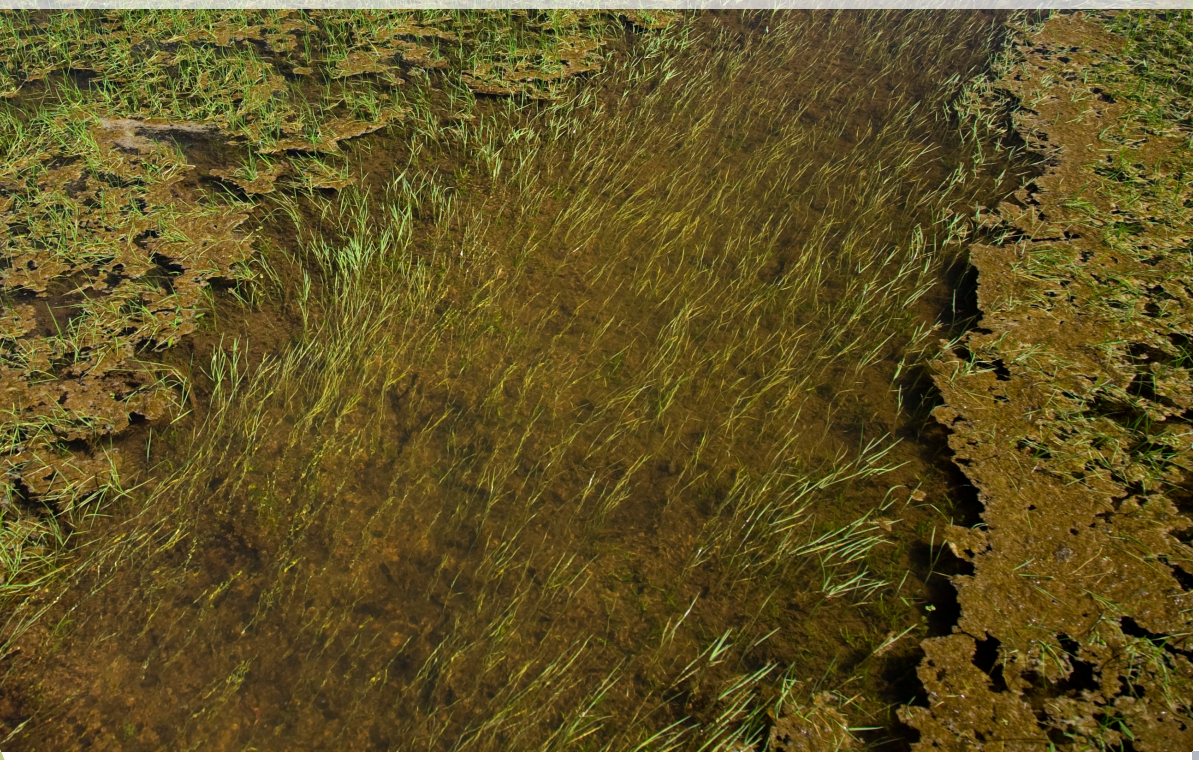
2014 Sustainable Groundwater Management Act: Challenges and Opportunities



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Submitted By:

William R. Gianelli Water Leaders Class of 2014

Prepared For:

WATER EDUCATION FOUNDATION

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Abbreviations and Acronyms

AB	Assembly Bill
AFY	acre-feet per year
AMA	Active Management Areas
CASGEM	California Statewide Groundwater Elevation Monitoring
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Code	1980 Arizona Groundwater Management Code
CWA	Clean Water Act
DWR	California Department of Water Resources
EPA	U.S. Environmental Protection Agency
GAMA	Groundwater Ambient Monitoring and Assessment
GMP	groundwater management plans
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
INA	Irrigation Non-Expansion Areas
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NDMA	N-nitrosodimethylamine
NPDES	National Pollutant Discharge Elimination System
Management Act	Sustainable Groundwater Management Act of 2014
PCE	perchoroethylene
Regional Boards	Regional Water Quality Control Boards
RWMG	regional water management group
SB	Senate Bill
SCVWD	Santa Clara Valley Water District
SDWA	Safe Drinking Water Act
State	State of California
SWRCB	State Water Resources Control Board

TDS	total dissolved solids
TCE	Trichloroethylene
UWMP	urban water management plan
WSA	Water Supply Assessment
WQA	Water Quality Authority

Executive Summary

This report, *2014 Sustainable Groundwater Management Act: Challenges and Opportunities*, was prepared by the Water Education Foundation 2014 Water Leaders Class, which is comprised of 21 water resources professionals from fields spanning the public, private, and non-governmental sectors. The focus of this report is groundwater management in California, a topic assigned by the Water Education Foundation Board of Directors. The 2014 Water Leaders Class refined that topic to focus on the Sustainable Groundwater Management Act of 2014 (Management Act) because of its important impact on groundwater management.

The information presented in this report relies in part on input provided by the mentors that each 2014 Water Leaders Class member worked with as well as from the water tours, conferences and events attended throughout the year. The 2014 Water Leaders Class developed a set of questions that were used during interviews of each mentor to collect perspectives on groundwater quality, groundwater quantity, surface-groundwater interactions, data, funding, and governance, among other topics. Mentor responses to the interview questions were used to characterize existing conditions relevant to groundwater management in the State of California (State), and to draw conclusions regarding the future of groundwater management, particularly as relevant to the Management Act.[1] Mentor responses remain anonymous throughout this report, and the statements presented herein reflect the 2014 Water Leaders Class' interpretations of mentor perspectives.

Existing Groundwater Conditions

Groundwater is a vital resource to residents, businesses, farms, and industries in the State. It provides close to 40 percent of the State's water supply in an average year and as much as 45 percent in dry years. During extensive dry or drought years, groundwater can provide close to 60 percent of the water supply (DWR, 2014a). Forty to 50 percent of Californians rely on groundwater for part of their water supply and many small- to moderate-sized towns and cities are entirely dependent on groundwater for drinking water supplies (DWR, 2003).

In the last few years, groundwater levels have experienced all-time historical lows (over the period of record) in many regions of the State. For example, in many areas of the San Joaquin Valley, recent groundwater levels are more than 100 feet below previous historical lows (DWR, 2014a). In the spring of 2014, the California Department of Water Resources (DWR) found that 36 alluvial groundwater basins have a high degree of groundwater use and reliance and may possess greater potential to incur water shortages as a result of drought (DWR, 2014a).

[1] Mentor interviews were completed in the spring of 2014 prior to enactment of the Management Act, and the mentor's responses to questions on potential improvements to groundwater governance were compared to the provisions of the Management Act.

Pre-2014 Legal and Regulatory Landscape

In contrast to the statewide regulation of surface water rights by the State Water Resources Control Board (SWRCB), there is no singular State agency that directly controls the use of groundwater. Groundwater rights in California, like riparian rights, are correlative rights shared with other landowners. In general, any owner of land that overlies a groundwater basin may extract groundwater and put it to a reasonable and beneficial use without seeking permission to use the water and without a specific limit on the amount of water that may be extracted.

The SWRCB has jurisdiction over protecting water quality, including groundwater quality, throughout California by setting statewide policy. Under the Porter-Cologne Water Quality Control Act, the SWRCB and nine Regional Water Quality Control Boards (Regional Boards) are given the regulatory authority to comprehensively regulate waters of the State, which includes surface waters, groundwater, and saline waters within State boundaries. However, prior to 2014, there was no comprehensive regulatory framework for managing groundwater use in California.

Historically, the State has encouraged groundwater management at the local level through providing guidance for developing voluntary groundwater management plans (GMPs). Several legislative actions have been taken to develop assistance programs for local agencies to manage their groundwater. These legislative actions provide a framework for common groundwater management planning, but they do not require local agencies to develop GMPs. More than 125 GMPs have been developed, implemented, and updated since the 1990's (DWR, 2014c).

In addition to GMPs, groundwater management occurs at the local level through the preparation of Integrated Regional Water Management Plans,[2] Urban Water Management Plans,[3] groundwater adjudication, and Water Supply Assessments[4] for certain projects subject to the California Environmental Quality Act that identify groundwater as a source or potential source of water.

Barriers to Effective Groundwater Management and Management Success Stories

Effective groundwater management can be very complex, and is often hindered by one or more common factors such as the following: lack of funding; lack of accessible and reliable data; characteristics of California's water management system; lack of regulatory and enforcement powers; limited education and coordination among stakeholders; and pressure from various water demand.

The questions asked by the 2014 Water Leaders Class members to the mentors included one seeking specific examples of effectively managed groundwater basins, and the key factors leading to their success despite the common barriers to groundwater management listed above. While numerous individual basins were put forward by the mentors, the reasoning behind each nomination showed common themes around governance structures, authorities, and other water management activities. These included the following:

[2] Authorized in the Integrated Regional Water Management Planning Act of 2002
[3] Authorized in the Urban Water Management Planning Act of 1983
[4] Required under SB 610 passed in 2002.

- Creation or designation of a local agency with clear responsibility for basin groundwater management,
- Good communication, active involvement, and inclusive processes,
- Establishment of replenishment programs,
- Groundwater management as part of more integrated water management at the local scale,
- Establishment of regulatory authority and tools for management,
- Adjudication,
- Extensive collection of groundwater data,
- Establishment of financial mechanisms for management, and
- High levels of public education.

Sustainable Groundwater Management Act of 2014

Facing a record drought and dramatic groundwater declines in some areas of the State, the California Legislature passed a package of bills on August 29, 2014, intended to comprehensively regulate groundwater in California. The 2014 Management Act creates the greatest change to water rights in California since 1914.

The Management Act is comprised of three pieces of legislation: SB 1168, which sets the groundwork; AB 1739, which provides the enforcement mechanism; and SB 1319, which provides "clean up" language. Governor Brown signed the legislation on September 16, 2014, making the Management Act effective on January 1, 2015.

The Management Act aims to provide for local planning and management of groundwater basins. As described in Section 2.2 (Groundwater Basins and Conditions) of this report, DWR has defined 515 alluvial groundwater basins and subbasins in California. The Management Act requires DWR to prioritize these basins as high-priority, medium-priority, low-priority, or very low-priority using the California Statewide Groundwater Elevation Monitoring system, by January 31, 2015.

High- and medium-priority basins are required under the Management Act to develop and implement their own local groundwater sustainability plan or functional equivalent established by the local Groundwater Sustainability Agency (GSA) by specific deadlines established by the Management Act. If a basin fails to meet the requirements within the statutory deadlines, the Management Act authorizes the SWRCB to designate the basin as a probationary basin, develop an interim groundwater management plan for that basin, and assume the management authorities that the Management Act has granted to GSAs until the local GSA can assume management of the basin. The Management Act grants numerous powers to the GSAs and also mandates achieving sustainable management of high and medium-priority basins within 25 to 30 years. The Management Act states that it will not alter, establish, or determine groundwater or surface

water rights, but rather, establishes the policy of the State that groundwater resources be managed sustainably for long-term reliability and multiple beneficial uses.

Management Act's Responsiveness to Issues Identified by Water Leaders' Mentors

The Management Act has introduced a new era of groundwater management and stewardship in California. While this legislation represents a significant step toward sustainable groundwater management throughout the State, there remain several important components of groundwater management that were either not fully addressed in the legislation or have yet to be addressed by policymakers and regulators. One of the mentor questions asked by the 2014 Water Leaders Class was "If you had complete oversight of California's groundwater, what legislative or regulatory changes would you make to ensure effective groundwater management?" Mentor responses to this question were compared against the Management Act, which had not yet passed at the time the mentor interviews were conducted. The intention of this comparison was to evaluate whether and to what extent the legislation addresses issues identified by the mentors. The issues that were identified fell into the five general themes: funding; data availability; governance, regulatory oversight and enforcement; California's water management system; and education and communication. The Management Act is responsive to all of these issues to some degree, but does not fully achieve many of the changes suggested by the mentors.

Opportunities and Challenges in Implementing the Management Act

The Management Act changes the way groundwater is managed throughout the State, and aims to establish more effective means of groundwater management moving forward. This legislation enacts extensive and historic changes to groundwater management in California, and much is unknown regarding the immediate effect on local agencies, as well as the long-term implications of statutory and regulatory provisions authorized by this legislation. There will be a variety of short- and long-term challenges and opportunities associated with implementing the Management Act. Short-term challenges associated with implementation of the Management Act may be varied, including but not limited to the formation of GSAs, the clarification of key terms such as "sustainable groundwater management" and "sustainable yield" and cooperation and coordination between existing management entities within a region. Long-term challenges could include issues with enforcement powers and water rights, funding for management and data collection, and determination of surface water-groundwater connectivity.

