a melting of the snowpack earlier in the summer. Overall rise in temperature will also likely mean more precipitation in the form of rain and less in the form of snow, which will mean a decrease in the tempering of supply from snowpack. In order to reach sustainability in the future, California must rise to the challenge of not only balancing supply and demand based on current conditions, but those that are anticipated due to climate change.

Water Quality

Water quality varies drastically throughout California depending on location, supply, past activities, regulations and economics. For example, the City and County of San Francisco uses water from the Hetch Hetchy Reservoir to supply municipal drinking water for over 2.6 million people. The water quality is among the "purest in the word" ("Frequently Asked Questions," n.d.). In contrast, many rural communities (which are often forced to rely on groundwater for economic reasons) rely on water sources that face severe threats in terms of both water quality and quantity during California's latest drought (Rogers, 2016). For example, nitrate contamination of drinking water sources has become a serious concern in many regions of the state and has the potential to cause serious health risks ("Nitrate in Groundwater," n.d.). Supply must be addressed with consideration toward water quality problems such as these because increased water availability is not sustainable if available sources pose a hazard to human health.

Aging Infrastructure

In the peak of summer and amid California's drought, on July 29, 2014, a 90-year-old water main burst in Los Angeles, gushing more than 10 million gallons of water on to the University of California, Los Angeles campus and causing up to $13 million in flood damages (Gordon, 2015).

California's ability to meet current and future demands is dependent the condition of the infrastructure needed to collect, store, treat and deliver water. Key water supply infrastructure including the Central Valley Water Project, State Water Project and Los Angeles Aqueduct were completed before 1970. Since then, California's population has more than doubled and continues to take its toll on both statewide and local facilities. On a smaller scale, cities often distribute their supply through pipelines that are well beyond their useful life.

Although water main breaks tend to receive a lot of media attention and cause a great deal of community upset, the real water loss comes from old, leaky pipes. Los Angeles Department of Water and Power reportedly loses up to 36.1 million gallons per day (Reicher, 2014). The California Department of Water Resources found that utilities statewide lose an average of 10

percent of water produced, with a range of 5 to 50 percent, largely due to aging infrastructure ("Leak Detection," n.d.). To raise awareness of the nation's infrastructure needs, the American Society of Civil Engineers (ASCE) produces state and regional infrastructure report cards. In 2012, ASCE gave California's overall infrastructure a C grade. **Table 2-1** shows the grade for each subsection relating to water:

Table 2-1 – ASCE 2012 Grades for California Infrastructure

Infrastructure Type	2012 Grade	Annual Funding Needs 2012-2022
Levees/Flood Control	D	$2.8 billion
Urban Runoff	D+	$6.7 billion
Wastewater	C+	$4.5 billion
Water	C	$4.6 billion

Source: ("California Infrastructure," 2012)

2.2 Strategies

Strategy 1: Invest in a more complete understanding of the changing landscape of California's water supply, while better managing existing sources.

California's water system was built to capture rain and snowmelt where it occurs naturally, primarily in Northern California. However, it is important to keep in mind that even today, in 2016, California only has perhaps 100 years of records to help inform water supply decisions. What looked like the best way to utilize California's water supply in the 1940s might not be best suited for today or for California's future. New ideas and more complete information should be used to make decisions on where and when our water is collected and distributed.

One potential improvement comes from NASA's Jet Propulsion Laboratory, which has developed a new mission to better understand California's snowpack. The Airborne Snow Observatory mission uses cutting-edge technology to produce hyper-accurate snowpack measurements by mapping an entire watershed. Old technology used single-point specific snow measurements or manual snow surveys. With this new technology, water managers will get better predictions of runoff volume and timing, to enable more effective decision-making. Another example is a partnership being developed between the Department of Water Resources

and the Friant Water Authority to conduct expanded watershed mapping of the San Joaquin River in the winter of 2016/17. New and innovative information and projects such as these will give water managers, utilities and cities the information they need to make efficient and sustainable decisions when planning their supply.

Another important part of increasing our understanding about existing water supply is through better management and monitoring of groundwater sources. As climate change begins to impact the availability of surface water sources, groundwater is becoming an increasingly essential component to the water supply picture in California. It is a reliable source in years of drought and a balancing mechanism in years of abundance. The sustainability of this asset is being addressed through the Sustainable Groundwater Management Act (SGMA), which passed into law in 2014. This hallmark piece of legislation is arguably one of the most impactful milestones to affect California since the Water Commission Act of 1914. A detailed discussion of SGMA and its role in the effective management of groundwater resources is presented below in **Section 4.2, Strategy 11**.

Strategy 2: Diversify supply by developing new sources & capturing water through groundwater recharge.

In addition to enhancing the reliability of groundwater and surface water, new sources must be pursued to build stronger portfolios of supply to meet growing demands. Potable reuse of recycled water represents a “new” source of water that is available during wet and dry months, and can address supply and seasonal variability.

Wastewater treatment plants, for the most part, treat water used for cleaning, washing or flushing to a level that meets the discharge requirements of specific bodies of water in order to not degrade the quality of the surface water it is being discharged into. Potable reuse involves treating this water to a higher level and reintroducing it into the potable water system, typically after several months, by discharging it into an environmental buffer such as an aquifer or surface water body. This strategy is a highly effective way of increasing potable water supply for many areas in California, as wastewater is created at a mostly constant rate throughout the year, and is already being treated to meet water quality standards. Though public health concerns have been

raised regarding the final quality of the water produced, California is in the process of enacting regulations to develop this resource safely across the state.

Desalination is another emerging source for California. Desalination has been implemented in countries such as Israel with great success, but caution should be taken in terms of scalability. For example, Poseidon, the largest desalination plant in the western hemisphere, began operations in Carlsbad along the coast in California in 2015. Poseidon can produce approximately 60 thousand acre-feet of water per year ("Home," n.d.) but took fourteen years to build, cost $1 billion and has resulted in impacts to marine life in areas surrounding the outflow vents (Fikes, 2016). To put this in a statewide perspective, if California wanted to solve its water supply exclusively through desalination, assuming 80 million acre-feet of demand ("California Water Plan Update 2013," 2014), the state would need approximately 1,300 Poseidon-sized plants, or one plant every half-mile along the California coastline, at a cost of $1.3 trillion (not to mention the costs to add pipelines to move the water across the state and over coastal mountain ranges). Desalination is an expensive technology and has limitations based on location, but the fact that it relies on an essentially unlimited source of water—the ocean—holds great promise to augment California supply during periods when there is little else available.


Poseidon Desalination Plant

More cutting-edge technologies, such as fog capture and atmospheric water generation, also are promising ways to harness undeveloped sources of water, especially in locales such as the San Francisco coast, where there is a reliable source of fog. These new technologies are important to pursue, but are only pieces of the puzzle of overall sustainability in supply, and must to be developed in conjunction with better management of our existing sources of water.

The El Nino-Southern Oscillation (ENSO) weather pattern provides another opportunity to capture new water. ENSO is characterized by many years of low precipitation punctuated by periodic years of intense precipitation patterns brought on by fluctuating water temperature in the eastern Pacific Ocean. This weather pattern highlights the need for adequate reservoirs and

detention in order to make the highest use of water that is available during ENSO-driven years of high precipitation. The amount of water released during ENSO events are usually far more than what could be detained in man-made reservoirs, and in order for California to better capitalize on this weather pattern, water managers must develop better ways to use the natural storage capacity of groundwater aquifers in order to capture more of this water than has historically been harnessed. New studies by the University of California, Davis, have shown an ability to use existing perennial cropland such as almond orchards as conduits to groundwater recharge basins during extreme precipitation events. These studies have shown that these orchards can withstand short-term flooding without any significant effects to yield. It is important for water managers to pursue options such as these to maximize capture of available fresh water during extreme precipitation events, especially those brought on by ENSO patterns.

Strategy 3: Develop Flexible Management Plans

In northern California, water flowing to the Sacramento-San Joaquin Delta is highly regulated for salinity control and fisheries purposes ("San Francisco Bay," 2016). Southern and Central California benefit from this high quality water as well—assuming the water is actually available. When water is not available from the Central Valley Project or State Water Project due to regulatory restrictions, Central and Southern Californians must rely on their local supplies—which often means pumping from groundwater sources. As groundwater levels fall over long periods of drought, the quality of that groundwater often diminishes.

Plans like the California WaterFix, which propose to add new points of diversion for the Central Valley Project and State Water Project, aim to increase water quality and availability in Southern and Central California by allowing those projects more flexibility to meet existing regulations within the Delta and providing those projects with additional options of when and where to take water ("San Francisco Bay," 2016). The proposal is hotly contested, but is an example of how investment in new infrastructure and creation of additional options for withdrawing water can potentially help increase water quality for users and the environment.

Strategy 4: Require Asset Management Plans

Typically, the operations and maintenance of water facilities is funded through utility rates, which fail to include renewal, rehabilitation and replacement costs. An obvious strategy for improving this aging infrastructure is implementation of effective funding mechanisms for operation and maintenance. Asset management plans are effective to plan for operations and maintenance funding needs and can help to identify strategies to address these infrastructure needs.

The asset management strategy can be implemented statewide in two fashions:

- Require all applicants seeking federal or state funding to demonstrate how the project fits within a current asset management plan.
- Require all public agencies owning water infrastructure to develop and maintain an asset management plan.

Similar strategies have been implemented in other countries such as Canada and Australia as well as in other categories of infrastructure projects, including transportation. In 2015, the U.S. Federal Highway Administration published a Notice of Proposed Rulemaking that would require all state departments of transportation and all public transportation agencies that receive federal assistance to develop a risk-based asset management plan (23 U.S.C. 119(e)(1), MAP-21 § 1106). Success in implementing regulatory requirements for an asset management plan is based on uniform definitions and standards to compare needs and risks. In 2014, the International Organization for Standardization (ISO) published ISO 55000, an international standard for the management of physical assets. ISO 55000 has provided an asset management framework on the national scale for agencies such as the USACE, as well as for local agencies including the City of San Mateo Public Works Department, which is currently developing its asset management program. Regardless of the type of infrastructure, an asset management plan can be a useful tool to make decisions on when and where to invest state and federal funding by identifying the most cost-effective strategies to achieve and sustain water infrastructure over the asset life-cycle.

Perhaps the best, and least controversial, method to maintain a sustainable supply of quality water within California would be to invest money to repair and fortify delta levees that are


Levee in Sacramento, CA

essential for protecting California's existing water infrastructure. Water flowing through the Delta supplies roughly two-thirds of California with drinking water as well as irrigation supplies for millions of acres of agricultural production (Gaddie, Marr, & Mierza, 2016). On June 3, 2004, Jones Tract, an island in the Delta, suffered a levy breach (Gaddie et al., 2016). The 12,000-acre island was flooded to an average depth of 12 feet and repairs took over six months at a cost of $90 million dollars (Gaddie, Marr, & Mierza, 2016). Many of the levees in the Delta are currently considered at risk and, beyond mere economic damages from property destruction, "a major failure could also affect water exports from the Delta for as much as a year" (Taylor, Favorini-Csorba, & Brown, 2015). Further cuts to supply, especially in a time of drought, would be catastrophic to Central and Southern California residents and the state economy as a whole. Because of the importance of the Delta to drinking and agricultural supplies, the worst action is inaction.

3 Demand Management

Meeting California's future water supply demands in an era of climate change and continued population growth will pose significant challenges for decades to come. This section explores potential strategies for managing California's water supply demands in a sustainable way given the challenges that lay ahead. Our strategies focus on minimizing urban and agricultural demand, while addressing the limited access to water supplies in some areas of the state.

3.1 Background

As previously discussed, California's water supply is highly seasonal and this variability will likely increase in an era of climate change ("California Water Action Plan," 2016). All of this is occurring at a time when the state's population is projected to increase from 38 million to approximately 50 million by 2049, and to 52.7 million by 2060 ("California Water Action Plan," 2016). Current trends show that from 2015 to 2016, population growth was widely distributed with most counties experiencing growth. The fastest growing counties are San Joaquin County in the Central Valley, Santa Clara County in the Bay area, Yolo County west of Sacramento, and Riverside County in the Inland Empire region of Southern California with rates around 1.3 percent from 2015 to 2016. Los Angeles, the state's most populated city, crossed the 4 million mark in 2016, and now has nearly as many people as the next four largest cities combined ("E-4 Population Estimates," 2016).