Potential Future Actions

Future refinement of the Management Act in the form of three potential bills is currently under consideration. The need for these bills was identified at a series of stakeholder meetings and input that Assemblymember Dickinson's office (D-Sacramento) received from affected stakeholders. These potential bills would do the following:

- Create mechanisms for an expedited and streamlined adjudication process,
- Refine the specific types of groundwater data that will be made available to the public, and
- Refine the requirements for demonstrating the functional equivalency of existing groundwater management plans to be used in-lieu of a new GSP.

At the time of this report's development, the end of the 2013 to 2014 legislative session, the above legislative concepts had neither bill numbers nor bill authors. Nonetheless, once the Legislature reconvenes for the 2015 to 2016 legislative session, it is likely that one or all of these measures be introduced.

In addition to these potential legislative actions, the Water Leaders class identified other potential future actions that may arise from the Management Act. In particular, coordination and cooperation amongst the public, stakeholders, and regulatory entities will be critical to achieve sustainable groundwater management. The Water Education Foundation can play a critical role in bringing stakeholders together in a non-partisan manner to facilitate education, collaboration, and the exchange of ideas on groundwater management and groundwater conditions across the State. Local regulatory entities will also need to invest significant time and resources to facilitate coordination within their groundwater basin and in developing a plan for groundwater management.

Actions to facilitate conjunctive use of surface water and groundwater will also be necessary to support sustainable groundwater use. These actions may include clarification and guidance regarding the rights and obligations associated with groundwater banking, as well as reexamining restrictions on the use of surface water. In addition, sustainable groundwater management must consider and plan for climate change and the possibility of prolonged droughts and altered hydrologic patterns. Management entities will need to evaluate how a changing climate could alter both surface water and groundwater supplies. As California's government leadership makes this a priority there will be a heightened awareness and political will to ultimately challenge the entire State to diversify the water portfolio and become more creative with water sustainability.

In summary, the 2014 Water Leaders Class believes that the Management Act represents a significant step toward sustainable groundwater management throughout the State, but there remain implementation challenges to the current legislation, and future refinement of the legislation is needed to fully manage groundwater sustainably.

1.0 Introduction

This report was prepared by the Water Education Foundation 2014 Water Leaders Class, which is comprised of 21 water resources professionals from diverse fields spanning public, private, and non-governmental sectors. The report focuses on the topic of groundwater management in California, as assigned by the Water Education Foundation Board of Directors. This topic is currently of particular relevance as the State of California (State) is facing consecutive drought years and widespread groundwater overdraft conditions.

This section provides an overview of groundwater in California and the role that groundwater plays in the State's water supply, as well as an introduction to the 2014 Water Leaders Class participants and mentors.

1.1 Background

Groundwater is a vital source of California's water supply. In an average year, groundwater accounts for more than one-third of Statewide water use, and in a drought year it accounts for more than one-half (Senate Bill (SB) 1168 (2013-2014 Reg. Sess.) §1(a)(2)). Some regions of the State exclusively depend on groundwater for their water supply. This critical water supply has faced increasing demands as the State's population continues to grow and water users turn to groundwater to compensate for reduced surface water supplies due to regulatory restrictions and drought conditions.

Despite groundwater's critical role in supplying California cities, families, farms, and businesses with essential water supplies, prior to 2014, groundwater use was largely unregulated. However, years of concurrent droughts from 2012 to 2014 (and continuing) placed significant pressure on groundwater supplies and spurred executive and legislative action. In January 2014, California Governor Jerry Brown issued an Emergency Drought Declaration which, among other things, found that groundwater levels throughout the State have dropped significantly. The Emergency Drought Declaration provided several mandates, and ordered the California Department of Water Resources (DWR) to evaluate changing groundwater levels, land subsidence, and agricultural land fallowing, as well as to provide a public update by April 30, 2014 that identified groundwater basins with water shortages and detailed gaps in groundwater monitoring. On April 25, 2014, the Governor issued an executive order proclaiming a continued state of drought emergency and ordering DWR to provide a public update by November 30, 2014, that identifies groundwater basins with water shortages, details remaining gaps in groundwater monitoring, and updates its monitoring of land subsidence and agricultural land fallowing. Shortly after, DWR provided its April 30, 2014 report regarding groundwater conditions, which found significant and widespread declines in groundwater levels throughout the State, potential water shortages in several groundwater-dependent regions, and many data gaps in groundwater monitoring. These actions collectively increased the attention for California's groundwater management issues in 2014, setting the stage for the Sustainable Groundwater Management Act of 2014 (Management Act), which is addressed throughout this report.

In August 2014, amidst growing concerns about groundwater overdraft and declining groundwater levels, land subsidence, groundwater-surface water interactions, and groundwater quality issues, the State legislature passed a package of bills collectively known as the Management Act. The Management Act is one of the most significant pieces of legislation in the State's water history and represents the State's first effort to provide for comprehensive regulation and management of groundwater. However, the Management Act is not without controversy or challenges. Several stakeholder groups were opposed to this legislation and there remain many questions regarding how the Management Act will be implemented. But it is beyond dispute that the Management Act will significantly alter the "waterscape" of California in the years to come, as it requires "sustainable" management of groundwater basins that are deemed as medium- or high-priority basins.

Given the importance of groundwater in California and the recent legislative changes, the purpose of this report is to provide background information regarding the State's groundwater conditions and concerns, the regulatory environment that preceded the Management Act, the provisions of the Management Act, and the opportunities and challenges that may arise from the Management Act.

1.2 Water Leaders

This report was prepared by the 2014 Water Leaders Class. Throughout the year, each Water Leaders Class participant worked with a mentor, including spending one day of mentor "shadowing." Each mentor was also interviewed by their associated 2014 Water Leaders Class participant, and each mentor was asked the same set of questions relevant to groundwater management, as collectively developed by the 2014 Water Leaders Class. Topics covered by these interview questions included: water quality, water quantity, surface-groundwater interactions, data, funding, and governance, among others.

Mentor responses to the interview questions were used to characterize existing conditions relevant to groundwater management in the State, and to draw conclusions regarding the future of groundwater management, particularly as relevant to the Management Act. It is important to note that the statements presented herein reflect the 2014 Water Leaders Class members' interpretation of mentor perspectives, and that interview responses were provided by mentors prior to the passage of the Management Act. Although interview questions addressed the same primary issues addressed by the Management Act, mentors were not necessarily responding to direct questions about the Management Act, which was still in development at the time that mentor interviews occurred. The Water Leaders Class used mentor responses to infer opportunities and challenges regarding the future of groundwater management in California. The Mentor responses were supplemented with independent research by the Water Leaders Class members to develop this report. Mentor responses to the interview questions remain anonymous throughout this report.

Table 1-1. 2014 Water Leaders Class Participants and Mentors

WATER LEADER	MENTOR
Chris Alford *Associate Director* American Rivers	**Vicki Kretsinger** *President and Principal Hydrologist* Luhdorff and Scalmanini
Eleanor Bartolomeo *Water Resources Control Engineer* State Water Resources Control Board	**Lester Snow** *Executive Director* California Water Foundation
Amanda Bohl *Economic Development Lead* Sacramento-San Joaquin Delta Conservancy	**Steve Phillips** *Hydrologist* U.S. Geological Survey
Holly Canada *Water Resources Engineer* California Department of Water Resources	**Tina Cannon Leahy** *Principal Consultant* Assembly Water, Parks and Wildlife Committee
Laura Carpenter *Hydrologist* Brown and Caldwell	**Roy Herndon** *Chief Hydrogeologist* Orange County Water District
Omar Carrillo *Policy Analyst* Community Water Center	**Chris Petersen** *Vice President* West Yost & Associates
Lindsay Correa *Senior Environmental Scientist* Delta Stewardship Council	**Jason Gianquinto** *General Manager* Semitropic Water Storage District
Roberto Cortez *Assistant Superintendent of Aqueduct* East Bay Municipal Utility District	**Chase Hurley** *General Manager* San Luis Canal Company / Henry Miller Reclamation District
Rebecca Crebbin-Coates *Policy Director* Planning and Conservation League	**Rob Swartz** *Manager of Technical Services* Regional Water Authority
Kristina Donnelly *Research Associate* Pacific Institute	**Danielle Blacet** *Special Projects Manager* Association of California Water Agencies
Rebecca Guo *Senior Water Resources Engineer* MWH Americas	**Caren Trgovcich** *Chief Deputy Director* State Water Resources Control Board

WATER LEADER	MENTOR
Trudi Hughes *Director Government Affairs* California League of Food Processors	**Thomas Harter** *Faculty, Cooperative Extension Groundwater Hydrologist* University of California, Department of Land, Air, and Water Resources
Minta Konieczki *Hydrologist* ESA	**Mark Larsen** *General Manager* Kaweah Delta Water Conservation District
Elizabeth Leeper *Attorney* Kronick Moskovitz Tiedemann & Girard	**Jay Lund** *Director/Faculty* University of California Davis, Center for Watershed Sciences
Sean Maguire *Water Resources Engineer* Kennedy/Jenks Consultants	**Daniel Wendell** *Associate Director, Groundwater* The Nature Conservancy
Maureen Martin *Associate Water Resources Specialist* Contra Costa Water District	**Sarah Raker** *Senior Principal Geologist* AMEC/Environmental and Infrastructure, Incorporated
Aubrey Mescher *Water Resources Planner* Aspen Environmental Group	**Brad Herrema** *Attorney/Shareholder* Brownstein Hyatt Farber Schreck, LLP
Christopher Park *Water Resource Planner* CDM Smith	**Robert Van Valer** *President* Roscoe Moss Company
Susan Reyes *Legislative Aide* State Senator Ed Hernandez, O.D.	**Ted Johnson** *Chief Hydrogeologist* Water Replenishment District of Southern California
Erin Rice *Natural Resources Specialist* Bureau of Reclamation	**Tim Parker** *President* Parker Groundwater-Technology, Innovation, Management, Incorporated
Elizabeth Sarine *Attorney* Remy Moose Manley, LLP	**Dan McManus** *Regional Planning Branch Chief* California Department of Water Resources

2.0 Existing Groundwater Conditions and Management Issues

This section provides an overview of existing groundwater conditions in California, including groundwater use and reliance (Section 2.1), groundwater basins and conditions (Section 2.2), and groundwater management issues (Section 2.3).

2.1 Groundwater Use and Reliance

Groundwater is a vital resource to residents, businesses, farms, and industries in California. It provides close to 40 percent of the State's water supply in an average year and as much as 45 percent in dry years. During extensive dry or drought years, groundwater can provide close to 60 percent of the water supply (DWR, 2014a). Forty to fifty percent of Californians rely on groundwater for part of their water supply and many small- to moderate-sized towns and cities entirely depend on groundwater for drinking water supplies (DWR, 2003).

Groundwater use throughout the State fluctuates seasonally and annually, based on hydrologic conditions and water needs. DWR estimates that on average, annual groundwater extractions in California are approximately 16,500,000 acre-feet and contribute about 39 percent of the State's total water supply. On average, California's groundwater supplies account for an estimated 39 percent of the total annual agricultural water supply and 41 percent of the total urban water supply. However, these estimates do not capture the recent increase in groundwater use over the last few years of drought and also mask the regional variation in groundwater use and dependency. For example, evaluation of groundwater use by region indicates that the three Central Valley hydrologic regions (Tulare Lake, San Joaquin River, and Sacramento River) account for about 75 percent of California's average annual groundwater use. The Tulare Lake region is by far the largest groundwater user and is also the third most groundwater-reliant region, with groundwater contributing about 53 percent of their total water supply. The two most groundwater-reliant regions in the State are the Central Coast (86 percent) and the South Lahontan (66 percent). (DWR, 2014a)

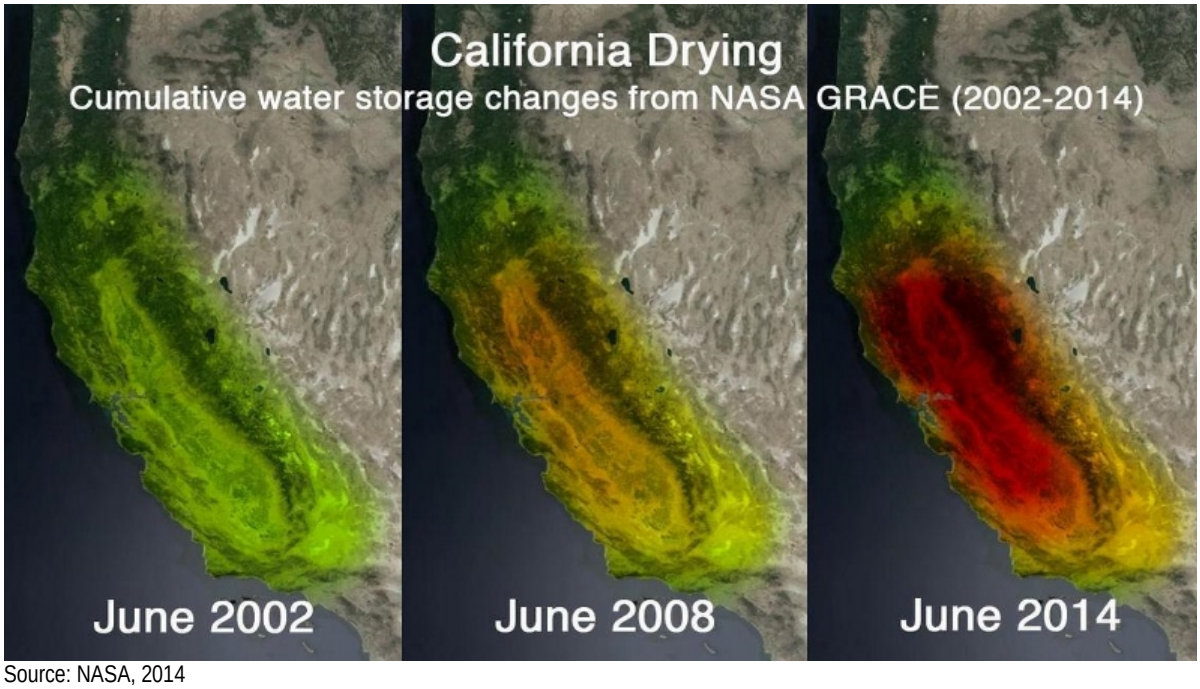
During droughts, California traditionally depends on its groundwater to supplement reduced surface water supplies. Increased reliance on groundwater during the recent drought, along with regulatory cutbacks in surface water supplies, has resulted in significant declines in groundwater levels in many basins. (DWR, 2014a)

2.2 Groundwater Basins and Conditions

The vast majority of California's groundwater that is accessible in significant amounts is stored in alluvial groundwater basins. These alluvial basins cover nearly 40 percent of the geographic area of the State (DWR, 2003). As of 2003, DWR had delineated 431 groundwater basins within

the State. Of those, 24 basins are subdivided into a total of 108 subbasins, giving a total of 515 distinct groundwater systems (DWR, 2003). Of California's 515 alluvial groundwater basins, 169 are fully or partially monitored under the California Statewide Groundwater Elevation Monitoring (CASGEM) Program (DWR, 2014a). Close to 90 percent of the groundwater used in California is extracted from only about 126 of the 515 alluvial groundwater basins (DWR, 2014a).

In the last few years, groundwater levels have experienced all-time historical lows (over the period of record) in many areas of the State. For example, in many areas of the San Joaquin Valley, recent groundwater levels are more than 100 feet below previous historical lows (DWR, 2014a). In addition, many basins and counties have experienced significant water well deepening activities since 2010, an activity indicative of declining groundwater levels (DWR, 2014a). Images such as the National Aeronautics and Space Administration (NASA)-produced figures provided below (Figure 1-1) capture recent changes water storage, including groundwater storage, throughout California. These images show cumulative water storage changes, as captured by imagery used in the NASA Gravity Recovery and Climate Experiment program. The changes from green to yellow and red indicate a relative decrease in the quantity of groundwater since 2002. These images indicate that California has lost a substantial amount of groundwater over the past dozen years, particularly in the Sacramento River and San Joaquin River basins.



Source: NASA, 2014

Figure 1-1. California's Water Storage Changes

In the spring of 2014, DWR found that 36 alluvial groundwater basins have a high degree of groundwater use and reliance, and that these basins may possess greater potential to incur water shortages as a result of drought (DWR, 2014a). Those basins exist in the North Coast, Central Coast, Sacramento River, Tulare Lake, and South Coast hydrologic regions.

2.3 Groundwater Management Issues

Three major management-related issues involving groundwater in California are overdraft, saltwater intrusion, and contamination, summarized below.

- Groundwater overdraft, which occurs when more water leaves a basin than is replenished to it over a long period of time, has serious implications on water supply reliability.

- Saltwater intrusion, or the movement of salt water into historically fresh aquifers, is a persistent issue particularly in coastal aquifers, where heavy groundwater pumping draws saline water inland.

- Groundwater contamination occurs through a variety of means, and tends to intensify in areas of heavy groundwater pumping.

These issues were selected for detailed discussion in this report because they are critically relevant to ongoing groundwater management efforts throughout the State as guided by the Management Act. The following sections examine each of these three issues in further detail.

2.3.1 Overdraft

Groundwater overdraft occurs when more water leaves a groundwater basin than is replenished to it over a long period of time. Under normal circumstances, groundwater levels fluctuate annually depending on factors such as climatic variations and reliance on groundwater versus surface water supplies. Year-to-year fluctuations do not necessarily indicate the presence of overdraft, as groundwater is typically more heavily relied on during dry years, with the expectation that subsequent wet years will provide the recharge necessary to restore balance. True overdraft conditions are characterized by long-term declines in groundwater levels, or increased depth to reach groundwater, over periods comprised of both wet and dry years.

In order to accurately characterize groundwater overdraft in any given basin, it is necessary to have reliable spatial data representing horizontal and vertical characteristics of the aquifer, and to have such data for the long-term, over both wet and dry years. The extent of overdraft throughout California is not well quantified due to widespread inconsistencies in data quality and availability. A comprehensive assessment of overdraft in California's groundwater basins has not been conducted since 1980; however, it is currently estimated by DWR that state-wide overdraft amounts to one to two million acre-feet per year (AFY). Most of this overdraft occurs in the Tulare Lake, San Joaquin River, and Central Coast hydrologic regions. (DWR, 2009)

The persistence of groundwater overdraft has widespread ramifications, including uncertain water supply reliability, land subsidence, increased expenses associated with groundwater extraction, and water quality degradation.

- **Water Supply Reliability**. California relies heavily on groundwater resources, both as a direct source of water supply, and as a mechanism for water supply management, such as through banking programs that allow for heavier reliance during times of surface water shortages. Overdraft conditions threaten water supply reliability by persistently and substantially decreasing the amount of groundwater available for use.

- **Land Subsidence**. Subsidence occurs when groundwater is withdrawn from an aquifer to the extent that subsurface clay layers become compacted and settle, resulting in a lowering of the ground surface. More than 80 percent of the identified subsidence cases in the United States are associated with human impact on groundwater (Galloway et al., 2000). Depending on subsurface characteristics, land subsidence can be irreversible, such as in the San Joaquin Valley (pictured in Figure 2-1). However, in certain situations it can also be mitigated to some extent with groundwater management efforts; for instance, in the La Quinta area of Coachella Valley, Riverside County, increased recharge operations at the Thomas E. Levy Recharge Facility have coincided with recovering groundwater levels and decreased subsidence rates (Brandt et al., 2014).

Source: USGS, 2013a

Figure 2-1. Subsidence in the San Joaquin Valley

- **Expense of Extraction**. The greater the depth to groundwater, the more expensive it is to extract from the subsurface. As the depth to groundwater increases, it is also necessary to increase the depth of extraction wells and the size of associated pumps. The energy and expense associated with installing and operating these facilities increase, sometimes to the point of a negation of benefits; for instance, for certain agricultural water users, profits associated with the sale of crops may become overshadowed by the cost of withdrawing deep groundwater. Such conditions could lead to land use or crop conversions.

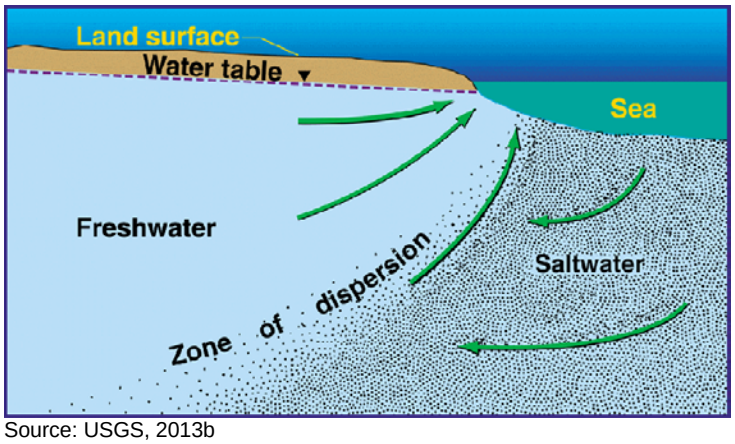
- **Water Quality Degradation**. Overdraft conditions are often tied to water quality degradation, as constituents such as minerals and salts increase in concentration as the quantity of water in a given aquifer is depleted. Some constituents are naturally occurring, such as total dissolved solids (TDS) and arsenic, while others are a result of human activities such as nitrates and TDS associated with agricultural uses. At some point, groundwater must be treated prior to use, whether for agricultural, residential, or even industrial purposes such as the rinsing of solar panels to maximize energy production. Groundwater quality degradation is further addressed in the subsequent two subsections.

At the present time, overdraft conditions throughout California are generally managed on a reactive basis, meaning that management efforts are implemented once problematic conditions have developed. The viability of such management efforts depends on local circumstances

including, but not limited to, financing, staffing, public perception, and cooperation amongst local and regional entities.

2.3.2 Saltwater Intrusion

As noted above, saltwater intrusion is the movement of salt water, usually from the ocean, into historically fresh aquifers. This movement can result in contamination of coastal wells, making the water unfit for human consumption or irrigation.



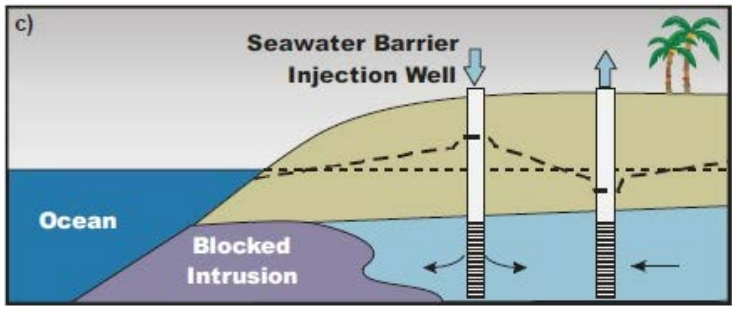
Source: USGS, 2013b

Figure 2-2. Saltwater – Freshwater Contact

In the same way that inland ponds are hydraulically connected to the underlying groundwater, near the coast, the ocean is hydraulically connected with the neighboring freshwater aquifer (Figure 2-2). Saltwater and fresh water meet in a transition zone at the point of hydraulic equilibrium. This equilibrium occurs where the head exerted by the fresh water is equal to the head exerted by the salt water. When the height of the freshwater aquifer is drawn down through excessive groundwater pumping, this reduces the head exerted against the saltwater. This allows the denser, heavier salt water to flow in a wedge shape beneath the fresh water and shifts the equilibrium point inland.

It is also possible to encounter saltwater intrusion in wells that are nowhere near the present day coastline. Through geologic time, sea level has risen then receded multiple times, leaving behind layers of sediment and, in some places, trapped layers or pockets of saline water. These layers of saline water often lie below fresher aquifers. Poorly constructed wells or over-pumping can draw this saltwater up into the overlying fresh water, thus causing saltwater contamination.

There are several commonly used methods of addressing saltwater intrusion. They all have the common basis of reestablishing the hydraulic equilibrium at a point near the coastline. The first approach is to significantly reduce long-term pumping and aquifer drawdown near the coast. This can be done by reducing overall pumping or by relocating wells sufficiently far inland that the drawdown cone does not reach the transition zone. Both approaches may be necessary. In regions with high rates of groundwater recharge, fresh water should displace the intruded salt water and the old equilibrium should reestablish naturally.