There are countless numbers of public and private agencies that provide water throughout the state from various sources of supply. Many areas of the state have access to diverse sources of supply due to geographic location and regional planning efforts on the state, federal, and local levels. However, many remote areas of the state face challenges in years of drought, leaving isolated populations at risk of water shortages. In 2014, 17 rural drinking water systems that served populations as small as couple dozen to a few thousand people were identified by the California Department of Public Health as at-risk communities and were provided aid to increase conservation and potentially access new supplies ("California Department of Public Health," n.d.). Many disadvantaged communities in the state also face similar challenges in maintaining

enough supply to meet demands in times of drought and are in need of assistance since they are typically unable to afford the development of new supplies on their own.

Water supply demands in California in an era of changes in the annual variability of supply present risk and uncertainty for water managers. In addition to population growth, rising temperatures due to climate change are likely to increase the demand for water by the agricultural industry, for use as environmental flows for species and habitat needs and for urban use generally (Mount, Escriva-Bau, Hanak, & Lund, 2016). California's current water supply is divided among three main sectors as follows: (1) 50 percent environmental flows; (2) 40 percent agricultural and (3) 10 percent urban (Chapelle, Escriva-Bou, Hanak, & Mount, 2016). In order to attempt to meet California's future water demands, action must take place at all levels of government, in the private sector and at home to plan for both climate change and population growth.

3.2 Strategies

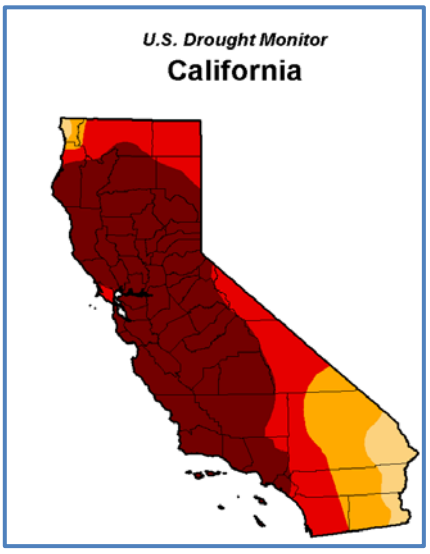
Strategy 5: Increase urban water use efficiency

Water savings that minimize the impact of a population growth can be achieved through increasing water efficiency. Three examples of strategies to increase water efficiency are active conservation, building code-based conservation and price-effect conservation. Implementation of best management practices (BMP) created by the California Urban Water Conservation Council (Council) is an example of active conservation ("BMP Resources," n.d.). The Council's BMPs include four subcategories that consist of (1) operational practices, (2) water loss control, (3) metering and billing and (4) retail conservation pricing. In addition to providing lists and reports of established BMPs, such as those previously listed, the Council also creates "potential BMPs" that agencies can choose to pursue or become early adopters of. Aggressive adoption of these BMPs could also help accelerate development of effective new ways to increase water use efficiency throughout the state.

Building code-based or "passive" conservation is water saved as a result of changes in water efficiency requirements for plumbing fixtures. For example, in 2015, the Model Water Efficient Landscape Ordinance drafted by the state for local agencies was revised to increase water

efficiency standards for new and retrofitted landscapes via more efficient irrigation systems, greywater usage, on-site stormwater capture and by limiting the portion of landscapes that can be covered with turf. Price-effect conservation is the result of behavioral usage reduction resulting from increases in the prices of water such as a tiered-rate structure. Consumers respond to changes in price of water by reducing usage when faced with higher water rates It is anticipated that the cost of water supply and water delivery systems will continue to increase, and in turn will lead to increases in the rates that are paid by customers. Additionally, there is a shift toward tiered pricing and water budgets that reflect the higher cost of service for providing increasing amounts of water. Consumers thus face true or higher cost of incremental water supplies, which in turn promotes more efficient use of water and higher water conservation savings ("BMP Resources," n.d.).

Strategy 6: Establish Drought Management Plans



In times of water scarcity, it becomes important to have a set of management principles to prevent shortages from becoming severe. ("Guidelines for Preparation," 2015). However, many small water systems and private pumpers do not have the means to establish effective management plans, leaving them vulnerable to shortage during a drought. The unincorporated community of East Porterville, for example, relies heavily on shallow private wells. During the current drought, the groundwater level fell below their shallow wells, leaving the community without access to their only source of water. Nonprofit organizations and the state provided aid in the form of household water tanks and contracted truck deliveries. However, these emergency actions are not cost effective or long-term reliable solutions ("White Paper: Water," 2016). The state is currently assessing the feasibility of creating a new public water system or connecting the community to an existing public water system. In doing so, East Porterville will be protected by a drought management plan of an existing agency or be empowered to construct and execute a drought management plan on their own.

An example of an effective regional drought management plan is the Metropolitan Water District of Southern California (MWD) Water Surplus and Drought Management Plan (WSDM). MWD establishes the linkage between surplus and shortage resource management actions in order to establish integrated management of regional resources and avoid self-imposed mandatory water allocations to its member agencies to the extent practicable ("Water Surplus," 1999). For example, during times of surplus, the WSDM plan calls for operation to replenish storage in the San Luis Reservoir as carryover storage of State Water Project Supplies. This action provides the most amount of flexibility to deliver water to areas that are solely reliant on State Water Project supplies, and shift water from the Colorado River Aqueduct to areas that can take either supply if SWP resources are scarce. Another important component of the WSDM plan is Diamond Valley Lake (DVL) which was constructed in March of 2000 and nearly doubled Southern California's surface storage. DVL gives operational flexibility to store water in region when it is plentiful and secures a strictly maintained six months of emergency storage west of the San Andreas Fault. These flexible management choices have been an integral part of WSDMs success. Since the WSDM plan's adoption in the late 90s, MWD has been able to avoid allocation of its supplies most of the time despite the persistence of drought over the past decades.

Strategy 7: Continue to improve agricultural water-use efficiency


Drip Irrigation System

California farmers have been proactively investing in water conservation practices that improve water efficiency on their farms and ranches. The need to stretch limited resources has encouraged farmers throughout the state to increase irrigation efficiency through investments in drip irrigation line, sub-surface drip irrigation, micro-sprinklers, and leveling of fields for efficient flow of water. Agricultural demand ultimately reflects farm-level efficiency of water use and consumption. Improving agricultural water efficiency use in California depends on 1) disseminating information on the use, costs, benefits and impacts of technologies directly to farmers, 2) providing technical assistance and training on the site-specific nature of implementing water efficient technologies, and 3) providing incentives for implementation. Experience shows that water suppliers and growers

respond strongly to financial incentives, such as grants ("California Water Plan Update 2013," 2014).

Strategy 8: Prioritize policies and incentives that provide disadvantaged communities with adequate water

Access to clean, safe and affordable water is a fundamental human right essential for a healthy population, environment and economy and is characterized as a human right in California Law (CA Water Code sec. 106.3). Still, some economically disadvantaged and rural communities in our state lack access to safe, affordable drinking water. Disadvantaged communities (DAC) tend to be disproportionately impacted by disasters, both natural and human caused, due to a general lack of diversified resources. Furthermore, these communities tend to be reliant on a sole source of water, which can be polluted, be geographically distant from large water projects, and not have a ratepayer base available to develop additions resources and to invest in improving existing sources. These issues can leave DACs with depleted or unhealthy water sources, and limited means for either remediation. These communities can also lack technical resources, making it difficult for them to operate and maintain their water and wastewater system, complete repairs and improvements, as well as respond to regulations. In order to address the health and the basic water supply needs of DACs, the following options should be pursued simultaneously:

- Strengthen the enforcement of policies and regulations that prevent pollution and groundwater depletion in disadvantaged communities.
- Increase state and federal collaboration with local environmental justice organizations to offer special assistance with grant funding water projects.
- Closely monitor known and potential pollution sources located in disadvantaged communities
- Tier water rates to match cost with use and improved demand forecasting to ensure appropriate water rates.
- Itemize water bills so they are easily understandable, and offer flexible payment and billing options.
- Use grants, charities and tax revenues to fund low-income financial assistance programs to help offset water bills. Encourage stakeholder engagement in decision-making processes through outreach and education in those communities.

4 Laws and Governance

4.1 Background

Because California's limited water resources have long been subject to competing demands, our state has a well-earned reputation for multi-decade lawsuits and fierce political battles between water users. As the most severe drought in California's modern history continues into a sixth year, there is a growing public awareness of the water supply issues facing different regions in the state. A majority of voters in a 2016 survey responded that their state and local governments were not doing enough to respond to the drought (Baldassare, Bonner, Kordus, & Lopes, 2016). This heightened public concern over water supply issues has already driven major developments in legislation. Proposition 1, which provides 7.12 billion dollars for water infrastructure development, passed in 2014 with 67 percent of voters in favor. That same year, the legislature enacted the Sustainable Groundwater Management Act, which is perhaps the most significant development in water resources law in the last 100 years ("Water Events: Groundwater," n.d.). Given this strong public awareness about the role that state and local governments play in water management, it has become increasingly likely that Californians will continue to demand legislative changes that will have major, lasting impacts on how water use is governed in this state.

The strategies discussed below address problems that were identified by the Water Leaders in group discussions based on their individual experiences and mentor interviews. The existing problems with laws and governance that were identified as the most pressing are: (1) the methods for curtailing pre-1914 and riparian water rights during surface water shortages; (2) the existing barriers for participation in water markets; (3) the lack of effective government institutions to manage over-drafted groundwater sources; and (4) multiyear permit lead-times for water-related projects that cause disruptions in the development of local water resources projects. Although this is not an exhaustive list, the problems that were identified are representative of issues that are being considered by voters throughout the state.

4.2 Strategies

Strategy 9: Incentivize voluntary water-use reduction programs

As demands on surface water throughout the state have increased, the tensions between water users in times of drought have become more intense. The summer of 2015 was the first time since the 1977 drought that the SWRCB sought to enforce the water rights priority system by curtailing pre-1914 water rights (Boxall, 2015). Most senior rights-holders contested the board's jurisdiction over their rights (Hanak et al., 2015). The curtailment approach that was used by the SWRCB in 2015 is still being challenged in court, calling into question whether a similar approach will be effective in the future. A possible alternative to repeating this contentious, time-consuming process is widespread adoption of the voluntary water use reduction program that was implemented amongst in-Delta riparian rights claimants during 2015.

While legal battles over the curtailment orders were being fought, many in-Delta farmers were working with the SWRCB and the Delta Watermaster to implement a voluntary 25 percent diversion reduction program that saved approximately 150,000 acre-feet of water (George, 2016). To participate in the program, farmers were required to have a statement on file with the SWRCB claiming riparian water rights in the Delta, submit a plan to alter their farming practices to reduce diversions by 25 percent, and provide monthly documentation of water use to prove that reduction goals were being met. In its first year, the program was able to realize significant benefits for farmers, regulators and other beneficial users. Farmers avoided more severe water rights curtailments, regulators saved staff time and resources that would have been spent on enforcement actions, and other beneficial users benefitted from the increased water quality associated with 150,000 acre-feet fewer diversions (George, 2016).

The Voluntary Diversion Reduction Program could serve as an effective model for implementing curtailments on senior water rights holders throughout the state during times of drought. When faced with the uncertain possibility that their entire water right will be curtailed, a significant number of water rights holders have shown a willingness to accept a partial reduction in their rights in exchange for a guarantee to the remaining allocation (George, 2016). Additionally, these programs could encourage meaningful collaboration between farmers and regulators.

Similar programs should be introduced in other watersheds during future droughts as a precursor to mandatory curtailments.

Strategy 10: Expand water markets for more efficient use of existing water rights

Improving water transfer processes and increasing access to information on water markets in California could play an important role in helping to promote widespread participation in California's water markets. Greater participation in California's water market will help to improve surface water availability for all categories of users during times of shortage ("Recommendations for Improving," 2016).

Water transfers in California have increased dramatically over the last thirty years. Coinciding with that increase is a shift in the ways that transferred water is being used. As shown in **Figure 4-1**, water purchases for urban users and the environment now represent over half of all transfers (Hanak & Jezdimirovic, 2016).