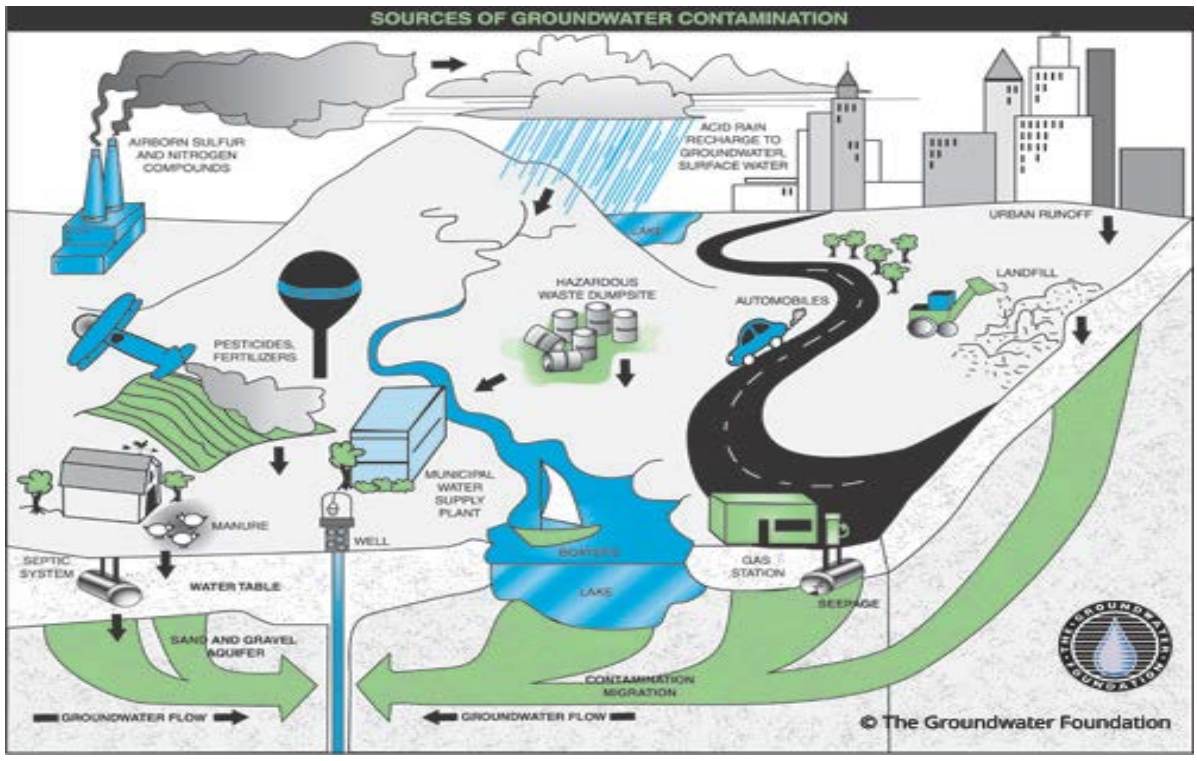
Source: WRDSC, 2007

Figure 2-3. Hydraulic Barrier – Injection Well

A second management approach is artificial recharge of the aquifer. Surplus surface water, storm water, or treated wastewater can be recharged into the aquifer to increase water levels and create a hydraulic barrier against saltwater intrusion. The water can either be spread on the surface in percolation ponds or unlined canals, or injection wells can be used to insert the water directly into the aquifer. This method has been used successfully in California by the Los Angeles County Flood Control District.

2.3.3 Groundwater Contamination

Groundwater overdraft and saltwater intrusion can both result in water quality degradation. Groundwater is susceptible to contamination from various other sources as well, both natural and manmade. Chemicals or wastes from residential, municipal, commercial, industrial and agriculture activities released into the environment account for the majority of contamination into aquifers. Some more common natural sources of groundwater contamination include iron, manganese and arsenic. These substances can be released from rocks and soils as water percolates to the aquifer. As water moves downward, the concentrations can increase high enough that it makes the groundwater unusable even for irrigation without proper treatment. Bacteriological and chemical contamination of groundwater can lead to serious health effects, including developing cancers.



Source: The Groundwater Foundation, 2014

Figure 2-4. Groundwater Contamination Cycle

3.0 Pre-2014 Legal and Regulatory Landscape

This section reviews the legal and regulatory landscape of groundwater management that existed prior to 2014 and the establishment of the Management Act. Under pre-2014 conditions, laws and regulations pertaining to groundwater management in California were a patchwork of various State and federal legislation, policy directives, case law, and regional and local management. Although many of those laws and regulations will continue to govern groundwater in 2014 and subsequent years, management efforts will largely be guided by the Management Act moving forward. The Management Act is discussed in detail in Section 5.0.

3.1 State and Federal

As noted above, this section characterizes the State and federal legal and regulatory landscape that guided groundwater management in California under pre-2014 conditions.

3.1.1 Common Law Groundwater Rights

Groundwater rights in California, like riparian rights, are correlative rights shared with other landowners. In general, any owner of land that lies above a groundwater basin may extract groundwater and put it to a reasonable and beneficial use without seeking permission to use the water and without a specific limit on the amount of water that may be extracted[5] (except note that well drilling permits may be necessary per local regulation). But, as established by a 1903 California Supreme Court case, landowners do not have an absolute right to groundwater. The right to use groundwater is limited by the reasonable use doctrine and other common law restrictions that also apply to use of surface water (See *Katz v. Walkinshaw* (1903) 141 Cal. 116, 135-136). In particular, the rights of others with land overlying the same groundwater aquifer must be taken into account. Subsequent court decisions found that groundwater may also be appropriated for use outside the basin, but established that an appropriator's rights are subordinate to landowners with overlying rights.

In contrast to the statewide regulation of surface water rights by the State Water Resources Control Board (SWRCB), there is no singular State agency that directly controls the use of groundwater. However, in some basins, groundwater rights have been judicially determined through groundwater adjudications, described in detail in Section 3.2.1. There are approximately 26 adjudicated basins in California. In these basins, groundwater use is governed by Watermasters, or local agencies pursuant to enforceable court decrees adjudicating the groundwater rights within the basins. In a small number of basins where the management of groundwater is directly related to surface water issues, administrative adjudication by the SWRCB stands in the place of a court decree.

[5] http://www.waterboards.ca.gov/waterrights/board_info/water_rights_process.shtml#rights

3.1.2 State Water Resources Control Board's Groundwater Governance and Management Activities

The SWRCB has jurisdiction over protecting water quality throughout California by setting statewide policy. Under the Porter-Cologne Water Quality Control Act, the SWRCB and nine Regional Water Quality Control Boards (Regional Boards) are given the regulatory authority to comprehensively regulate waters of the State, which includes surface waters, groundwater, and saline waters within State boundaries.

These authorities of the SWRCB and Regional Boards have been exercised through the adoption of Water Quality Objectives, Basin Plans, and other policies to protect water quality for beneficial uses. One of these policies includes the California Antidegredation Policy (Resolution No. 68-16), which requires high quality waters, including groundwater, be maintained to the extent possible (SWRCB, 2008). This means that waste discharge and basin clean-up efforts are regulated to protect the antidegradation of high quality groundwater in the State.

Several other management activities and permitting systems used to protect the water quality of groundwater supplies, as administered through the SWRCB, include those listed below (SWRCB, 2013):

- Onsite Wastewater Treatment Systems Policy
- Waste Discharge Requirements Program
- National Pollutant Discharge Elimination System (NPDES) Storm Water Program (including low impact development requirements)
- Recycled Water Permits
- Irrigated Lands Regulatory Program
- Confined Animal Facilities/Concentrated Animal Feeding Operations Program
- Land Disposal Program
- Site Cleanup Program
- Department of Defense Cleanup Program
- Water Rights Administration (subterranean streams and interconnected groundwater)
- Aquifer Storage and Recovery Permit

3.1.3 SBX7 6 and the California Statewide Groundwater Elevation Monitoring (CASGEM)

In November 2009, the California Legislature passed SBX7 6, adding provisions for Groundwater Monitoring to Division 6 of the California Water Code (Water Code, §10920 et seq.). This change to the Water Code set new direction for statewide seasonal and long-term

groundwater elevation monitoring. The legislation called for collaborative efforts between local monitoring parties and DWR for the regular and systematic collection of groundwater elevation data, making groundwater elevation data readily and widely available, and the continuation of DWR's current network of monitoring wells in coordination with local entities.

To fulfill its responsibilities under SBX7 6, DWR developed the CASGEM program (DWR, 2014b) to provide a permanent, locally-managed program of regular and systematic monitoring. Through CASGEM, DWR is working with local groundwater monitoring entities (as defined in Water Code §10927) to collect and report on the status of groundwater basins and subbasins throughout the State. The first CASGEM status report (DWR, 2012) was provided to the Governor and Legislature in 2012, with subsequent status reports scheduled to occur every five years starting in 2015.

In addition to its groundwater monitoring role, CASGEM is being used to meet DWR's responsibilities under Water Code §§10933 and 12924 to prioritize groundwater basin and conduct groundwater basin assessments. Using eight criteria (e.g., overlying population and overlying irrigated acreage) to prioritize basins, CASGEM reported that 127 of California's 515 groundwater basins and subbasins are high- and medium-priority basins. These 127 basins account for 96 percent of California's annual groundwater pumping and supply 88 percent of the population which resides over groundwater basins. For more information about the CASGEM basin prioritization process and associated findings visit: http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm.

3.1.4 Groundwater Management Plans

Prior to 2014, the State has encouraged groundwater management at the local scale through providing guidance for developing groundwater management plans (GMP). Several legislative actions have taken effect that assist local agencies to voluntarily manage their groundwater. These actions include the passing of several bills including, Assembly Bill (AB) 225 (1991), AB 3030 (1992), SB 1938 (2002), and AB 359 (2011) summarized in the table below.

Table 3-1. Overview of Legislation Related to Groundwater Management Plans

Year	Legislation	Description
1991	AB 255 (Ch 903)	AB 255 authorized local agencies overlying basins subject to critical overdraft conditions, as defined in DWR's Bulletin 118-80 (DWR, 1980), to establish programs for groundwater management within their service areas. Water Code §10750 et seq. provided these agencies with the powers of a water replenishment district to raise revenue for facilities to manage the basin for the purposes of extraction, recharge, conveyance, and water quality management. Seven local agencies adopted plans under this authority: Buena Vista Water Storage District, Exeter Irrigation District, Kings County Water District, Laguna Irrigation District, North Kern Water Storage District, Shafter-Wasco Irrigation District, and Tulare Irrigation District (DWR, 1999).
1992	AB 3030 (Ch 947)	The provisions of AB 255 were repealed in 1992 with the passage of AB 3030. This legislation set forth a common management framework for local agencies throughout California. AB 3030, codified in Water Code §10750 et seq., provides a systematic procedure to develop a GMP by local agencies overlying a groundwater basin defined by DWR's Bulletin 118 (DWR, 1975) and updates (DWR, 1980, 2003).
2002	SB 1938 (Ch 603)	In 2002, the California Legislature passed SB 1938, which provides local agencies with incentives for improved groundwater management. While not providing a new vehicle for groundwater management, SB 1938 modified the Water Code by requiring specific elements to be included in a GMP in order for an agency to be eligible for certain DWR funding for groundwater projects.
2011	AB 359 (Ch 572)	This legislation adds several requirements to both GMPs and the process of developing GMPs. This includes providing copies of resolutions and GMPs to DWR, increased public availability of documents, increased notification of the public and DWR on adoption hearings, and inclusion in the GMP of a map identifying areas of recharge.

Source: California Water Foundation, 2014

Key:

AB = Assembly Bill
DWR = California Department of Water Resources
GMP = Groundwater Management Plan
SB = Senate Bill

Although the bills described above provide a framework for common groundwater management planning, they do not require local agencies to develop GMPs. However, AB 3030 (1992), SB 1938 (2002), and AB 359 (2011) provided support and guidance to local agencies interested in voluntarily developing GMPs that could open the door for DWR grant funding (e.g., Integrated

Regional Water Management[6] and Local Groundwater Assistance[7]). More than 125 GMPs have been developed, implemented, and updated since the 1990's (DWR, 2014c).

3.1.5 Integrated Regional Water Management Plans

The Integrated Regional Water Management (IRWM) Planning Act of 2002 (SB 1672; Water Code, §§10530-10550) authorizes a regional water management group (RWMG) to prepare and adopt a regional plan that addresses water supply, water quality, flood protection, or related matters. Among other requirements, an Integrated Regional Water Management Plan (IRWMP) must identify any significant threats to groundwater from overdrafting and must address protection of groundwater resources from contamination (Water Code, § 10540(c)).

Since 2002, cities, counties, water districts, and others have worked to organize and establish RWMGs that collectively have defined 48 IRWM regions covering 87 percent of California and 99 percent of the State's population.

3.1.6 Urban Water Management Plans

The Urban Water Management Planning Act was enacted in 1983, requiring every urban water supplier that provides water to 3,000 or more customers or provides over 3,000 AFY of water to prepare and adopt an Urban Water Management Plan (UWMP) (Water Code, § 10610 et seq.). The legislative intent of the act include "[i]mplementing effective water management strategies," such as "groundwater storage projects" or "requir[ing] specific water quality and salinity targets for meeting groundwater basins water quality objectives" (Water Code, §10610.2(a)(6)).

In preparing a UWMP, the urban water supplier is required to coordinate with other agencies, including relevant groundwater management agencies. For example, the UWMP must include a description of the different ways recycled municipal water could be used, including for groundwater recharge (Water Code, § 10633(d)).

If groundwater is the existing or planned source of water for the urban water supplier, then the UWMP must include: a copy of any groundwater management plan adopted by the supplier; a description of the groundwater basin; and a description of the location and amount of groundwater that has been and will be pumped by the supplier (Water Code, § 10631(b), as modified by the Management Act).

3.1.7 Water Supply Assessments Required for CEQA projects

Established in 2002, SB 610 requires cities and counties to prepare Water Supply Assessments (WSA) for certain development projects that are subject to the California Environmental Quality Act (CEQA) and would use groundwater as an identified or potential water supply. A WSA must address whether existing water supplies will suffice to serve the project and other planned development over a 20-year projection in average, dry, and multiple-dry year conditions, and must set forth a plan for finding additional supplies as necessary.

If a water supply assessment identifies groundwater as a source of water for the project, the water supply assessment must include: a review of relevant UWMPs; a description of the

[6] Information available at: http://www.water.ca.gov/irwm/grants/
[7] Information available at: http://www.water.ca.gov/lgagrant/

groundwater basin; and a description of the location and amount of groundwater that has been and will be pumped by the supplier (Water Code, § 10910(f)). Under current law, cities and counties have the final decision-making authority on the sufficiency of a WSA, and may find that long-term water supplies are sufficient even if there are uncertainties or shortfalls identified in the WSA. In other words, local agencies can approve a project even if its WSA indicates that there is great uncertainty about future available groundwater and there are no other readily available water supplies.

Also in 2002, SB 221 took effect and required cities and counties to impose a new condition of approval on tentative subdivision maps requiring the applicant to provide written verification from a water supplier that sufficient water supply will be available for the project before the final subdivision map can be approved. This requirement applies to similar-sized projects as those addressed in SB 610 (2002).

3.1.8 California Water Action Plan

Under the direction of Governor Edmund G. Brown, the California Resources Agency, the California Environmental Protection Agency, and the California Department of Food and Agriculture worked with others to complete a plan of action for the sustainable management of California's water resources over the next one to five years. In January 2014, the Governor approved the California Water Action Plan (California Natural Resources Agency, 2014), which identifies declining groundwater supplies as a challenge for managing California water resources and sets the direction for improving sustainable groundwater management. The plan identifies 10 key actions to address groundwater and other water resources challenges, including "expand water storage capacity and improve groundwater management."

The California Water Action Plan further provides a clear statement about the State's investment priorities for improving groundwater management, including the following:

- Provide essential data to enable sustainable groundwater management
- Support funding partnerships for storage projects
- Update bulletin 118, California's groundwater plan
- Improve sustainable groundwater management
- Support distributed groundwater storage
- Increase statewide groundwater recharge
- Accelerate clean-up of contaminated groundwater and prevent future contamination

3.1.9 Public Trust Doctrine

The public trust doctrine stands for the proposition that certain natural resources (e.g., navigable water) are the property of all citizens and subject to supervision by the State, which holds the resource as a trustee for the benefit of all Californians. Currently, the public trust doctrine does not apply to groundwater, but as discussed below, ongoing litigation may modify this.

In the classic 1983 "Mono Lake" case, the California Supreme Court explained that the "state has an affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible" (*National Audubon Society v. Superior Court* (1983) 33 Cal.3d 419, 437, 446). The Court held that the public trust doctrine extends beyond direct application to "navigable" waterways to cover curtailment of harmful diversions of non-navigable tributaries, where curtailment is necessary to protect navigable waters.

Ongoing litigation over the Scott River may help to resolve the question of whether the public trust doctrine should be applied to groundwater. A July 2014 ruling by the Sacramento County Superior Court held that the public trust doctrine protects navigable waters from harm caused by groundwater extraction, where the groundwater is "so connected to the navigable water that its extraction adversely affects public trust uses." The trial court did not hold that groundwater is a public trust resource; rather that groundwater pumping can be curtailed in order to protect navigable waters that are connected to the groundwater basin. But the case is far from over. Siskiyou County filed a Petition for Writ Mandate in the California Supreme Court on August 25, 2014, seeking Supreme Court review, but at the time of drafting this report the Court had not yet acted on the petition. If the Supreme Court takes the case, the parties will file briefs and the Court will later set the matter for oral argument. The Supreme Court could also deny the petition, in which case it is anticipated that Siskiyou County would seek review in the Court of Appeal. The Supreme Court could also grant Siskiyou County's petition but send the case to the Court of Appeal for its decision.[8]

3.1.10 Public Interest Considerations in the California Water Code

The California Water Code contains a broad policy statement that expresses legislative intent to consider the protection of the "public interest" when determining how both surface water and groundwater should be used in the State:

> *"It is hereby declared that the protection of the public interest in the development of the water resources of the State is of vital concern to the people of the State and that the State shall determine in what way the water of the State, both surface and underground, should be developed for the greatest public benefit."* (Water Code, §105.)

But, this statement of general policy has little regulatory effect, and its mention of "underground" water is merely an implied assertion of jurisdiction to regulate groundwater.

In contrast, the Water Code is clear about the SWRCB's duty and authority when considering applications to appropriate surface water: "The [SWRCB] shall reject an application when in its judgment the proposed appropriation would not best conserve the public interest" (Water Code, §1255; see also Water Code, § 1253).

[8] For more details, see *Environmental Law Foundation v. SWRCB*, Case No.: 34-2010-80000583, July 15, 2014 Order at http://www.envirolaw.org/documents/ScottOrderonCrossMotions.pdf.

3.1.11 Federal Regulation: Safe Drinking Water Act, Clean Water Act, and CERCLA

Several federal laws set national standards for maintaining water quality, which in some instances impact groundwater management. State compliance with these federal laws is largely managed by the SWRCB and the Regional Boards, with oversight from the U.S. Environmental Protection Agency (EPA).

The federal Safe Drinking Water Act (SDWA) authorizes the EPA to set standards for drinking water quality and to oversee state and local implementation of these standards. The SDWA applies to drinking water from numerous sources, including groundwater wells (except for private wells which serve fewer than 25 individuals).

The federal Clean Water Act (CWA) aims to, among other things, restore and maintain the chemical, physical, and biological integrity of the nation's waters by preventing point and nonpoint pollution sources. There is disagreement in the courts about the extent to which the CWA applies to groundwater. Some courts have held that a NPDES permit is needed for discharges into groundwater that is connected to jurisdictional surface water.

Finally, groundwater quality is also managed through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Under CERCLA, the EPA has enforcement authority to conduct hazardous waste site assessment and remediation, including remediation of groundwater contamination.

3.2 Regional/Local Management

This section contains information about regional and local groundwater management in California for adjudicated and non-adjudicated basins.

3.2.1 Adjudicated Basins

Groundwater adjudication is the process by which a court identifies water rights holders in a given basin and issues a court decree that not only determines how much groundwater each entity may use on an annual basis but also develops a physical solution for the basin. There are 26 adjudicated groundwater basins and subbasins in the State (SB 1168 §10720.8). To some, adjudication carries a negative connotation that implies a court-mandated production limit on groundwater pumping, while others may believe adjudication is necessary and has the potential to improve groundwater conditions and reliability. Adjudication may provide mutual prescription of water rights that helps restore the supply-demand balance to a basin (Blomquist, 1992). In fact many of the 2014 Water Leaders Class mentors referenced several adjudicated basins as effectively managed groundwater basins. In some cases, adjudication has helped create a flexible, locally-managed governance structure, while the court has continuing jurisdiction over water rights. Moreover, as new things come up and the conditions of the basin change, opportunities can present themselves to make amendments to a judgment. This adaptability can provide for more flexibility and creative solutions; for example, by subsequent amendments provided by the Upper San Gabriel Valley Municipal Water District in the Main San Gabriel Basin judgment.

While the adjudication process can become a lengthy and costly endeavor, the final judgment provides certainty and predictability for all parties and makes water rights fungible with the ability to lease or sell those rights. According to Ken Manning, Executive Director of the San Gabriel Basin Water Quality Authority who has extensive experience with both the Main San Gabriel Basin and the Chino Basin, one of the most valuable resources in the adjudication process is the data collected in the characterization of the basin that can lead to a better understanding of the basin, more logical decision-making, and better groundwater management. The end result could have many benefits for water rights holders and water users. When parties reach a negotiated settlement agreement, the court approves a judgment also known as physical solution of the basin that specifies basin boundaries, extraction rights and appoints or creates a managing body to enforce the rules of the basin's use and produce annual reports to the court.

The role of this governing entity, known as the Watermaster, has evolved over time. In the "early generation" of adjudication, as Ken Manning describes the evolution of this role, the Watermaster was one person at DWR and was seen more as an accountant, with powers limited to tracking inputs (recharge) and outputs (pumping and leakage or underflow). Today the Watermaster is made up of a board of water rights holders and plays a more pronounced role in the "second generation" of adjudicated basins. The biggest change in authority was the ability to regulate groundwater pumping, followed by the ability to use storage as a tool for groundwater management. When the very first adjudications took place in the 1950s no one thought about using groundwater aquifers as storage. However, as time passed and stakeholders learned from their past experiences, people became more open to the role of the Watermaster and the creation of a representative board versus having only one person act as a record keeper.

3.2.2 Non-Adjudicated Basins

Many groundwater basins are managed to some degree by either a single local agency or a network of entities working in cooperation to deal with region-specific concerns. These entities vary widely in their approach to planning, methods and level of implementation, and ability to sustainably manage groundwater quantity and quality to meet long-term needs.

Through their existing police powers, cities and counties in California have the ability to develop local groundwater ordinances. Just over half of California counties–30 out of 58–currently have some form of ordinance that addresses groundwater management, the most common of which require permits for drilling wells and the extraction of groundwater (DWR, 2014e; DWR, 2003).

Additionally, there are currently 13 Special Act Districts, created and given specific authorities by the State legislature to manage local groundwater basins. For instance, Santa Clara Valley Water District and Orange County Water District, both listed by multiple 2014 Water Leaders Class mentors as examples of effective groundwater management agencies, have the ability to regulate groundwater use through pump taxes, but cannot directly limit extraction.

4.0 Barriers to Effective Groundwater Management and Management Success Stories

4.1 Barriers to Effective Groundwater Management

Effective groundwater management can be very complex, and is often hindered by one or more issue areas, such as: funding; data management and accessibility; the California water management system; governance and regulatory oversight; education and communication; and water demand pressures. Each of these barriers to effective groundwater management is addressed below, using input provided by the 2014 Water Leaders Class mentors as well as independent research conducted by the Water Leaders Class.

4.1.1 Funding

Funding for groundwater management activities comes from various sources and depends on the management structure in the affected basin. Historically, the majority of funding for groundwater management plans has come from voter-approved bonds, local tax revenue, and other funding sources (Hanak et al, 2014). Although some agencies are allowed to implement groundwater pumping charges, as of 2014, the majority of those agencies have not; only 6 of the 14 groundwater management agencies created by special acts charge pumping fees and of the 26 adjudicated basins, only a few charge replenishment fees (Hanak et al, 2014). In some places, such as Kern County, an agency may operate a groundwater banking program for third parties as a way to raise funds for infrastructure to help with conjunctive use management in addition to the use of state bonds.

4.1.2 Data Management and Accessibility

Sustainable groundwater management cannot be ensured without the proper data to inform management decisions. The following information is typically necessary for groundwater managers to ensure sustainable use:

- Groundwater aquifer characterization: size, geology, recharge area delineation, etc.;
- Groundwater quality;
- Well log information and pumping rates; and
- Land surface compaction and subsidence.

Data quality must also be ensured. Data are expensive and difficult to collect, and technical expertise is needed to obtain, manage, and analyze it. Rural and disadvantaged communities, in particular, struggle to ensure groundwater protection and sustainable use, where the technical and financial capacity to do so is lacking. How the monitoring program is structured is also an

important consideration. Monitoring and production wells should collect data often enough and from enough locations in order to accurately assess groundwater basin conditions under current and projected land and water management scenarios, as well as climate scenarios. If there is not a single entity collecting data, separate monitoring entities must use common protocols when collecting and reporting data to ensure that it is comparable and accessible for analysis.

Some of the fundamental information about a groundwater aquifer is available in the reports users file when a well is drilled. These well completion reports contain information such as aquifer conditions, characteristics, location of the well, depth of the well, proposed pumping rates, and the intended use. Despite the fact that every other Western state makes these reports publicly available, California law prevents public disclosure (Choy et al., 2014).

There are groundwater monitoring programs in place but there are significant data gaps in many groundwater basins. Two statewide systems that are in place to monitor groundwater conditions include the CASGEM and GAMA programs. The CASGEM program requires local groundwater monitoring entities to coordinate groundwater elevation monitoring and reporting to DWR, and the GAMA program collects test results and existing groundwater quality data from several agencies into a publicly accessible information system. Prior to implementation of these programs, centralized, state-wide information about groundwater levels and quality did not exist. These programs are a necessary first step in producing much-needed information regarding groundwater conditions.