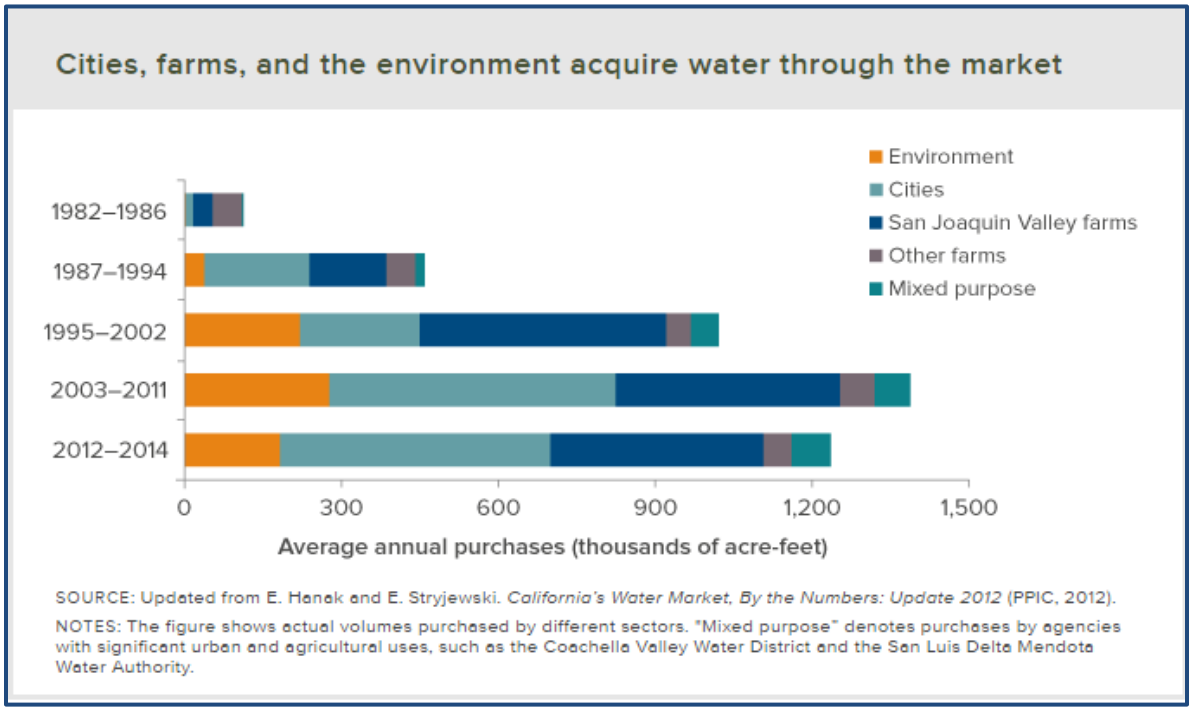


Figure 4-1 – Water Purchases from Different Sources

In September of 2016, the Open and Transparent Water Data Act was signed into law in order to provide transparency for water markets by requiring that details of approved water trades be

published on a publicly accessible database (AB 1755, 2016). This reform provides important assistance to water markets because it will allow water buyers and sellers to determine a fair price for water based on comparisons to other completed water trades. Even though transparency is an important first step toward more efficient water markets, the other major factors preventing more widespread adoption of water markets are the high transactional costs that prevent small-scale water transfers ("Recommendations for Improving," 2016).

Expediting the review of certain types of water transfers would encourage new participants to join water markets as both buyers and sellers because it would reduce the transactional costs that currently force small buyers and sellers out of the market ("Recommendations for Improving," 2016). Senior water rights holders who can demonstrate water use reductions that exceed the required amount would be permitted to transfer their additional savings to others to allow farmers with fixed demand (i.e. orchards and vineyards) to participate in the program without dramatically reducing water use. This expedited category of water transfers could compliment Voluntary Diversion Reduction Programs and increase incentives for participation. **Figure 4-1** demonstrates the diverse categories of water users that could benefit from these types of in-basin transfers during a drought.

Strategy 11: Empower local governments to manage groundwater resources regionally

Groundwater is a major source of supply for California. Both shallow and deep aquifers have been reliable sources of water for both cities and agriculture. These sources are also replenished with natural precipitation cycles, but are typically resilient to long-term variations in supply. Though groundwater has historically been thought of as a drought-tolerant supply for California, the extended drought has led to a marked decrease in groundwater levels statewide. Farms and cities throughout the state currently receive water from critically over-drafted groundwater basins that have a long history of significant pumping-related impacts such as subsidence and sea-water intrusion. Because of the growing prevalence of pumping impacts, it is becoming increasingly apparent that California's groundwater is being used in an unsustainable manner.

SGMA, discussed briefly in **Section 2.2, Strategy 1**, allows local governments to develop Groundwater Sustainability Plans (GSPs) that allow for regional monitoring and management of

groundwater with the goal of long-term sustainability. The law is a hybrid of state and local control that was designed to provide overlying local governments with authority to collectively manage groundwater sources if key sustainability benchmarks are being met. If a GSP that is developed to manage a particular basin does not adequately ensure that groundwater extractions will reach sustainable levels by the year 2040, then the SWRCB has authority to manage the basin on behalf of local governments. Although it is still too early to determine if this law will be successful, similar models for groundwater management have already shown promise in other countries (Girard, 2016).

In France, state-administered individual groundwater extraction limits were being unsuccessfully enforced because state agencies lacked the financial and human resources to monitor compliance with the terms on each individual permit. In 2006, France enacted a new law in which groundwater users overlying a particular basin were required to join self-governed Water Users' Associations, comparable to Groundwater Sustainability Agencies under SGMA. The state then oversees total extractions by issuing each Water Users Associations with a permit for a fixed-volume – less than the sustainable yield for the groundwater source – which is then allocated amongst members of the Association. Hurdles still remain for implementation of France's new laws, but there are indications that this approach has the potential to ensure that groundwater extractions are kept within sustainable limits without igniting serious conflicts between local users (Girard, 2016).

Although there are a number of notable differences in the economic and institutional contexts between France and California, SGMA's focus on local governance features shows similar promise for limiting conflicts created by pumping limits. Like the new French law, SGMA permits state oversight of stakeholder-governed management agencies that decide how to best meet sustainability goals ("The 2014 Sustainable," 2015). As SGMA quickly approaches the first mandatory deadline – creation of Groundwater Sustainability Agencies for all critically over-drafted basins – there are already reasons to be optimistic. For example, because the state acts as the backstop for groundwater management, the threat of state intervention appears to be acting as motivation to encourage stakeholders and local political leaders to collaborate to create effective management agencies (Kiparsky et al., 2016). As a result, although it is still too early to tell

exactly how implementation will play out in areas where groundwater resources are extremely stressed, the framework that has been developed shows clear signs of promise.

Strategy 12: Increase collaboration between permitting agencies

Navigation through the permitting process is a major milestone for any project. For a single activity or project, a number of permits may be required, each with different agencies, requirements, timelines and fees. Often, this process drains time and resources of the applicant and the permitting agencies, and can potentially undermine or significantly alter the final design of a project. If multiple permitting agencies that have jurisdiction over a particular project can collaborate to integrate existing permitting processes to eliminate overlapping or conflicting requirements, it can encourage water resources development by reducing the time and resources spent on permitting.

There are already several examples of integration and collaboration amongst state permitting agencies that can be expanded upon to reduce permit lead-times and expense. California Public Resources Code §71021 and California Code of Regulations, Title 27 §10200 have set forth a consolidated permitting process through the California Environmental Protection Agency (Cal/EPA). A permit applicant can request to have all state environmental permits coordinated by a single agency as designated by the Cal/EPA Secretary. The consolidated permitting agency will then arrange a meeting between the permit applicants and participating permit agencies that will determine the required environmental permits, forms, and available options for a consolidated permit. The overall outcome of the process is issuance of a single, consolidated permit. If executed as planned, benefits of this process include early identification of permits, reduction of duplicate efforts, and clear communication through a single point of contact for multiple permits. Another example of permitting agency coordination is the Habitat Restoration and Enhancement Act (AB 2193) signed into law by Gov. Brown on September 22, 2016, which expedites the permitting process for Section 1600 Lake and Streambed Alteration Agreement (LSAA) and Section 2081 California Endangered Species Act permits. Project eligibility is based on the State Water Resources Control Board criteria for the General 401 Water Quality Certification for Small Habitat Restoration Projects, thereby aligning the agencies for a quickened process.

Once a project is past the initial permitting and has been constructed, further hurdles can arise in the permitting of operation and maintenance (O&M) activities. Most permits are intended for a one-time activity, which can become problematic for performing regular maintenance on an existing facility, especially when the facility predates the regulation. In some instances, maintenance activities can be prohibited by other regulations. For example, sediment removal and stream maintenance can require a number of national, state and local permits to ensure no adverse impacts result from the activity. Obtaining new permits on a yearly or regular basis can be a waste of resources and lead to poorly maintained facilities. This issue has been plaguing state and local entities that are responsible for O&M of flood protection infrastructure up and down the state. Mechanisms for multi-year permits for O&M are currently being explored by the California Department of Water Resources (DWR) as a potential strategy to assist with addressing this problem. For example, in 2015, DWR began preparation of the Environmental Impact Report for multi-year environmental permitting of O&M activities for flood protection infrastructure in the Sacramento River basin. The draft Environmental Impact Report is expected to be released for public comment in late 2016 or early 2017, and may contain O&M strategies that can be applied by other entities.

In 2013, the Council on Environmental Quality (CEQ) and the California Governor's Office of Planning and Research (OPR) released *NEPA and CEQA: Integrating Federal and State Environmental Reviews*, a handbook on improving the efficiency and effectiveness of the state and federal environmental review process. The purpose of the handbook is to aid in the development of a single joint National Environmental Protection (NEPA)/California Environmental Quality Act (CEQA) review process that can fulfill the requirements of both statutes ("NEPA and CEQA," 2013). The information in this handbook can serve as an example and framework to further integrate similar state and federal regulations, thereby facilitating better communication between agencies. Whenever a project triggers both state and federal permitting, there are often even larger expenses and delays caused by overlapping or conflicting requirements. If state and federal agencies build on the models for inter-agency permit integration described above by actively collaborating to minimize and address overlapping or conflicting permit requirements, it would reduce the permitting costs and delays that affect water resources development.

5 Funding

5.1 Background

Securing persistent, adequate financial resources for California water management is a major challenge that will be extremely difficult to address. California's current water system is funded primarily by local entities (84 percent), while the state (12 percent) and federal governments (4 percent) contribute the rest (Hanak et al., 2014). Amendments to the California Constitution passed by voters over the last four decades were intended to increase accountability for how public dollars are spent; however, they have also unintentionally made securing funding for water management more challenging. These amendments include Proposition 13 (1978), which requires a two-thirds supermajority of local voters to pass special taxes, Proposition 218 (1996), which establishes strict requirements for fees for services that are directly tied to property ownership, and Proposition 26 (2010) which is threatening to further restrict funding for stormwater and ecosystem improvements (Hanak et al., 2014). Collectively, these changes to California's Constitution have drained local governments' authority to pass taxes and have restricted their authority to adopt fees and other charges, resulting in funding gaps for maintenance of and re-investment in critical water-related infrastructure (Chapelle et al., 2016).

Over 85 percent of California water management spending is on water supply and wastewater treatment, with funding coming almost entirely through local entities raising revenues. (Hanak et al., 2014). Although water supply and wastewater treatment are generally the best funded aspects of water management in California, these two areas can also face fiscal challenges, especially regarding long-term maintenance. For example, a survey of nearly 1,000 California water and wastewater utilities revealed that more than half of them had operations and maintenance costs, including asset depreciation, which exceeded their operating revenue during the period between fiscal year 2001 and 2010 ("Defining a Resilient Business Model," 2014). Additionally, there are three major water management areas that are perennially underfunded, including: 1) adequate and affordable clean drinking water for disadvantaged communities (DACs); 2) environmental needs, including water flows and ecosystem restoration; and 3) storm and floodwater management, including groundwater recharge.

Addressing the fiscal challenges facing California water management will likely require making modifications to the aforementioned propositions, particularly Proposition 218. Achieving this goal will be a daunting challenge considering that previous attempts to reform Proposition 218 failed due to staunch opposition. Absent sweeping reform, incremental changes to Proposition 218 can be accomplished through nuanced public outreach strategies, which could include 1) creating an outreach campaign for California voters that capitalizes on the recent drought and establishes a clear connection between drought preparation, sustainability and maintenance of rate payer protections and 2) has gubernatorial support (Brown, 2015).

5.2 Strategies

Strategy 13: Authorize the use of lifeline rates for disadvantaged communities

Access to clean drinking water is still a major issue for many Californians, with over a million residents exposed to unsafe drinking water every year ("Annual Compliance Report," 2014). Many of these water quality violations occur in impoverished, rural water districts (i.e., DACs) that have limited capacity for funding improvements to their water systems.

In the energy utility sector, low-cost lifeline rates for lower-income customers are common. Revenue generated from energy rates paid by higher-income households help to subsidize these lifeline rates. However, the proportionality requirement of Proposition 218 makes it challenging for water utilities to provide a similar subsidy for lower-income residents. Therefore, funding for such subsidies must come from a source other than utility rate revenues, such as property taxes. Exempting "lifeline" rates from the cost-of-service-based standards of Proposition 218 would be one incremental approach for reducing the funding gap that currently exists for ensuring that low-income customers have access to high-quality water service.

A recent public opinion survey indicates that the lack of access to safe drinking water is a major concern across geographic regions and political parties (e.g., 61 percent of Republicans, 72 percent of Independents, and 83 percent of Democrats are extremely or very concerned), which may indicate a general willingness to pay for DAC water needs: (Fairbank, Maslin, Maullin, Metz & Associates, 2015). Furthermore, access to safe, clean, affordable and accessible water is a human right pursuant to California law; this fact may make it easier to justify to the public the

need for an incremental change to Proposition 218 allowing lifeline rates for low-income Californians. As a result, the lifeline rate mechanism discussed above is an example of an incremental reform to Proposition 218 that can be used to limit existing funding gaps in the provision of key services.

Strategy 14: Maintain Funding for watershed plans

The watershed concept of management, which expressed the need to view natural resource issues within a connected landscape, gained momentum in the United States in the early 1990's (Duram, Loftus, Adams, Lant, & Kraft, 2008). Collaboration between diverse partners in a watershed intrinsically helps address a wider array of regional resource concerns through integration (e.g., setback levees provide flood risk reduction and also restore floodplain habitat). Collaborative place-based management reduces competition for funding and support within a basin and also helps prioritize local resources on higher priority efforts; collaboration also increases the ability to raise local funds, which then can be leveraged to acquire outside funding.

DWR's integrated regional water management program provides grants and facilitation services to regional water management groups, many of which centered on regional or watershed based management (see case study below). These services help to jumpstart local watershed planning processes, but these planning efforts are often difficult to sustain once this funding source runs out. Maintaining watershed-based planning efforts over the long-term may require increasing the flexibility of local governments to directly fund these efforts (see Strategy 15 below).

Strategy 15: Allow local governments more flexibility in raising revenue

Limitations on the taxing ability of local governments have created a climate in which local governments must look outside their tax base to fund watershed projects. "Almost half of county revenues come from the state and federal governments (28.8 percent and 19.1 percent, respectively)" (Escriva-Bou, McCann, Hanak, Lund, & Gray, 2016). Below are two approaches local governments could pursue to bolster their revenues, but they will not be easy to achieve in the current political climate.

Case Study: The Inyo-Mono Integrated Regional Water Management Program (IRWMP) formally began in 2008 and since its inception has raised more than $2.5 million to assist with essential water management projects and research for Inyo, Mono and Kern counties. The efforts of the Inyo-Mono IRWMP are guided by the Integrated Regional Water Management Plan and are supported by over 30 organizations. A DWR Implementation grant – made available through Proposition 84 funding – is helping pay for implementation of seven Inyo-Mono IRWMP projects, including a drinking water and fire water supply feasibility study for two DACs, replacement of a leaky sewer main to prevent surface and groundwater contamination, and drilling of a new well to provide a more reliable water supply for an elementary school.

A "benefits assessment" is a property-based assessment that is calculated in relation to the amount of benefits that are received by a property owner. Proposition 218 restricts the use of benefits assessments because it requires agencies to prepare highly-detailed reports that determine the specific benefits that will apply to a particular parcel, thereby reducing their ability to assess a general benefit. In looking for funding to develop projects that will help ensure the long-term sustainability of a particular watershed, it may be difficult to utilize benefits assessments because a project may provide benefits to the watershed as a whole, but have no direct impact on particular properties. Allowing local government to consider watershed-scale improvements when developing a benefits assessment could help increase local revenue to improve regional watershed management.

Local governments within a region could also collaborate to propose a watershed-wide parcel tax, with funds earmarked to fund watershed management. Unlike a benefit assessment, a parcel tax can be applied to properties that do not receive direct benefits from the new service. Ideally, a parcel tax would be uniform for every parcel, although a relatively low tax rate or separate rates depending on property types could be required to avoid inequity for owners of large, undeveloped tracts of land (Sonstelie, 2015).

Strategy 16: Leverage use of federal planning processes

Historically, the federal government stepped in to provide major cost-share for many water management issues; in recent decades though, financial support from the federal government has waned significantly (Hanak et al., 2011). Increasing federal funding will be a challenging prospect given how irregularly funding for water projects is authorized, the fact that Congressional funding appropriations are often much lower than authorized spending (Carter & Stern, 2013) and that California has to compete with other states that are also clamoring for limited federal dollars. The USACE planning process represents one major remaining nexus for directing federal funds for certain water projects like improved channel navigation, flood management and habitat restoration (e.g., USACE spent $210 million in FY14 on California water infrastructure) (Mount et al., 2016). A key strategy to increase the likelihood that USACE identifies a water infrastructure project as warranting federal investment is to clearly identify multiple benefits from a project (e.g., ecosystem improvements), thereby generating a better expected cost-benefit ratio (USACE established Engineering Circular (EC) 1105-2-404).

Case Study: One USACE project for Hamilton City in Glenn County, CA was planned based on the EC 1105-2-404 guidance ("Hamilton City Flood Damage," 2004). For this project, initial USACE analyses indicated no likely federal interest in improving flood protection for Hamilton City ("Managing an Uncertain Future," 2008), but local stakeholders, including The Nature Conservancy, recognized the great value in constructing a setback levee for riparian and floodplain restoration. The Nature Conservancy ultimately purchased and donated 1,400 acres of land for restoration purposes, which also contributed toward the local cost share. After years of planning, groundbreaking on the project finally began in early 2016. Based on the Hamilton City example, there have been other efforts to integrate ecosystem restoration into the scoping of USACE planning, such as the reevaluation of the Sacramento River Flood Control Project.

Additional strategies worth exploring

5.2.1.1 Increased use of Public-Private Partnerships

Public-Private Partnerships (P3s) are often used to help finance projects that are difficult for public agencies to fully fund. They are not without controversy though, with critics apprehensive to cede local control to companies motivated by profit. Alternative contracting methods like build-design-operate (BDO) help create P3s that can reduce costs of water management. For example, a BDO contact for a water treatment facility incentivizes private contractors to design the infrastructure in a way that minimizes long-term O&M costs, as they would be responsible for operations post-construction. However, effective oversight by the local agency is critical to ensure a private contractor does not inappropriately cut corners to save money. Another emerging opportunity for P3s is through social impact investing. Private investors may be willing to lend money up front for public benefit projects that will contribute to long-term sustainability, if such investments make business sense. For example, major investments in corporate sustainability practices are a strategy often used by Silicon Valley businesses to compete for and retain top tech talent.

5.2.1.2 Modify focus of court reviews on Proposition 218 and Proposition 26 based challenges

Article 10, Section 2 of the California constitution, enacted in 1928, calls for the water resources of the state to be put to beneficial use to the fullest extent possible. A recent report from Public Policy Institute of California (PPIC) suggested that Propositions 218 and 26 should be amended to explicitly require the courts to interpret those sections of the California Constitution in a manner that is consistent with the water conservation and reasonable use directives of Article X, Section 2 (Hanak et al., 2014).

5.2.1.3 Use of Cap and Trade funds

One potential approach to funding water infrastructure improvement is to use AB 32 cap-and-trade revenues, given the nexus between water treatment/delivery and energy consumption. There are already programs that have begun to use AB 32 cap-and-trade funds to promote water

infrastructure improvements that reduce greenhouse gas emissions while promoting water conservation. The State Water Enhancement and Efficiency Program (SWEEP), administered by California Department of Food and Agriculture, provides financial assistance in the form of grants to implement irrigation systems that reduce greenhouse gases and save water on California agricultural operations. The 2016 SWEEP Program Round II made 18 million dollars of funds available. Additionally, limited cap-and-trade funds are dispersed by DWR through its Water-Energy Grant Program (via SB 103), however funding is relatively limited ($19 million for 2016) and has been focused generally on end user water efficiency upgrades (e.g., low-flow showerheads and toilets).

6 Public Outreach

6.1 Background

Creating a sustainable water future for California is a complex scientific, political and social challenge. Nevertheless, when messaging is clear, Californians tend to be responsive and proactive in the face of water challenges. For example, when Gov. Brown ordered urban water use reductions in 2015-2016, Californians nearly met the goal of 25 percent savings from 2013 water use. Urban users, however, are but one group among many in California's water landscape. Competing interests abound, making communication and coordination a difficult, but crucial, venture. New strategies often meet resistance, sometimes solely because they are new. Reaching in (an agency, for example) is sometimes just as important as reaching out. At the same time, it is important to raise the 'water literacy' of the entire state. Those who wish to dive deeper into water issues should have opportunities to do so, and should be encouraged.

6.2 Strategies

Strategy 17: Improve messaging around sustainability

Recent research into conservation messaging suggests that appealing to a person's identity and connecting to social norms are more effective than the common strategy of solely providing information on how to save water (Fielding & Hornsey, 2016; Seyranian, Sinatra, & Polikoff, 2015). Some studies have even shown that conservation messaging without connecting to a person's identity can backfire and spur residents to use *more* water (Seyranian et al., 2015). Messaging that appeals to a person's identity can target either their social identity as a community resident or their personal identity by using individual language such as "you" and "your." Targeting social identity, for example, would use strongly inclusive language, e.g., "as residents of Palo Alto we understand the critical water shortages facing our city and state." Language for appealing to personal identity could be effective, such as: "Starting today, do your best to conserve your precious water resources!" Using social norms to "peer pressure" neighbors into conserving water can be effective by simply displaying a happy face to provide

positive reinforcement for those who use less than average and pressure high water users into reducing consumption by displaying a sad face. Using social norms, personalized messaging and peer pressure – *in addition* to providing water saving tips – have been shown to be more effective than water-saving tips alone (Fielding & Hornsey, 2016; Seyranian et al., 2015).

Water reuse messaging suffered major setbacks in the 1990s, but recent polls have shown that today Californians have a much higher comfort level with the idea of recycled water. In 2016 a statewide survey found that "76 percent of respondents believe recycled water should be used as a long-term solution for managing water resources, regardless of whether or not a water shortage continues" ("New Survey Reveals," 2016). Education and outreach is especially important for recycled water: 89 percent of the same respondents were more willing to use recycled water after reading educational material and 88 percent agreed that visiting a recycled water production facility would make them more comfortable using recycled water ("New Survey Reveals," 2016).

Studies have shown that in the United States public acceptance of water reuse seems to be higher when (Hartley, 2006):

- Degree of human contact is minimal
- Protection of public health is clear
- Protection of the environment is a clear benefit of the reuse
- Promotion of water conservation is a clear benefit of the reuse
- Cost of treatment and distribution technologies and systems is reasonable
- Perception of wastewater as the source of reclaimed water is minimal
- Awareness of water supply problems in the community is high
- Role of reclaimed water in overall water supply scheme is clear
- Perception of the quality of reclaimed water is high
- Confidence in local management of public utilities and technologies is high

Strategy 18: Improve water education in K-12 education

At the crux of the social issues impacting sustainability is a lack of connection between K-12 education in the classroom, and students' understanding of their local environment and watershed. STEM (Science, Technology, Engineering and Mathematics) education—taught through collaborative, hands-on learning experiences—promotes interdisciplinary and critical thinking skills, and sets many students on a trajectory to keep working in STEM fields (King & Kitchener, 1994) (Miller, Slawinski Blessing, & Schwartz, 2006; Jonassen, 2011). The study of watershed and natural resources issues is inherently interdisciplinary, and develops intellectual growth in various scientific and mathematic fields, language arts and communication, and social studies. By implementing watershed-focused STEM education programs, we will empower the next generation of thought leaders to create a sustainable water future for the state. Specifically, we recommend the implementation of curriculum-integrated watershed studies in K-8 classrooms, and workshop-based student team-driven opportunities for 9-12 grade students (i.e. MWD's Solar Cup Program). We also recommend broader promotion of online watershed education program repositories to enable teachers to capitalize on programs with proven results and improve the sharing of resources.

STEM Classroom

Strategy 19: Expand Inreach

The process of actively engaging members already involved in a process or organization in order to provide education is termed inreach. At its most basic this is the process of aligning a group with a common core understanding. Organizations working toward water management goals, such as state agencies, regional entities and local water districts need to align thinking in regards to actions or initiatives that promote sustainability. Different levels of staff experience, expertise and drive to carry out meaningful change are all internal challenges in developing an initiative or program within an organization. Incorporating institutional inreach addresses these issues by

looking inwardly at the organization and identifying such concerns. This strategy offers opportunities for alignment of staff on mission, goals and technical capabilities while providing an opportunity of receiving a different perspective and garnering 'buy-in.' By reaching out to individuals and groups and working toward an aligned message of sustainability, successful inreach efforts will create additional buy-in and help to facilitate sustainable resource management.