However, there remains an overall lack of comprehensive, state-wide, quality, readily-available data and there are still significant information gaps that preclude effective groundwater assessment and management. For example, DWR recently reported that 40 of the 126 high- and medium-priority groundwater basins are not monitored under CASGEM and there are significant CASGEM groundwater monitoring data gaps in the Sacramento, San Joaquin River, Tulare Lake, Central Coast, and South Lahontan hydrologic regions. And although CASGEM ensures that DWR receives elevation data at least twice a year, monitoring entities are not required to submit information on pumping rates. The lack of pumping information precludes adequate understanding of the rate of overdraft, subsidence, and sustainable yield of an aquifer. CASGEM currently does not provide all the monitoring data that might be useful for management, perhaps in part due to funding limitations. Statewide information about recharge as well as surface and groundwater interactions is also unavailable as a result of insufficient long-term monitoring and reporting.

4.1.3 California Water Management System

In California, surface water and groundwater are not only physically linked, but also operationally linked. The reliability of surface water can affect the reliability of groundwater in many ways. For example, when surface and groundwater systems are directly connected, surface water draw down results in groundwater drawdown. In addition, conjunctive use systems depend on a plentiful and reliable surface water supply that can recharge groundwater supplies and bank water for future dry years. And, perhaps most importantly, when less surface water is available, such as during the summer months or times of drought, water users increase use and reliance on groundwater.

Generally, effective groundwater management depends on the availability of alternative or supplemental surface water supplies, but California's surface water supplies are unreliable. California has highly variable precipitation - more than any other State - that can fluctuate from less than 100 million acre-feet in dry years to more than 375 million acre-feet in wet years. On average, the bulk of our precipitation arrives in only 5 to 15 days per year (Dettinger et al., 2011). Since the quantity and timing of surface water can vary widely from year to year with no predictability, and since surface water and groundwater are interlinked in many ways, effective groundwater management requires accounting for the variability in surface water supplies.

Some of California's precipitation and snowmelt are captured in upstream storage reservoirs. Surface water releases from reservoirs are regulated for a variety of considerations, including environmental, flood management, hydropower, recreational, and water supply. Regardless to whether these operating rules are necessary or archaic and outdated, they introduce a rigidity into the management of the California surface water system that complicates effective groundwater management.

4.1.4 Governance, Regulatory Oversight, and Enforcement

Prior to the Management Act, California was the only Western state without a comprehensive legal framework regulating groundwater use. Groundwater use in California still largely retains the characteristics of the "Wild West," with very little regulation or oversight. As a result, there was no motivation for groundwater users to curtail their pumping rates or assess what level of pumping a basin could sustainably support. According to the 2014 Water Leaders Class mentors, many groundwater users are aware that their current pumping rates are unsustainable, but without implementation and enforcement of regulatory standards or the existence of basin-wide groundwater management plans, there is no incentive or requirement for water users to reduce pumping rates.

4.1.5 Education and Communication

In some regions of California, there is insufficient information and education regarding the groundwater basin characteristics, the scope and nature of groundwater use, and the challenges facing groundwater basins. This lack of education can be a barrier to effective groundwater management if groundwater users are not informed about the conditions of their basin.

Also, in the California groundwater world, there are many stakeholders with different interests and objectives. Water suppliers, regulators, environmentalists, farmers, urban, and industrial users all hold varying viewpoints and attitudes towards regulation of groundwater. These differences often present challenges to developing a basin-wide approach to groundwater management and can be exacerbated by a lack of communication between individual water users, governmental entities, and the public. Historically, coordination between stakeholders has been weak with little to no incentive or requirement to cooperate. Thus, despite groundwater being a common resource by its nature, in most groundwater basins there is insufficient communication, collaboration, and coordination amongst stakeholders.

4.1.6 Water Demand Pressures

Effective groundwater management is challenged by pressure from various water users, with primary uses throughout the State being urban, agricultural, and environmental. Agriculture relies heavily on groundwater, especially in droughts, and particularly for water-intensive or

permanent crops. Some farmers have made the transition from annual crops to more profitable permanent crops. As an example, almonds, one of California's largest permanent crops, increased around 30 percent from 1996 to 2005 (Adelman, 2007). Tree and vine crops, both permanent crops, utilize a large percentage of agricultural water in California. Three million of California's nine million acres of irrigated farmland are in tree and vine crops, providing more than 59 percent of the State's gross crop revenues (Lund et. al, 2014).

In some areas, "excess" water percolating into the ground from irrigation is an important input to groundwater storage and recharge, although the quality of this water is often degraded and the ability to access it for use later on is not always guaranteed. Alternately, some believe that overdraft due to agriculture is partly due to changing agricultural uses. For example, in Paso Robles and the eastern San Joaquin Valley, agriculture has expanded into former rangelands with growers using irrigation systems that rely on groundwater (Harter, 2014).

California's growing population also impacts groundwater and contributes to overdraft. Approximately half of California's population depends on groundwater for its drinking water (Natural Resources Defense Council, 2001). Particularly in times of drought, groundwater is heavily relied on to compensate for reduced surface water supplies. California's growing demand for water poses a challenge for effective groundwater management, particularly where current levels of groundwater use exceed the basin's sustainable yield.

4.2 Groundwater Management Success Stories

As previously discussed, prior to the Management Act, California did not utilize a comprehensive state-wide approach to groundwater management. Although this left some areas with virtually no management of groundwater resources, other areas have utilized various legal tools and management approaches to implement long-range plans aimed towards groundwater sustainability and water supply reliability. This section explores how a particular groundwater basin should be considered "effectively managed", and provides several examples of different types of management approaches.

4.2.1 What Makes Groundwater Management Effective at the Basin Level?

As described in the Introduction to this report (Section 1.0), the 2014 Water Leaders Class participants worked with mentors throughout the year, and interviewed each mentor using a common set of questions focused on groundwater management. One of these questions asked for specific examples of effectively managed groundwater basins, and the key factors leading to their success. While numerous individual basins were put forward by the mentors, the reasoning behind each nomination showed common themes around governance structures, authorities, and other water management activities. Commonalities among effective groundwater management at the basin level are summarized below.

- **Creation or designation of a local agency with clear responsibility for basin groundwater management**. Components of this include locally-driven management, accountability, and flexibility to decide priorities.

- **Good communication, active involvement, and inclusive processes.** Several related key factors include openness and trust through regular communication, stakeholders working together actively and cooperatively towards common objectives, and management entities having the opportunity to sit down with regulators to work through local issues.

- **Replenishment programs**. Developing clear plans and methods for recharging groundwater, which may include use of recycled water.

- **Groundwater management as part of more integrated water management at the local scale.** Local and regional investments in complementary water management activities, including conjunctive use and active water conservation programs.

- **Regulatory authority and tools for management.** Several mentor responses noted control over well drilling and groundwater extraction as a key component of effective management. This includes local agencies having the ability to constrain groundwater use and development through well permitting or other pumping limitation processes, as well as having enforcement authority.

- **Adjudication**. Several mentors mentioned basin management was effective because of the adjudication process, referencing some of the regulatory authorities listed above, such as pumping limitations and enforcement.

- **Extensive collection of groundwater data**. Thorough knowledge of basin levels, quality, pumping demand and other data points can help groundwater entities make informed management choices.

- **Financial mechanisms for management**. Sustainable funding sources for groundwater planning and implementation are important for achieving management goals. Mentors mentioned local fee authority as a key factor, but also noted that basins with revenue from large urban bases were more likely to be successful.

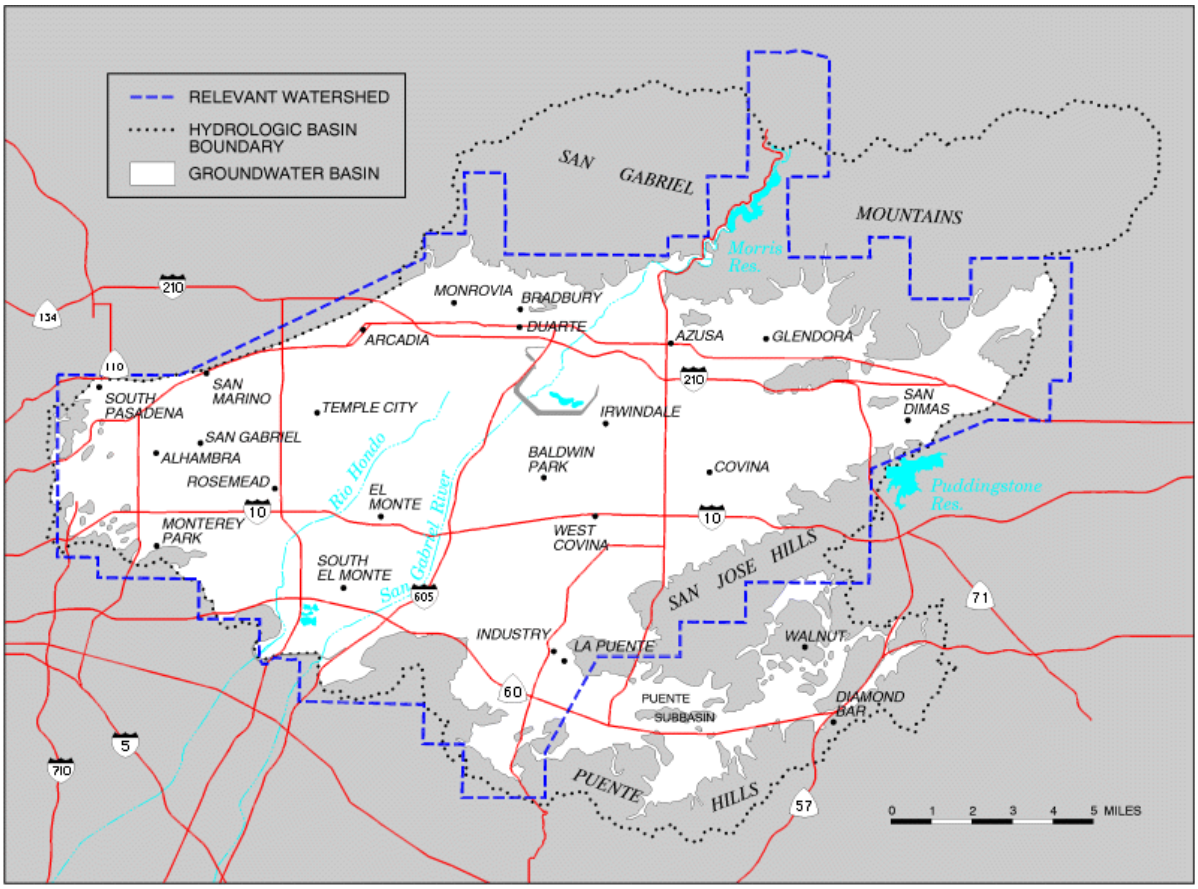
- **Public education**. In several basins, public outreach and engagement have helped lead to more support for fees and local government ordinances related to groundwater management.

4.2.2 Examples of Effectively-Managed Groundwater Basins

As described throughout this report, groundwater resources throughout California are managed in different ways, depending on a variety of factors such as local conditions, agency involvement, and access to funding. Based on input from our mentors, the 2014 Water Leaders Class identified three groundwater basins that are currently being successfully managed, using different management techniques. These basins, described in detail below, include the following: Main San Gabriel Basin (adjudicated), Santa Clara and Llagas Subbasins (special act district), and Sacramento Groundwater Basin (network of local agencies).

4.2.2.1 Adjudicated Basin: Main San Gabriel Basin

The Main San Gabriel Basin is a positive example of a successfully managed adjudicated groundwater basin (Figure 4-1). The overview of this basin draws from the history written in "Dividing the Waters" by William Blomquist, as well as interviews and correspondence with San Gabriel Valley water experts: Tony Zampiello, Executive Officer, Main San Gabriel Basin Watermaster; Shane Chapman General Manager, Upper San Gabriel Valley Municipal Water District; Ken Manning, Executive Director, Main San Gabriel Basin Water Quality Authority; and Wendy La, Engineer/Principal, LASER LLC. The basin was informally managed prior to its adjudication in 1973. During early disputes over the San Gabriel River surface flows, institutional arrangements across multiple agencies were made to monitor the groundwater conditions. The installation of the Baldwin Park Key Well in 1931 (which was later incorporated



Source: Main San Gabriel Basin Watermaster, 2013

Figure 4-1. Main San Gabriel Basin Map

into the judgment) marked an important step in the history of the basin, as this monitoring well located in the center of the basin allowed water users to have a shared picture of the basin conditions. In the 1940s, the San Gabriel Valley experienced a period of rapid urbanization, which led to an increased demand for water drawn from the Main San Gabriel Basin. The rise in water consumption coupled with a 20-year drought cycle lead to the overdraft of the basin.

The Main San Gabriel Basin encompasses 73,000 acres, has more than 300 production wells and associated facilities and 17 spreading grounds for groundwater recharge. Ninety percent of the

basin's water supply comes from the percolation of the adjacent San Gabriel Mountains National Monument. In September of 1965, the Baldwin Park Key well registered a record low of 209 feet above sea level; the contract engineer determined that the basin was in overdraft, and not enough imported water supplies were available. The various water agencies in the basin realized a solution was needed in addition to ensuring that enough water would flow to the neighboring Central Basin. After five years of negotiation, a court judgment was entered in 1973. The judgment defined the water rights of 190 original parties in five different categories. It created a new governing body, the Main San Gabriel Basin Watermaster, and described a program for management of water in the basin.

The Watermaster has the authority to make policy-level decisions as well as monitoring functions. Moreover, the Watermaster has the authority to assess four different types of fees on water producers that support management programs. Many of the Water Leaders mentors identified fees as a change they recommend to ensure effective groundwater management. The Watermaster also has the authority to "pre-purchase" imported water whenever it is available using a line of credit. The decision of purchasing the replenishment water upfront versus at the end of the water year when rates are likely higher represents significant cost savings and a wise decision for local water producers. This practice enables the Watermaster to maintain water storage in the basin within the safe yield. One of the greatest tools given to the Watermaster through the judgment is the ability to store water in the basin and practice conjunctive use in the importation and spreading of Bay Delta and Colorado River water, while maintaining the flexibility to manage supply locally based on the basin's conditions. As surface water supplies have become more limited and science has proven recycled water meets public health standards, the judgment was amended to allow recycled water for the basin's replenishment. This is indicative of the ability to amend a judgment as conditions change as well as the evolution of replenishment programs.

In 1979 EPA discovered groundwater contamination that came from decades prior, due to industries' poor chemical handling and disposal practices. The Watermaster's role in water quality significantly expanded, as the Main San Gabriel Basin became the largest Superfund site in the nation. This led to the creation of the San Gabriel Basin Water Quality Authority (WQA), an agency charged with the development, financing and implementation of groundwater treatment and remediation programs. The water rights assigned through adjudication gave producers an incentive to work through the San Gabriel Basin WQA with responsible parties and leverage federal funds to pump, treat and serve this water to customers. Thanks to the collaboration of local, state and federal entities, the 31 treatment facilities in the basin have removed over 140,000 pounds of contaminants. Today the beneficial use of this treated water comprises about 60 percent of the water produced in the basin and provides a reliable drinking water supply for 3.4 million valley residents and businesses.

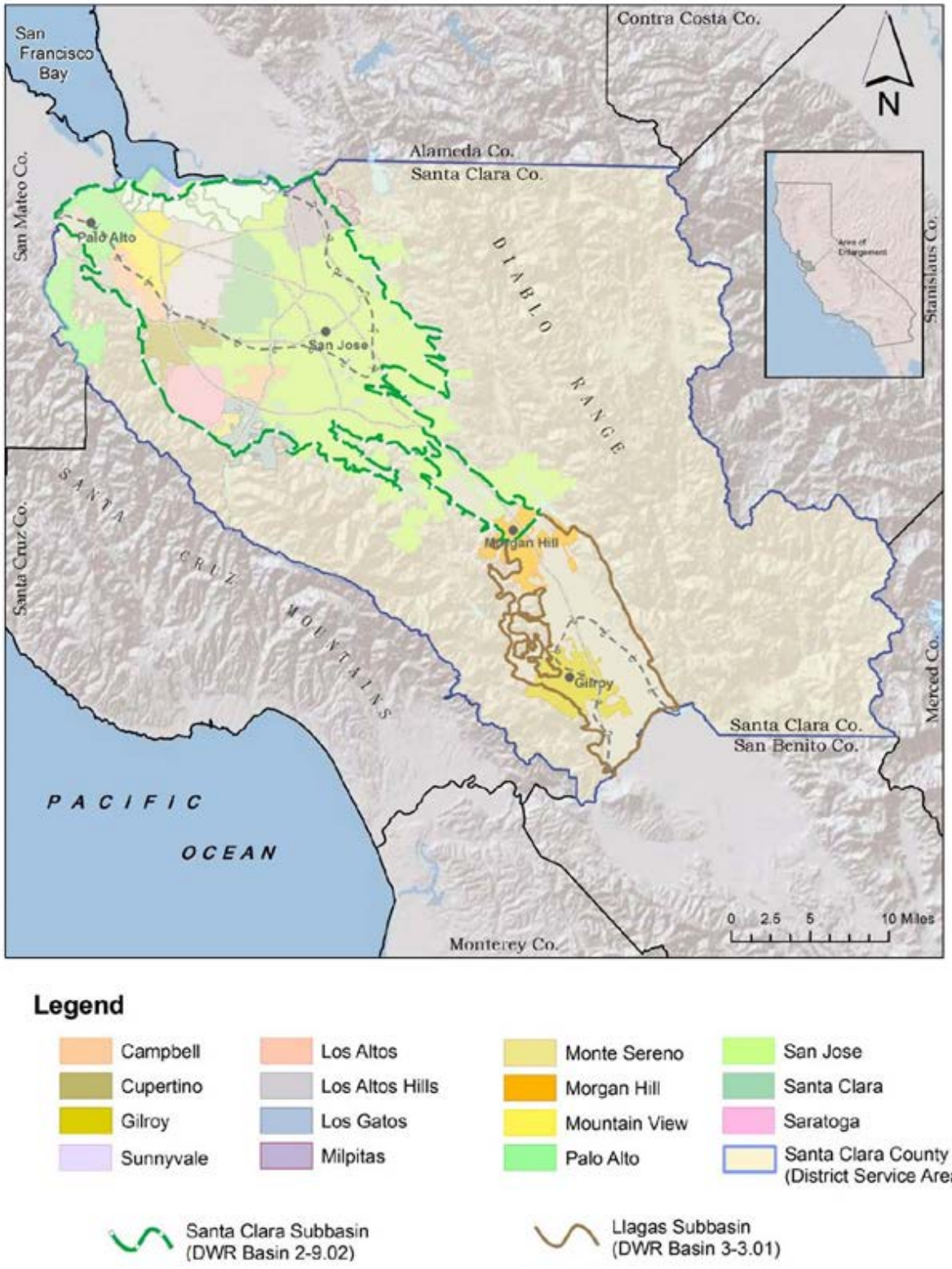
Since the basin's adjudication in 1973, it has operated within or very close to its safe yield of 200 to 250 feet above sea level (except for a record low of 190 feet in December, 2010) according to the Baldwin Park Key Well. To date, no water producer has received sanctions for overproduction or for failing to pay their assessments to the Watermaster. Even though the basin still continues to meet its ongoing challenges to clean up legacy pollution and meet the water demands of an ever-growing population, it has demonstrated immense efficiency in preventing degradation and depletion of groundwater. A strong collaborative effort amongst agencies exists

to further improve the region's local reliability by increasing capacity at existing water resources facilities, investment in recycled water and stormwater capture, and raising awareness about water conservation. All these practices have led to a well-managed and sustainable state of the Main San Gabriel Basin.

4.2.2.2 Special Act District: Santa Clara and Llagas Subbasins

The Santa Clara Valley Water District (SCVWD) is the groundwater management agency for the Santa Clara and Llagas Subbasins in Santa Clara County (Figure 4-2). SCVWD was noted by several of the 2014 Water Leaders Class mentors as having an excellent groundwater management plan.

Local communities in the Santa Clara and Llagas Subbasins have relied on groundwater since the 1850's to meet residential, agricultural and industrial demands. By the 1920s, far more water was being pumped than nature could replenish, resulting in declining groundwater levels and permanent land subsidence. The SCVWD was formed in 1929 by an act of the California legislature through the Santa Clara Valley Water District Act for the purpose of providing comprehensive management for all beneficial uses and protection from flooding within Santa Clara County.



Source: Santa Clara Valley Water District, 2012

Figure 4-2. Santa Clara Valley Water District Overview Map

Since the 1930s, SCVWD has sought to maximize conjunctive use between surface and groundwater supplies to enhance water supply reliability. Local groundwater resources must be augmented by other water supply management activities to reliably meet the needs of the local community and environment. These activities include managing recharge of imported and local supplies, acquiring supplemental water supplies, and water conservation and recycling.

The SCVWD has a comprehensive groundwater management plan that contains key outcome measures to evaluate the effectiveness of groundwater management actions. These outcome measures were cited by 2014 Water Leaders Class mentors and other experts as one of the reasons groundwater management continues to be so successful in the region. The outcome measures used to evaluate the groundwater management program include the following:

1. Projected end-of-year groundwater storage is greater than specified volumes for each subbasin.

2. Groundwater levels are above subsidence thresholds.

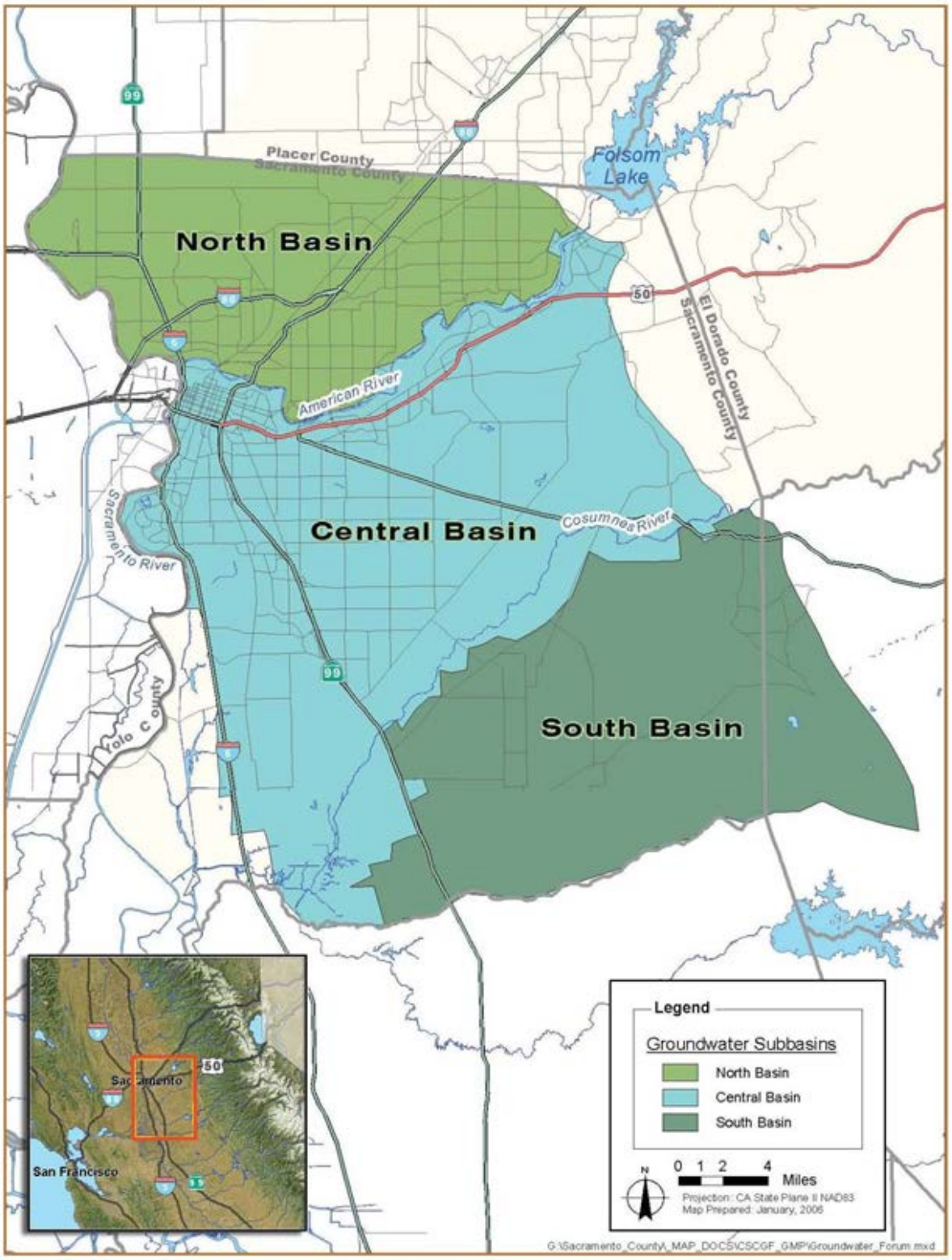
3. At least 95 percent of water supply wells meet water quality standards for drinking and agriculture.

4. At least 90 percent of wells in both the shallow and principal aquifer zones have stable or decreasing concentrations of nitrate, chloride, and TDS.

If evaluation of the outcome measures indicates poor performance, potential changes to existing programs and activities are considered. Any significant policy or investment decisions are developed and evaluated in consultation with local stakeholders. The proactive approach to groundwater management programs and activities have helped to maintain groundwater levels, minimized land subsidence, and improved groundwater protection.