Strategy 20: Use Traditional Ecological Knowledge

Traditional Ecological Knowledge (TEK) is a body of knowledge held by native people who have lived in close contact with nature over many generations. Generally, TEK includes empirical observations about the local environment and management strategies that govern the use of resources (Johnson, 1992). One of the guiding principles for managing California's water resources includes the integration of TEK where appropriate. Specific objectives include 1) initiating pilot projects to develop resource management plans based on the integration of TEK and western science, 2) using TEK to establish baseline resource conditions, and 3) creating TEK training for state agencies ("California Water Plan Update," 2013).

Historically, public agencies have only met the minimum requirements for outreach with tribes and have missed opportunities for meaningful communication and collaboration with indigenous groups (Vinyeta & Lynn, 2013). Although sometimes viewed as opposing methods, TEK and western science can be complementary tools for enhancing our understanding of the environment. For example, in 2008 the U.S. Fish and Wildlife Service used both western scientific data and TEK to justify listing the polar bear as a threatened species under the Endangered Species Act (Rinkevich, Greenwood, & Leonetti, 2011). The usefulness of TEK for water management amidst climate change has been shown in the Four Corners region of the southwest United States where federal and tribal groups met in a workshop to develop a drought early warning system (Ferguson et al., 2011). One goal of the workshop was to explore the feasibility of forming a knowledge network that would function through enhanced ties between tribal groups and state and federal government to develop a regional network of parties that can gather information that can form the basis of the early warning system.

7 Data

7.1 Background

As larger volumes of data on urban and agricultural water use, groundwater levels, river conditions and water quality compliance are being collected, government agencies still face policy hurdles in using this data to inform water resources management. This section illustrates the problems faced by agencies seeking to incorporate more data into decision-making and discusses possible strategies to improve existing shortcomings in data implementation policy.

Natural resources disputes often prove to be uniquely challenging because they involve fundamental conflicts between stakeholder groups that have differing goals for the same resource (Biber, 2013a). The result is an inter-related web of stakeholders, processes and priorities (**Figure 7-1**).

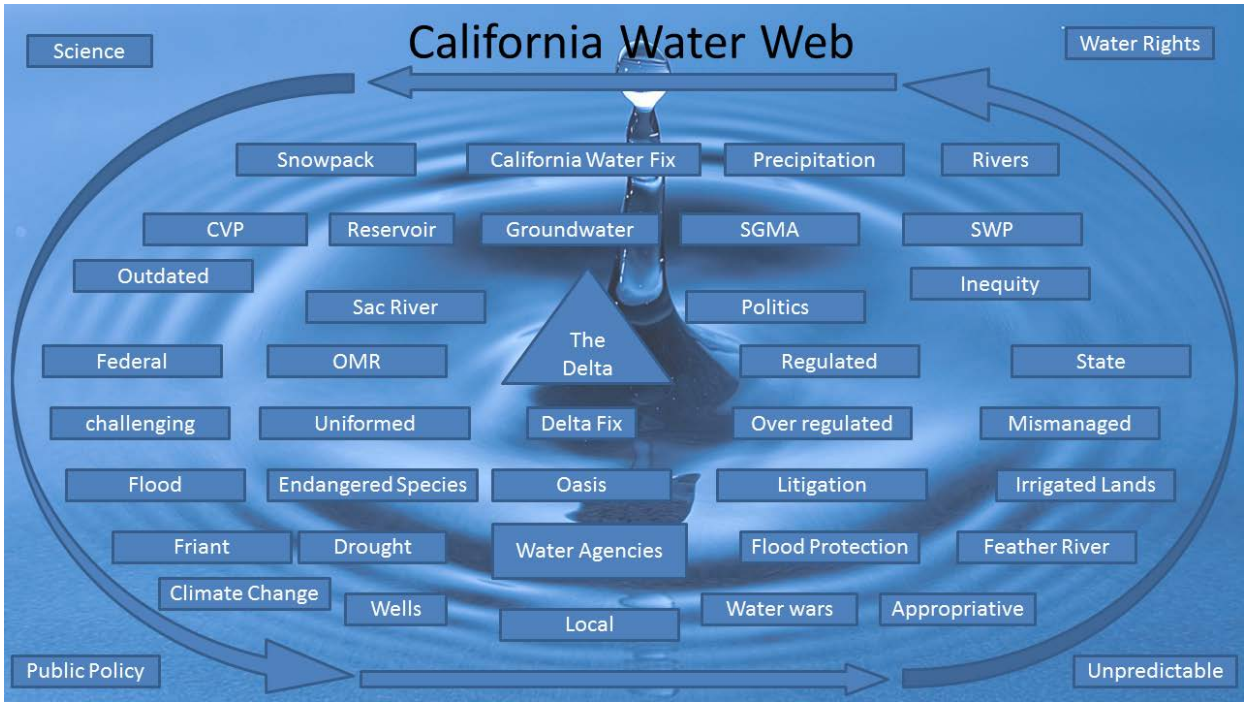


Figure 7-1 - California Water Web (Edstrom, 2016)

In these types of disputes, two different interest groups can look at the same data and arrive at different conclusions (Camacho, 2008). As a result, when government agencies use

environmental monitoring data to understand and address conflicts between resource users, intense debates erupt about how that data should be used to make decisions that affect individual users and the environment (Biber, 2013b). Water resources in California are no exception. Permit hearings and enforcement actions at the SWRCB frequently involve highly technical disputes over the types of data that should be used to judge water supplies and the threshold levels for water quality hazards, such as salinity, that should trigger mitigating actions.

In general, three broad questions motivate the need to collect and analyze data about our water resources: 1) how much do we have? (i.e., water availability), 2) who has claims to it? (i.e., water claims), and 3) how much is being used? (i.e., water use). While California's water agencies have taken steps to improve their understanding of water availability, claims and use, critical information gaps remain. The lack of information about our water systems has resulted in frustration and conflict among water users and between water users and state regulatory bodies. The lack of consistent data standards for the different agencies responsible for collecting water-related data makes accurate accounting of water supply and demand, as well as integration across different data types (e.g., displaying stream flows, water quality and fish presence on the same map), challenging (Escriva-Bou et al., 2016; Castle, Saracino, & Tompkins, 2015).

Adaptive management is a policy framework that is designed to promote the use of data to inform regulatory requirements using a process in which management and regulatory decisions are purposefully made flexible so that future adjustments can be made on the basis of ongoing data collection and scientific study. However, because of debates regarding the lingering uncertainty surrounding management data, one key hurdle in using adaptive management is getting regulated communities to accept the data triggers for regulatory intervention (Biber, 2013b). As more reliable methods of data-collection and reporting are being made available, disputes over the environmental triggers used in adaptive management could become less pronounced.

7.2 Strategies

Strategy 21: Following the principles of data transparency will enhance the value of new datasets and efforts to consolidate existing databases

Some progress has been made in consolidating and increasing access to California's water data. For example, the California Environmental Data Exchange Network (CEDEN) is the State Water Board's system for compiling water quality data from different regions of the state. CEDEN has general data standards that allow for a wide range of data sources and types to be incorporated into the network, but also encourages entities to provide more details than the minimum requirement to allow the data to become useful for wider applications (Kearns & West and The Spatial Collaborative, 2011).

Synthesizing the vast amount of data to be included in platforms such as these necessitates the development of protocols to ensure generally agreed upon principles of open data are maintained. The following principles are widely recognized as characterizing open data (Welle Donker, van Loenen, & Bregt, 2016) and are adapted from The Sunlight Foundation (2010):

1. Completeness: Datasets should include entire period of record and be fully attributed and documented with metadata
2. Primacy: Datasets include original information collected, collection methods and a means for users to verify the information
3. Timeliness: Data is released as quickly as possible
4. Ease of physical and electronic access: Application Program Interfaces (API), which allow the user to easily find and select data, should be prioritized over processes that require the user to fill out forms or requests
5. Machine-readable, in formats that allow machine-processing: For example, tabular data is provided in formats such as comma-separated values (CSV) files, rather than within commonly used document files like Portable Document Format (PDF)
6. Non-discrimination**:** Available to anyone without a requirement for identification or justification for access

7. Use of commonly owned or open formats**:** For example, tabular data is provided in formats such comma-separated values (CSV) files rather than proprietary Microsoft Excel (XLSX) files
8. Licensing: Attribution requirements only include public data being labeled as such
9. Permanence: Online archives are accessible into perpetuity
10. Public data is available free of charge: No licenses and/or registration fees should be required to access data

Strategy 22: Data standards facilitate quality control of data collection and analysis

Data standards promote consistency for how data is described and organized (e.g., naming conventions, formats) and help enforce a certain threshold of data quality. The recognition of the importance of data standards has resulted in a push for entities to develop data management plans that explain how data will be acquired, stored, documented and made accessible. For example, the White House in 2013 released a policy memorandum requiring federally funded scientific research entities to implement data management plans in order to receive grants and contracts (Holdren, 2013).

Strategy 23: Harnessing the data sector as a source of innovation in water management

Recently created apps and programs, such as the program CrowdHydrology ("How it Works," n.d.), allow the crowdsourcing of surface water measurements for streams that are not yet automatically reporting flows. The SWRCB also held a Data Innovation Challenge in April 2016 for the creative use of data in user-friendly applications and programs ("2016 CA Water Board," 2016). The winner of this competition was an application that aggregates and maps stormwater quality violations by Orange County Public Works and CloudCompli, Inc. (CloudCompli WQ Explorer, n.d.). The runner up was H2Open from UC Davis, which features excellent graphical representations of urban water conservation, the reduction in energy and greenhouse gas emissions from water conservation, comparisons to energy efficiency programs, and common water quality and stormwater quality violations. These programs demonstrate the incredible potential that exists in harnessing the data sector to help provide innovative new ways to understand and present the water resources data gathered through regulatory programs.

Strategy 24: Stakeholder buy-in is critical to collecting data from individual water users

One strategy for resolving stakeholder uncertainty associated with the collection of monitoring data is to develop independent monitoring agencies that collect and disseminate data and do not use that same data to bring enforcement actions against the regulated community. Agencies that focus primarily on data collection and analysis avoid the conflicting goals that emerge when an agency relies on its own data to advance political goals (Biber, 2013a). For example, stakeholders in a regulated community may not trust an enforcement agency to objectively collect and interpret monitoring data when that data is being used to justify actions that further the political goals of that agency. However, an independent agency whose primary role is to collect and observe monitoring data provides the dual advantages of (1) continuity because public institutions tend to outlast private organizations, and (2) expertise by being an agency that focuses solely on a monitoring role, which allows the agency to develop specialized institutional knowledge.

The U.S. Geological Survey (USGS) is a great example of an agency that has an increasingly prominent role in the collection and study of environmental monitoring data. Because the USGS does not have any significant management or regulatory responsibilities, it is often seen as impartial. (Biber, 2016a). Building on its reputation as an impartial arbiter of geological data, the USGS has established itself as an agency that is a leading provider of environmental monitoring services.

Using the USGS as an example, the state of California should seek to identify an agency, or a portion of an agency, that can be transitioned into an environmental monitoring agency with responsibility for collecting and analyzing environmental data. The key characteristic for this agency must be that it cannot have a role in using the data to enforce policies. If California can create an agency or entity that can develop widespread credibility for its ability to impartially collect and analyze data, then stakeholder uncertainty associated with providing that data can be reduced.

8 Conclusions

The Water Leaders Class of 2016 has developed 24 strategies for achieving sustainability in California within the following key issue areas: water supply, demand management, laws and governance, funding, public outreach and data. **Table 8-1** summarizes these strategies along with examples of these strategies in action.

These strategies that were developed range from revising the language in outreach messaging, to investing in technological innovation to further our understanding of climate change impacts on our watersheds and communities. There is, however, a common theme that appears throughout the strategies presented herein: capitalizing on the engagement of local stakeholders, i.e. local governments, citizen scientists, farmers, tribes, students and more. By putting more responsibility in the hands of local water regulators, managers and users, California will address many of the sustainability goals highlighted above, including improved water data transparency and access, greater understanding of watershed science and processes, broader restoration of critical habitat, and improved water use efficiency. That said, there is also a clear need for state and federal governments to act to meet sustainability goals. These actions include: investing in infrastructure repair, reformulating permitting structures and supporting the expansion of water markets. These strategies were developed by a diverse group of water stakeholders and reflect our vision for a sustainable water future in California.

Table 8-1: Summary of Strategies for Achieving Water Sustainability

Topic	Strategy	Example(s)
Water Supply	**Invest in a more complete understanding of the changing landscape of California's water supply, while better managing existing sources.**	➢ NASA's Airborne Snow Observatory mission uses cutting-edge technology to produce hyper accurate snowpack measurements by mapping an entire watershed—providing water managers with improved predictions of runoff volume and timing, and enabling more effective decision making. ➢ Improved management and monitoring of groundwater resources, which is being done through the Sustainable Groundwater Management Act (discussed further in **Section 4.2, Strategy 11**)
	Diversify supply by developing new sources & capturing water through groundwater recharge.	➢ Potable reuse of recycled water is available year-round ➢ Ocean desalination is another emerging source for California. ➢ Cutting-edge technologies such as fog capture and atmospheric water generation are promising ways to harness undeveloped sources of water. ➢ Using existing perennial cropland such as almond orchards as conduits to groundwater recharge basins during extreme precipitation events.
	Develop Flexible Management Plans	➢ The California WaterFix proposes the addition of new points of diversion for the Central Valley Project and State Water Project to increase water quality and availability in Southern California.
	Require Asset Management Plans	➢ Asset management plans are an effective way to plan for operations and maintenance funding to repair and protect aging infrastructure.

Topic	Strategy	Example(s)
Demand Management	**Increase urban water use efficiency**	➢ Building code-based or "passive" conservation saves water as a result of changes in water efficiency requirements for plumbing fixtures (such as the Model Water Efficient Landscape Ordinance).
	Establish Drought Management Plans	➢ The Water Surplus and Drought Management Plan (WSDM) of MWD is an example of an effective drought management plan. During times of surplus, WSDM calls for operations to replenish storage in the San Luis Reservoir as carryover storage of State Water Project supplies. This action provides the most amount of flexibility to deliver water to areas that are solely reliant on State Water Project supplies, and shift water from the Colorado River Aqueduct to areas that can take either supply if SWP resources are scarce.
	Continue improvement of agricultural water-use efficiency	➢ Farmers are shifting from the historical flood irrigation to drip, sub-surface drip, micro sprinklers and conventional sprinklers, and leveling their fields, for proper slopes for the desire flow of water.
	Prioritize policies and incentives that provide disadvantaged communities with adequate water	➢ Increase state and federal collaboration with local environmental justice and encourage stakeholder engagement in decision-making process through outreach and education in those communities/organizations to offer special assistance with grant funding water projects.

Topic	Strategy	Example(s)
Laws and Governance	**Incentivize voluntary water-use reduction programs**	➢ The Voluntary Diversion Reduction Program implemented amongst in-Delta riparian rights claimants during 2015, during which In-Delta farmers worked with the State Water Resource Control Board and the Delta Watermaster to implement a voluntary 25 percent diversion reduction program that saved approximately 150,000 acre-feet of water.
	Expand water markets for more efficient use of existing water rights	➢ Expedited review of certain types of water transfers would encourage new participants to join water markets because it would reduce the transactional costs.
	Empower local governments to manage groundwater resources regionally	➢ In France, groundwater users in a particular basin are required to join in a self-governed Water User's Associations. These Associations are issued a groundwater extraction permit - for a volume of water less than the sustainable yield of the basin - which is subsequently allocated amongst members of the Association. California's 2014 Sustainable Groundwater Management Act similarly places a focus on local governance to develop strategies for achieving sustainable groundwater management.
	Increase collaboration between permitting agencies	➢ The Habitat Restoration and Enhancement Act helped expedite the California Department of Fish and Wildlife review process of small-scale, voluntary habitat restoration projects by consolidating Section 16000 Lake and Streambed Alteration Agreement and Section 2081 California Endangered Species Act permits.

Topic	Strategy	Example(s)
Funding	**Authorize the use of lifeline rates for disadvantaged communities**	➢ In the energy utility sector, low-cost lifeline rates for lower-income customers are common. Revenue generated from energy rates paid by higher-income households help to subsidize these lifeline rates.
	Maintain Funding for watershed plans	➢ The Inyo-Mono Integrated Regional Water Management Program (IRWMP) formally began in 2008 and since its inception has raised more than $2.5 million to assist with essential water management projects and research for Inyo, Mono, and Kern Counties. The efforts include a drinking water and fire water supply feasibility study for two DACs and drilling of a new well to provide a more reliable water supply for an elementary school.
	Allow local governments more flexibility in raising revenue	➢ Allowing local government to consider watershed-scale improvements within a benefits assessment could help increase local revenue for landscape-wide watershed issues.
	Leverage use of federal planning processes	➢ United State Army Corp of Engineers (USACE) planning process is a major nexus for directing federal funds for certain water projects like improved channel navigation, flood management and habitat restoration. A project in Hamilton City, Glenn County, CA, was planned based on USACE guidance. Initial USACE analyses indicated likely no federal interest in improving flood protection for Hamilton City, but local stakeholders, including The Nature Conservancy, recognized the great value in constructing a setback levee for riparian and floodplain restoration. The Nature Conservancy purchased and donated 1,400 acres of land for restoration purposes, which also contributed toward the local cost share.

Topic	Strategy	Example(s)
Public Outreach	**Improve messaging around sustainability**	➢ Format messaging language to appeal to a person's identity as a community resident using individual language such as "you" and "your," and "Starting today, do your best to conserve your precious water resources!" ➢ Target social identity uses strong inclusive language, such as "As residents of Palo Alto we understand the critical water shortages facing our city and state."
	Improve water education in K-12 education	➢ Implement curriculum-integrated watershed studies in K-8 classrooms, and workshop-based student team-driven opportunities for 9-12 grade students ➢ Create a state watershed education program repository as online resource for teachers capitalizing on programs with proven results.
	Expand inreach	➢ Incorporate institutional inreach to address issues related to different levels of staff experience, expertise, and drive to carry out meaningful change.
	Use Traditional Ecological Knowledge	➢ In 2008, the United States Fish and Wildlife Service used both western scientific data and Traditional Ecological Knowledge (TEK) to justify listing the polar bear as a threatened species under the Endangered Species Act.

Topic	Strategy	Example(s)
Data	**Following the principles of data transparency will enhance the value of new datasets and efforts to consolidate existing databases**	➢ Principles include: completeness, primacy, timeliness, ease of physical and electronic access, machine readable, non-discrimination, use of commonly owned or open formats, licensing, permanence, public date is available free of change. Water users, data managers, politicians and the like should challenge themselves to see all the relevant data and provide it in new and innovative ways.
	Data standards facilitate quality control of data collection and analysis	➢ In 2013 the White House released a policy memorandum which required federal funding entities of scientific research to require data management plans as part of grants and contracts.
	Harnessing the data sector as a source of innovation in water management	➢ The 2016 Data Innovation Challenge, a program of the State Water Resource Control Board engaged the data sector to find creative uses of data in user friendly applications and programs. The winner of this competition was an application that aggregates and maps stormwater quality violations by Orange County Public Works and CloudCompli, Inc.
	Stakeholder buy-in is critical to collecting data from individual water users	➢ Informal meetings hosted by agency staff give regulators and stakeholders the opportunity to meet face to face and address underlying problems with data or to collaborate on common sense regulatory mechanisms that address regulatory goals.

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Appendix A: Definition of Terms

ACRONYM	DEFINITION
AB	Assembly Bill
ACWA	Association of California Water Agencies
API	Application program interfaces
ASCE	American Society of Civil Engineers
AVE	Avenue
BDO	build-design-operate
BLVD	Boulevard
BMP	Best Management Practice
CAL/EPA	California Environmental Protection Agency
CALFED	CALFED Bay-Delta Program, also known as CALFED, is a department within the government of California, administered under the California Resources Agency.
CDPH	California Department of Public Health
CEDEN	California Environmental Data Exchange Network
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CNRA	California Natural Resources Agency
CSU	California State University
CSV	Comma Separated Value
CUWCC	California Urban Water Conservation Council
DAC	Disadvantaged communities
DPR	Department of Parks and Recreation
DVL	Diamond Valley Lake
DWR	Department of Water Resources
EBMUD	East Bay Municipal Utility District
EC	Engineering Circular

ACRONYM	DEFINITION
ENSO	El Nino-Southern Oscillation
EPA	Environmental Protection Agency
ESA	Endangered Species Act
EU	European Union
GRI	Global Reporting Initiative
GSP	Groundwater Sustainability Plans
GWPCEE	Global Water Partnership Central and Eastern Europe
GWRS	Groundwater Replenishment System
IPCC	Intergovernmental Panel on Climate Change
IRWMP	Integrated Regional Water Management Plan
ISO	International Organization for Standardization
LEED	Leadership in Energy & Environmental Design
LIDAR	Light Detection and Ranging
LLP	Limited Liability Partnership
LN	Lane
MWD	Metropolitan Water District of Southern California
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
O&M	Operation and Maintenance
OECD	Organisation for Economic Co-operation and Development
OPR	California Governor's Office of Planning and Research
PDF	Portable Document Format
PE	Professional Engineer
PHD	Doctor of Philosophy
PPIC	Public Policy Institute of California
SARCCUP	Santa Ana River Conservation and Conjunctive Use Project
SB	Senate Bill
SGMA	Sustainable Groundwater Management Act

ACRONYM	DEFINITION
SWEEP	State Water Enhancement and Efficiency Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
TEK	Traditional Ecological Knowledge
UC	University of California
UCLA	University of California, Los Angeles
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WEF	Water Education Foundation
WSDM	Water Surplus and Drought Management Plan
XLSX	Microsoft Excel File Format

Appendix B: 2016 Water Leader Mentors and Interview Synthesis

Background

This section is a synthesis of the 18 mentor interviews conducted by the Water Leaders Class of 2016. The class shadowed their respective mentors over the course of four months, and conducted informal interviews with each one. The interviews included 14 questions that were developed by the class as a whole, and were chosen to support and add to the 2016 paper topic. The product of these interviews is over 250 responses that were summarized and are presented below. Included below is a table of the 2016 Water leaders and their assigned mentors. Because the Water Leaders wanted to let the mentors speak freely and honestly about the questions, answers to the questions have been left anonymous and the mentors' collective answers have been summarized. The water leaders wish to thank all of the mentors for their time and candor when addressing these important issues.

Mentors for 2016 WEF Water Leaders Class

WATER LEADERS	MENTORS
Carlos Carrillo Assistant Resource Specialist II Metropolitan Water District of Southern California 700 North Alameda Street Los Angeles, CA 90012-2944 ccarrillo@mwdh2o.com (213) 717-7140	Mike Markus -General Manager **Orange County Water District** -managed the implementation of the $480 million Groundwater Replenishment System program.
Anna Constantino Staff Engineer & Program Developer FlowWest & Intelligent Ecosystems Institute 1624 Franklin Street, Suite 901 Oakland, CA 94612 aconstantino@flowwest.com (510) 842-0547	Paula Kehoe -Director of Water Resources, San Francisco Public Utilities Commission; -Former Water Leader, class of 2002

WATER LEADERS	MENTORS
Carrie Crane Program Coordinator Tulare County Farm Bureau 737 N. Ben Maddox Way Visalia, CA 93292 ccrane@tulcofb.org (559) 732-8301	Dave Orth (Fresno area) -California Water Commissioner -Consultant -Former general manager of the Kings River Conservation District -Played key role in SGMA
Mathew Danielczyk Restoration Project Manager Audubon California 400 Capitol Mall, Suite 1535 Sacramento, CA 95814 mdanielczyk@audubon.org (916) 842-0178	Jay Lund -UC Davis Center for Watershed Sciences -civil and environmental engineering professor, UC Davis
Danielle Duncan Graduate Student, Masters of Science in Water Resources Management CSU Fresno 25079 River Road Stevinson, CA 95374 danielle.dubose.duncan@gmail.com (415) 385-5231	Ali Forsythe -Deputy Regional Director/San Joaquin River Restoration Program Manager Bureau of Reclamation -Former Water Leader
Andrew Edstrom Water Resources Senior Analyst Wonderful Orchards 6801 East Lerdo Highway Shafter, CA 93263 andrew.edstrom@wondeful.com (661) 399-4456	Rob Hansen (Visalia) -President, Tulare Basin Wildlife Partners -Ecology Professor at College of the Sequoias
Russell Frink Attorney Spaletta Law PC Lodi, CA russell@spalettalaw.com (530) 301-5074	Fran Spivy-Weber -Vice Chair of State Water Resources Control Board -former Executive Director of the Mono Lake Committee -Director of International programs for National Audubon Society
Amanda Heise Water Engineer CH2M 1000 Wilshire, Suite 2100 Los Angeles, CA 90017 amanda.heise@ch2m.com (213) 228-8264x35464	Celeste Cantu (Riverside) -General Manager Santa Ana Water Project Authority; -Former Executive Director, State Water Resources Control Board - WEF board member

WATER LEADERS	MENTORS
Laura Hollender Attorney California Department of Water Resources 1416 9th Street Sacramento, CA 94236 laura.hollender@water.ca.gov (916) 653-5555	Cynthia Koehler (San Francisco Bay Area) -Executive Director Water Now Alliance -Board Member, Marin Municipal Water District -WEF Board member
Daniel Huang Environmental Scientist Delta Stewardship Council 980 Ninth Street Suite 1500 Sacramento, CA 95814 daniel.huang@deltacouncil.ca.gov (916) 445-5339	Lester Snow (Sacramento) -Executive Director of the Water Foundation -Former Natural Resources Secretary -Former DWR Director -WEF board member
Betty Hurley Lindeman Drainwater Treatment and Reuse Coordinator Panoche Water and Drainage District 52027 West Althea Ave. Firebaugh, CA 93622 blinderman@panochewd.org (209) 509-5595	Tom Harmon -Head of Harmon Lab at UC Merced, which researches a variety of topics pertaining to hydrology, climate and sustainability issues in California and globally -Sierra Nevada Research Institute
Casey James LeBlanc Associate Civil Engineer East Bay Municipal Utility District 371 11th Street Oakland, CA 94607 cleblanc@ebmud.com (510) 287-0567	Lauren Sparandara -Sustainable Operations Team Lead, Google Architect background GRI Certified Sustainability Reporter
Henry McCann Research Associate II Public Policy Institute of California (PPIC) 500 Washington Street, Suite 600 San Francisco, CA 94609 mccann@ppic.org (415) 291-4409	Kathy Tiegs _ACWA president _Board member, Cucamonga Valley Water District
Jennifer Morales Environmental Scientist California Department of Water Resources 3374 E. Shields Ave. Fresno, CA 93726 jennifer.morales@water.ca.gov (559) 230-3381	Joe Del Bosque (Firebaugh) -California Water Commissioner - Farmer, organic melons, almonds, vegetables, etc.

WATER LEADERS	MENTORS
Jeffrey J. Patrick Attorney The Law Offices of Young Wooldridge, LLP 1800 30th Street, 4th Floor Bakersfield, CA 93301 jpatrick@youngwooldridge.com (661) 377-7135	Mike Chrisman (Visalia) -Director, Fish and Wildlife Federation -Former Natural Resources Secretary, California (2003-2010) -Former Fish and Game Commissioner -Ranching family
Lena Perkins, PhD Resource Planner City of Palo Alto Utilities 250 Hamilton Ave. Palo Alto, CA 94301 lena.perkins@cityofpaloalto.org (650) 329-2539	Cynthia Clark (Santa Clara) -Chief Development Officer Sustainable Silicon Valley
Amanda Platt District Manager Sloughhouse Resource Conservation District 8698 Elk Grove Blvd, Suite I-207 Elk Grove, CA 95624 sloughhouseRCD@gmail.com (916) 612-5163	Jonas Minton (Sacramento) -Water Policy Advisor Planning and Conservation League -Former Deputy Director of the California Department of Water Resources
Oliver Slosser, PE Senior Water Resources Engineer MWH, now part of Stantec 300 N. Lake Ave., Suite 400 Pasadena, CA 91101 oliver.slosser@mwhglobal.com (626) 568-6063/(310) 995-6260	Dusty Williams (Riverside) -General Manager Riverside County Flood Control and Water Conservation District, which is a low-impact development testing site.

Mentor Questions and Synthesized Responses:

Q1: How can California improve integrated water management to be more conducive to sustainability? What's working and what's not working, and why?

Most mentors agreed that integrated water management and grant funding are working well to:

- Encourage interaction amongst departments, agencies, and stakeholders to help them combine strengths and balance weaknesses within the region
- Implement multi-benefit projects

- Provide funding, especially for DACs

However, some of the feedback from the mentors mentioned that the awarded incentives may not be conducive to true integrated water management. The funding is broken into different categories – including water recycling, drinking water, stormwater and groundwater – which gets complicated when applying with a multi-benefit project. The funding should be distributed amongst the watersheds for the regional groups to determine which projects meet the local needs and priorities. The RWQCBs also need to be more involved in the IRWM process and begin implementing regional permits and regulations to continue this integration.

Some mentors commented that the current IRWM system fails to recognize that a project should be an outcome of the coordination and integration. Bringing people together for funding opportunities is different from bringing people together to manage a resource. After the project or when grant funding dries up, there is a huge challenge in continuing collaboration amongst groups. The incentive needs to be the synergies and efficiencies developed from working collaboratively within a watershed.

Other mentor suggestions on how to improve IRWM include:

- Increase funding, especially for ecosystem management
- Encourage smaller, more efficient distribution systems
- Develop a framework for O&M funding strategies
- Adapt to new technology
- Increase public and political education, recognition and involvement
- Streamline the permitting process for IRWM projects

Q2: What examples of successful and unsuccessful sustainable water management practices, including incentives for sustainability, have you seen in your agency or at other agencies? What examples have you seen outside of California?

The mentors listed the following successful sustainable water management projects:

- Grassy Meadows in the Marin Watershed, which measures carbon dioxide uptake from grasses and actively plants grasses that are designed to maximize uptake of the greenhouse gas.
- Inland Empire Utilities Agency produces commercial products, like fertilizer and methane, from the byproducts of the wastewater treatment process.
- The Santa Ana River Conservation and Conjunctive Use Project (SARCCUP) is an opportunity for five major wholesalers to come together and invest collectively on four large groundwater reservoirs to develop, manage and benefit from equally. This gives tremendous resiliency because it maximizes the ability to share.
- The Danube River in Germany was highly polluted and several countries have come together to change that through integrated water management.
- The sustainable water profiles put together by the Water Foundation provide a method to understand the stressors and drivers of water management in a region and evaluate the effectiveness of the water management.
- Del Bosque Farms has employed a multitude of practices that increases the farms efficiency, contributing to its sustainability. Practices such as building hedgerows, introducing beneficial species, using agricultural plastic to expedite plant growth while retarding weeds, installing drip and micro-irrigation systems, reducing tillage, and picking and packaging in the field.
- The San Joaquin River Restoration to restore flows and a population of Chinook salmon to a stretch of river downstream of Friant Dam.
- Facebook's new campus with its onsite blackwater, greywater, stormwater and rainwater treatment.

The mentors also listed the following successful practices:

- Implement sustainability on a regional scale
- Develop a sustainable yield and incentive program
- Incorporate multi-sector business models
- Use technology to develop streamlined processes and reduce redundancies
- Implement groundwater banking programs
- Increase water use efficiency programs including audits, tools and financial incentives

- Develop processes to reinforce relationships and highlight synergies that can result in some really great projects
- Reform the permitting process to reduce transactional cost of implementing projects. Consider a joint permitting form between state and federal agencies (e.g., include a common permit application, same review timeline, common review team, common deadlines etc.).
- Combine or connect all water agencies into a water management district

Q3: What laws, policies, and regulations need to be changed and why?

There were a wide range of answers from the mentors in response to this question, though one strong common theme stood out and three other lesser themes:

Main Theme:

- Prop 218 Reform. The issue is that public agencies are not able to raise money to deal with well-known environmental issues, budget shortfalls or infrastructure repairs. These are issues that clearly fall within the duties of the respective public agencies (i.e. water districts, cities, etc.) but there are so many hurdles in trying to raise money to address these problems. Unfortunately, the general consensus among the mentors was that Prop 218 reform faces steep hurdles from taxpayer advocacy groups.

Other themes:

- The Endangered Species Act (ESA). A couple of mentors mentioned that the ESA is too focused on one particular species or ecosystem instead of taking a wider view of the issues facing endangered species in places like the Delta.
- There are too many restrictions on the use of water for groundwater recharge. Storing water underground should be a beneficial use in and of itself, there should be no need to prove what use will come of the water after it is extracted. [This came up in Mike Chrisman's interview and later on in David Orth's interview (not in response to question 3).

- A watershed-wide focus instead of a countywide or agency-wide focus on issues affecting a particular river or region.
- Standardize and streamline which regulatory body approves new onsite wastewater treatment and reuse.

Q4: What's your opinion on recent sustainability legislation passed in California (i.e. SGMA, Prop 1, Prop 84, SB 375, etc.)?

As this was a very policy focused question, not all of the mentors had strong opinions on recent legislation, or in some cases were not familiar enough with the specifics of the legislation to have a strong opinion. Mentors were generally optimistic about these legislative efforts, but some were critical that the legislation didn't go far enough to solve the problems at hand. In terms of overarching thoughts about legislation regarding water issues, many mentors agreed that:

- Legislative efforts that instruct the state agencies to take a stronger role ("hammers") in water resource management (SGMA, statewide conservation mandate) can be valuable and necessary, but often very difficult to implement given the impenetrability of the 'status quo' among major water users (both agricultural and urban).
- Funding models like the water bond are imperfect tools, yet they continue to be used because major water stakeholders have grown to expect this type of funding model. If the state continues to fund water projects through bonds, they should place additional criteria on allocations, including more local matching and priority for truly integrated efforts.
- Issues like water trading, Prop 218 reform and water accounting/information should be taken up by the legislature to promote sustainability in water resource management.

Of those mentors who did have detailed responses on specific recent laws, SGMA was the most talked about legislation. While most agree that SGMA is an important step, many are unsure if implementing the law will be possible, recognizing the substantial lift required from regulatory/implementation agencies and the substantial uncertainty from the point of view of groundwater irrigators. The mentors generally felt that SGMA is a positive step in the right direction and gave several examples why they thought it would be beneficial to California, including:

- Protects all users and the whole system for future generations.
- Raises the bar and challenges people to create sustainable groundwater policy.
- Will yield greater sustainability.
- Groundwater pump metering needs to happen and likely will under SGMA.
- Will provide a good framework for all pumpers to contribute towards projects and management strategies to finally actively recharge the basins.
- The threat of the state coming in and managing groundwater basins has incentivized local agencies to act.
- It's good that it's locally controlled, and allows ample time for compliance.
- Progress on achieving sustainable groundwater will be a long, drawn-out process, but is entirely necessary and will provide long-run benefits beyond short-run "growing pains."

Some of the more cautious reactions to SGMA include statements such as:

- Difficulty in implementing SGMA is two-fold: 1) the law transforms groundwater from a "private property right" to a public good and 2) SGMA implementation is primarily in the hands of local stakeholders who may also be incapable of finding common ground with other users in their basin.
- We'll need to see if the GSAs developed under SGMA will be effective at developing sustainable groundwater management plans.
- It does have bad timing by coming out when surface water is reduced to nearly nothing; it can come across as an attempt to now take away groundwater.
- It may be too late being that our DAC's are already suffering from dry wells.
- Groundwater is a private property right and the thought of having to hook up to city water and pay the hook-up fee can be frightening
- It is yet to be determined if SGMA will yield greater sustainability.

The mentors had varying opinions on some of the other recent legislation in California, but no strong theme emerged. More than one mentor addressed the general obligation bond funding model (Prop 1, 84, etc.) and the SB 375 legislation. Most argued that general obligation funding is necessary but could be improved by placing greater requirements on grant allocation programs -- local matching and integration criteria. Prop 1 and SB 375 received the most comments after SGMA, which are summarized below:

- General obligation fund is the "status quo." The state must make an effort to creatively design grant criteria and local fund matching to make the "most" of an ineffective funding mechanism.
- Prop 1 could have been more articulate and firmer than Prop 84 in terms of Integrated Regional Water Management.
- Prop 1 should have raised the bar.
- We will see if Prop 1 will yield greater sustainability
- Prop 1 is viewed generally positively, except that the portion of the money dedicated to surface storage is scrutinized much more heavily than money dedicated to other uses, which can make these projects more difficult to accomplish.
- Under Prop 1 they carved out recycled water, stormwater and groundwater from integrated water management, which isn't conducive to an integrated water project. All water funding should have been administered watershed by watershed and the local needs would be prioritized.
- SB 375 is a little too focused on transportation and doesn't include analysis of water; the legislature needs to go back to modify SB 375 so it does.
- SB 375 is good but there needs to be a greater sense of urgency.

Finally, some of the mentors looked forward as to what sort of legislation the State is heading towards, and gave examples of what they think future legislation should address:

- We need proposals for better coordination and better water accounting framework.
- I think there will be work this year on legislation that tries to open up transparencies on some of the types of water transactions that takes place, such as who's paying for it and so on.
- A policy change that has been talked about is the use of groundwater recharge as a type of defined "Beneficial Use' in California water law.

Q5: What comparisons can we draw from other sectors to inform water management policies in a more sustainable way?

The difficulty in answering this question goes to show how unique water management issues are. Few mentors had any concrete strategies from other industries that may work, but many

commented on the direct interaction water has with other sectors. Simply put, there seems to be no other corollary for the complex issues facing the water sector. It is difficult see a particular mechanism from other sectors that we can easily lift and apply as a strategy to our water issues.

The most obvious comparison comes from the energy sector. A couple mentors commented on how the energy sector paved the road for integrated resource management in California as it responded to the energy crisis in 1970s. One mentor opined that the mechanism of energy management has transitioned from conservation to efficiency, and that the energy sector has seen major innovation over the last 20 years with the private sector bringing in innovation and creativity. Pricing signals for demand management, in particular, are something already implemented in the water sector. However the key difference is that you don't have as many endangered species issues in your energy distribution system like you do with water.

One interesting suggestion made was to follow the "biodynamic agriculture" method. This form of agriculture consists of management practices that are intended to "restore, maintain, and enhance ecological harmony." Some mentors advocated for better inclusion of environmental goals in water management, and in some instances there can be a dual benefit to the environment and society.

Overall, the take away of this question was an affirmation that the issues in the water sector are incomparably complex. However, the complexity shows how connected water is to almost every sector imaginable. There was a lot of discussion about the water-energy nexus. Increased water operation efficiency can mean more flexibility in the energy sector. Improved efficiency in the energy sector could mean increased capacity and affordability of the various energy intensive operations of water (heating, transportation, treatment, and reclamation).

Q6: What data gaps and data challenges do you see as impeding sustainable water management and how can information technology improve water management while respecting privacy?

The mentors provided an extensive array of responses regarding what they viewed as data gaps and data challenges. Responses from the mentors included recommendations for

improved data regarding the following topics and issues:

- Groundwater storage
- Groundwater extraction rates
- Snowpack data
- Amount of water actually saved through conservation efforts
- Surface water extraction rates by riparian rights holders
- Impacts of contaminants in water supply
- Daily water balance information for surface water and groundwater systems
- Residential and commercial wastewater discharge, including relative breakdown between greywater and blackwater.

Additionally, there were several responses specifically related to the data challenges facing sustainable water management, which include:

- Accurate comparisons of benefits and costs of different water projects alternatives
- Lack of a framework for organizing missing or inaccessible data
- Insufficient accessibility of data and incompatibility of data between different agencies
- Data not presented in a user-friendly manner
- Information regarding real environmental water needs

There were fewer responses by the mentors related to the inquiry of what information technology can improve water management. Responses again varied widely and included:

- Use of Light Detection and Ranging (LIDAR) to measure snowpack
- Interactive modelling of groundwater basins to estimate extraction rates and available storage based on groundwater level measurements
- Aerial photography to determine expected water demand of parcels of land to inform water budgets
- Integrated data platforms that makes a wide variety of interrelated data (e.g., water quality, flows, fish presence) available in near real-time to the public

Q7: How do you rank or grade a sustainable project and what information or tools do you use to do that?

This was a difficult question to answer for many of the mentors, though some of the responses included:

- The ranking depends on the target for funding (drought management, better water quality in the Bay-Delta, etc.)
- Does the project add to surface or groundwater supplies? Specific personal definitions of meeting criteria of water resiliency without being detrimental to the environment.
- Not enough data to rank, so projects need to be ranked against their own individual goals
- No industry-accepted tools for ranking
- Leadership in Energy & Environmental Design (LEED) is good for individual buildings, Envision for infrastructure, but not a good ranking system for water management
- Sustainable Water Profiling Tool, a work in process for the Water Foundation
- Projects must be graded on how inclusively they were developed, whether all the beneficial uses were accounted, and the measure to which the project will be able to sustain those uses for seven generations.

Q8: Describe some examples of bringing competing stakeholders to the table and facilitating successful compromise. How do you balance their needs when making decisions? (i.e. agricultural interests, environmental, municipal, etc.)

The mentors had a wide range of examples, and more importantly, lessons on how to bring a diverse group of stakeholders together. The mentors listed examples at all different levels of government and business, including:

- The Yuba Accord
- CALFED
- Recent Climate Change Discussions
- Shasta Dam winter-run operations in Sacramento Valley.
- A local recycled water treatment plant that needed to be sited
- Executive Order S1706.

- The Kings Basin IRWM.
- Sacramento Groundwater Authority
- Inland Empire Los Angeles Treatment Plant for Groundwater Recharge
- Delta Conservancy
- Delta Accord

While the mentors went into specifics of many of these examples, the lessons they brought forth in their answers give a good picture of some of the strategies that help bring diverse stakeholders to the table and lead to successful compromise. Some of these include:

- Encourage everyone to keep an open mind, and learn to bend a little bit to each other while keeping the best interest in mind for the most vulnerable populations.
- Where there is a forcing function (i.e., something tangibly bad happens if we don't fix this) we see progress.
- The first step is to create a new identity. When people first come to the table, they come wearing their agency hats. You have to work hard initially to check hats and egos at the door and wear a new hat as a stakeholder
- When you distribute benefits, you will have winners and losers, which we need to keep track of. For the losers, we need to make sure their priorities are met in a side deal or in the future so they are made whole.
- There is a high importance of bringing stakeholders to the table early to get all the opinions that you need. If you build the project before going to stakeholders, you may have wasted money, or have to spend more money.
- Make sure everyone is represented and no one feels left out or that they don't have a voice
- At Large appointees is a way of getting others maybe from a DAC or environmental justice area in a Board member position and for representation. And the key is getting the local agencies to recognize that the stakeholders want to be part of the decision-making process. The people who refuse to give the stakeholders their due - that is a losing proposition in a lot of different ways.
- You bring all the stakeholders together and work to define the problem and have everyone address and define the problem and find some commonality in the solution

and solving the problem. It is important that everyone understands the problems.

- Solution oriented conversation as a group can sometimes compromise people's position. Bring people together once you have a draft solution.
- It is important to have people come together to make a strategy, having direct contact is important. Even groups that are historically at odds must come together to find a solution.
- Hiring professional facilitators. They employ tools that help regulate interactions amongst stakeholders in order to allow conversations on difficult issues to move forward.
- Open Data: Gathering and disseminating more data on resources that are the subject of regulation helps bring about greater agreement amongst the stakeholders for two reasons: (1) the policies can be tailored in a more precise manner when we have a better understanding of the resource; and (2) there is a greater sense of transparency in how the decisions affecting that resource are being made. Therefore, as regulatory agencies gather and share more data about the natural resources that they regulate, it is likely that competing stakeholders will have more productive discussions based around the data and addressing the problems that the data reveal.
- Getting people out of their comfort zones
- Everyone has to trust the data

Some of the barriers to success listed by the mentors include:

- Having nothing that is binding so parties could change their minds.
- If process is open ended and groups need to compromise for the good of the cause, then you basically never see resolution (e.g., climate change).

Q9: How do we ensure that the environment and social equity are adequately represented in our water management strategies?

There are three strong ideas purveying the Water Leaders mentor responses regarding environment and social equity: laws and regulations, promoting multiple methods of communication, and the continued drought being beneficial by exposing injustices. A few specific responses include:

- Needing a push from "above" and creating motivation
- Figure out how to strengthen existing laws and create political will
- Defining "adequate" is key
- The Water Commission has authorities to protect disadvantaged communities
- Grant programs
- Providing resources and organization, as well as funding
- Focusing on improving groundwater quality, using funding from a source that impacts water quality or quantity to mitigate
- Finding ways to allow people representing those interests to participate, which may involve financial assistance.

Only two mentors mentioned water rights for this response, and further mentioned the potential negative impacts of people retaining historical water rights and that, in their opinion, water allocation needs of the past are not the water allocation needs of today or the future.

Q10: What are the best ways to interact with, engage and educate the general public more broadly in promoting sustainable water projects and building public will? And/or how do you change an established culture within your organization to promote sustainability?

There were many differing thoughts about answering this question. Many again highlighted how the drought has helped expose water issues in the state. One answer that was a core part of the responses is the need for greater public education from multiple sectors. A few specific responses include:

- The need for goals and targets that are reinforced
- Opening multiple avenues of communication, from utility bills to stakeholder public meetings
- Have another drought to keep the public reminded about the need for water management
- War on lawns needs to be permanent
- Educating the public to allow for projects and decrease negative perception (GWRS)
- Outreach to children is key, such as school curriculum
- Being active on social media, increasing the public voice for agriculture
- Making sustainability less than just a catch phrase, make it real - why should we care?

- Include as many stakeholders as possible and educate the public early in the process.
- Fear and penalties have been working, but maybe not the best, take it to the local level

Surprisingly, education in school was only brushed on under "outreach to children." Education on California and its intrinsic relation with water is not taught in school curriculums, whether public or private. This is an essential part of interacting with, engaging, and educating the next generation of decision-makers.

Q11: Given the frustrations with existing funding models, what new and innovative strategies are available to fund and maintain sustainable projects?

One of the most common strategies posed by the respondents was to implement a public goods charge. Such revenue could be used to fund actions that generally lack secure funding like environmental flows, financial assistance to DACs, and integrated regional water management. Another common refrain was that sustainability projects should be paid – to the extent possible - by the beneficiaries; one mentor clarified though that such an approach is most appropriate in urban settings but less feasible for DACs, agricultural areas, and the environment.

One respondent called for filling in remaining funding gaps with general obligation bond funding, but another respondent cautioned that bond funding is an expensive strategy. Another approach posed by a couple mentors was to attract capital investors, who are starting to recognize the value of improving water sustainability as a good financial investment. Finally, one mentor presented an example from East Bay Municipal Utility District (EBMUD) that demonstrated the value in data collection and analysis for justifying raising additional revenue. In this example, EBMUD collected and analyzed data linking electricity consumption with the cost of water delivery within their service area; this information allowed EBMUD to vindicate increases in water rates for certain customers where delivery costs were higher.

Q12: What are your thoughts on the current allocation of water in California and what changes do you foresee, if any, in the current system of water rights?

On the whole, the mentors generally did not provide a specific response regarding their thoughts on water allocation in California. The few respondents that addressed this particular issue posited

that the current allocation of water may be inconsistent with the need to accommodate population growth and California's water policy objectives.

Mentors generally provided a response regarding their thoughts on current water rights system in California. Most respondents believed there are serious issues with the current water rights system, with one referencing it as "very antiquated" and another as "arcane". One respondent though opined that the current system works well and has for over a century.

Some mentors suggested that the current system may need to be revised, but there was a broad consensus amongst all the respondents that altering the water rights system would be extremely challenging. Due to the difficulty of changing the existing water rights systems (e.g., decades of expected litigation, controversial nature of impacting property rights, unexpected ramifications of such an action), most mentors ultimately questioned the appropriateness of completely altering current water rights. Mentors generally suggested first pursuing solutions within the existing water rights system (e.g., increased usage of water transfers).

Q13: How is your organization addressing sustainability in the face of climate change; what strategies have you seen that could better prepare us for future supply variations?

The mentors provided a wide range of responses to the question about how their own organization addresses sustainability in light of climate change. One respondent from the San Joaquin Valley mentioned that their local community generally did not accept the notion of climate change being a major problem. Other respondents provided examples of how their organizations closely integrate climate change considerations into their way of operations including:

- Water supply forecasting
- Future water demand predictions
- Watershed effects analysis
- Hydrologic modelling
- Advocacy for sustainability legislation (e.g., SGMA)

- Educating business about onsite wastewater treatment and reuse to help reduce their imported water requirements.

With regards to the issue of dealing with future water supply variations, the most common response was calling for a more diverse water supply portfolio, such as incorporating water recycling and desalination into the mix along with surface water and groundwater. Other suggestions from the mentors included considering altering existing reservoir release schedules to reflect declining future snowpack, as well as finding common ground amongst disparate interest groups (e.g., water conservation groups and flood management). One respondent expressed the view that although there is good information and analysis available on climate change impacts, it is difficult for water districts to identify specific on-the-ground steps to respond to climate change and water supply variations.

Q14: What happens if California does not become sustainable with its water use?

There was a general agreement that substantial changes would happen to California, mainly through shifts in the State's economy and an increase in conflicts between water users, if sustainability in water use is ultimately not achieved. Respondents from the San Joaquin Valley cautioned that without water sustainability, agricultural production will be adversely impacted because of the drive to allocate limited water to urban users and the environment (via strict protections under endangered species act). Respondents from Southern California posited that without sustainable water use, California's economy will suffer, e.g., through businesses leaving. One respondent from the nonprofit sector replied that disadvantaged communities will suffer the most, because they currently do not have similar protections like the environment does through ESA requirements.