4.2.2.3 Network of Local Agencies: Sacramento Groundwater Basin

Unlike an adjudicated basin or a special act district, where authority for managing groundwater resources is consolidated in one agency, the Sacramento Groundwater Basin is managed by a complex network of entities and stakeholders (Figure 4-3). Intensive use of groundwater in the Sacramento Groundwater Basin over the past 60 years has resulted in a general lowering of groundwater elevations of up to 50 feet in some areas. Over time, isolated groundwater depressions have grown and coalesced into a single cone of depression.



Source: Sacramento County Water Agency, 2006

Figure 4-2. Sacramento Groundwater Basin Map

Beginning in 1993, agencies and stakeholders in Sacramento County participated in a collaborative planning process called the Water Forum. The intent of the Water Forum was two-fold, as follows:

1. Provide a reliable and safe water supply for the region through the year 2030,

2. Preserve the environmental and recreational values of the lower American River.

In April 2000, Water Forum members approved the Water Forum Agreement, which consists of seven integrated actions necessary to accomplish the two main objectives. One of the seven elements in the Water Forum Agreement is groundwater management. The Water Forum Agreement divided Sacramento Groundwater basin into three subbasins, the North, Central, and South areas and recommended that each subbasin develop local groundwater management authorities and plans.

The North Basin is managed by the Sacramento Groundwater Authority. The Central Basin is managed by the Sacramento Central Groundwater Authority. The South Basin is managed by the Southeast Sacramento County Agricultural Water Authority. Each of these agencies was formed under a joint powers of authority with a wide variety of local cities, the County and water providers. Each of these agencies has an independent groundwater management plan but the management objectives of each plan are consistent with the objectives of the Water Forum Agreement.

Stakeholders throughout the Sacramento Groundwater Basin are in the process of establishing one or more agencies with the authority to implement the existing groundwater management plans and ensure that the groundwater management objectives can be achieved across all three subbasins.

5.0 Sustainable Groundwater Management Act of 2014

Amidst record-setting drought conditions, the Management Act recognizes the diversity of groundwater conditions throughout the State, including the patch-work regulatory landscape and barriers to effective groundwater management discussed in preceding sections of this report. In recognizing the variability of these conditions and barriers, the Management Act aims to provide a new pathway forward for California groundwater management.

5.1 Introduction

Facing a record drought and dramatic groundwater declines in some areas of the State, the California Legislature passed a package of bills on August 29, 2014, intended to comprehensively regulate groundwater in California. The 2014 Management Act creates the greatest change to water rights in California since 1914.

The Management Act is comprised of three pieces of legislation: SB 1168, which sets the groundwork; AB 1739, which provides the enforcement mechanism; and SB 1319, which provides “clean up” language. Governor Brown signed the legislation on September 16, 2014, making the Management Act effective on January 1, 2015.

The Management Act aims to provide for local planning and management of groundwater basins. As described in Section 2.2 (Groundwater Basins and Conditions) of this report, DWR has defined 515 alluvial groundwater basins and subbasins in California. The Management Act requires DWR to prioritize these basins as high-priority, medium-priority, low-priority, or very low-priority using the CASGEM system by January 31, 2015. The Management Act encourages, but does not require, that basins defined as low- and very low-priority; develop or be managed under a groundwater sustainability plan (GSP). High- and medium-priority basins however, are required to develop and implement their own local GSP or functional equivalent established by the local Groundwater Sustainability Agency (GSA) by the deadlines established in the Management Act. If a basin fails to meet the requirements within the statutory deadlines, the Management Act authorizes the SWRCB to designate the basin as a probationary basin, develop an interim groundwater management plan for that basin, and assume the management authorities that the Management Act has granted to GSAs until the local GSA can assume management of the basin. The Management Act states that it will not alter, establish, or determine groundwater or surface water rights, but rather, establishes the policy of the State that groundwater resources be managed sustainably for long-term reliability and multiple beneficial uses.

5.2 Intent of the Management Act

The Management Act states that it is intended to accomplish each of the goals listed below (§ 10720.1):

1. To provide for the sustainable management of groundwater basins.

2. To enhance local management of groundwater consistent with rights to use or store groundwater and Section 2 of Article X of the California Constitution. It is the intent of the Legislature to preserve the security of water rights in the state to the greatest extent possible consistent with the sustainable management of groundwater.

3. To establish minimum standards for sustainable groundwater management.

4. To provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater.

5. To avoid or minimize subsidence.

6. To improve data collection and understanding about groundwater.

7. To increase groundwater storage and remove impediments to recharge.

8. To manage groundwater basins through the actions of local governmental agencies to the greatest extent feasible, while minimizing state intervention to only when necessary to ensure that local agencies manage groundwater in a sustainable manner.

5.3 Groundwater Sustainability Agency

Under the Management Act, a Groundwater Sustainability Agency may be "any local agency or combination of local agencies overlying a groundwater basin" (Wat. Code, § 10723(a)). The GSA is responsible for carrying out requirements of the Management Act including but not limited to the development and implementation of Groundwater Sustainability Plans. This section further describes the establishment and responsibilities of GSAs.

5.3.1 Establishment and Coordination

In accordance with the Management Act, a "local agency" that may elect to be a GSA is any "local public agency that has water supply, water management, or land use responsibilities within a groundwater basin" (Wat. Code, § 10721(m)). The Management Act identifies a list of existing agencies as the "exclusive" agencies within their statutory boundaries that may elect to be the GSA, but those agencies have the option to "opt out" of being the GSA if they choose (Wat. Code, § 10723(c). If a portion of a groundwater basin is excluded from the boundaries or otherwise not within a management area of a GSA, the county in which the unmanaged area lies is presumed the default groundwater sustainability agency for such area (Wat. Code, § 10724(a)).

A GSA may be formed by a single local agency or a combination of local agencies overlying a groundwater basin. If the GSA is formed by a combination of local agencies, the local agencies

must enter into a legal agreement, such as a joint powers agreement or memorandum of agreement. The Management Act indicates that multiple GSAs can exist in a single basin, but they must either prepare a single plan together or enter into a coordination agreement the covers the entire basin. In addition, the Management Act provides a process for local agencies to request revisions to the boundaries of a basin, including the establishment of new subbasins (Wat. Code, § 10722.2).

5.3.2 Powers of the GSA

The Management Act gives a GSA broad power to adopt rules, regulations, ordinances, and regulations and take any action it deems necessary to carry out the Management Act. These powers and responsibilities include the following:

- Determine the need for groundwater management;
- Prepare and adopt a groundwater sustainability plan and implement rules and regulations;
- Propose and collect fees; and
- Monitor compliance and enforcement.

The GSA may investigate surface waters and groundwater, as well as surface and groundwater rights. The GSA may also inspect the property or facilities of a person or entity in its management area to assess compliance with the Management Act, after obtaining the necessary consent or inspection warrant.

A GSA may also:

- Require registration of wells within its management area;
- Require every well in the management area be measured by a water measuring device, at the expense of the well owner;
- Require a well owner or operator to file an annual statement setting forth the total extraction of groundwater from that well for the previous year;
- Acquire, hold, use, enjoy, sell, let and dispose of real and personal property including lands and water rights and construct, maintain, alter and operate any works or improvements within or outside the GSA as necessary and proper to carry out the Management Act;
- Appropriate, acquire, import, conserve and store surface water and groundwater and surface and groundwater rights as necessary and proper to carry out the Management Act, including for conjunctive use;
- Establish a program for voluntary fallowing of agricultural lands;
- Perform acts necessary to enable the GSA to purchase, transfer, deliver or exchange water or water rights; and

- Transport, reclaim, purify, desalinate, treat or otherwise manage and control polluted water, wastewater, or other waters.

A GSA has the additional authority to regulate groundwater extractions by:

- Imposing spacing requirements on new wells and imposing reasonable operating restrictions on existing wells to minimize well interference;

- Controlling groundwater extractions by regulating, limiting or suspending extractions from individual wells or in the aggregate, construction of new wells, enlargement of existing wells, reactivation of abandoned wells, or otherwise establishing groundwater extraction allocations; and

- Authorizing temporary and permanent transfers of groundwater extraction allocations; and establishing rules to allow unused groundwater extraction allocations to be carried over one year to another and voluntarily transferred.

Any limitation on groundwater extractions by a GSA, however, shall not be construed to be a final determination of rights to extract groundwater from the basin. As described above, the Management Act aims to govern how groundwater rights are exercised throughout the State but does not alter, establish, or determine such rights.

5.3.3 Financial Authority

In accordance with the Management Act, the local GSA has the authority to impose fees on groundwater extraction or other regulated activity to fund the cost of the local GSP. In order to impose or increase a fee a GSA must hold at least one public hearing prior to imposing or increasing fees on the owners or operators of wells either through an ordinance or resolution. The fees may include, but are not limited to: permit fees and fees on groundwater extraction or other regulated activity; funding the cost of a groundwater sustainability program; and funding investigations, inspections, compliance assistance, enforcement, and program administration. A GSA may also adopt a resolution requesting collection of fees in the same manner as ordinary municipal ad valorem taxes. Fees on the extraction of groundwater must be adopted in accordance with subdivisions (a) and (b) of Section 6 of Article XIII D of the California Constitution.[9]

5.3.4 Local GSA Enforcement Powers

The Management Act grants the local GSA the authority to administratively impose civil penalties to a person who violates any rule, regulation, ordinance or resolution adopted by a GSA in accordance with Water Code Section 10725.2. A person who extracts groundwater in excess of any rule, regulation, ordinance or resolution is subject to a civil penalty not exceeding $500 per acre-foot of water extracted in excess of the person's authorized amount. If the person fails to

[9] If an owner or operator of a well subject to a fee does not pay, the GSA may bring a suit against the owner or operator for the collection of the delinquent fee, plus interest or penalties imposed. The GSA action may include attachment against the property of the owner or operator, or any other civil remedy available. The GSA may also, after a public hearing, order the owner or operator to cease groundwater extractions until all fees are paid.

comply within 30 days of receiving notification of the violation, he or she is subject to a civil penalty not to exceed $1,000 plus $100 for each additional day the violation continues.

5.4 Groundwater Sustainability Plan

In accordance with the Management Act, each GSA established within a high- or medium-priority basin must develop a GSP which meets requirements identified by DWR, and is adopted by the deadlines outlined in the Management Act. For high- or medium-priority basins that are subject to critical conditions of overdraft, the GSP deadline is January 31, 2020. For all other high- or medium-priority basins, the deadline is January 31, 2022. By January 1, 2016, the DWR shall adopt regulations for evaluating a GSP, evaluating an alternative plan to a GSP and coordination agreements, and evaluating implementation of a GSP. These regulations will identify necessary GSP and alternative plan components and appropriate methodologies and assumptions for baseline conditions.

A GSP may be a single plan covering an entire basin implemented by one GSA, one plan covering an entire basin implemented by multiple GSAs, or multiple plans implemented by multiple GSAs through a coordination agreement covering an entire basin. The GSPs must include details of the groundwater basin, including: groundwater levels, groundwater quality, and subsidence; water demands and supplies of the basin; any groundwater-surface water interaction; a map of the basin; and measurable objectives in increments of five years to achieve the sustainability goal in the basin within 20 years of the adoption of the GSP. The "sustainability goal" is defined in the Management Act through a combination of specific terms, which include "sustainability goal," "sustainable groundwater management," "sustainable yield," and "undesirable results", each of which is defined in the Management Act and provided below.

- "Sustainability goal" means: "the existence and implementation of one or more groundwater sustainability plans that achieve sustainable groundwater management by identifying and causing the implementation of measures targeted to ensure that the applicable basin is operated within its sustainable yield."

- "Sustainable groundwater management" means: "the management and use of groundwater in a manner that can be maintained during the [50-year] planning and implementation horizon without causing undesirable results."

- "Sustainable yield" means: "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result."

- An "Undesirable result" includes any of the following: (1) Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon; (2) Significant and unreasonable reduction in groundwater storage; (3) Significant and unreasonable seawater intrusion; (4) Significant and unreasonable degraded water quality; (5) Significant and unreasonable land subsidence that substantially interferes with surface land uses; and (6) Depletions of interconnected surface

water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

Using the terms and definitions provided above, the GSP must include measurable objectives to achieve operation of the basin within its sustainable yield, within 20 years of adoption of the GSP (unless DWR grants an extension). In addition, the GSP must provide for the management and use of groundwater in a manner that doesn't cause "undesirable results" over the 50-year planning and implementation horizon. In addition, the GSP must include, as applicable to the basin, components regarding: monitoring and management of groundwater levels, groundwater quality, subsidence, and changes in related surface flow; mitigation of overdraft; use of recharge areas and available surface water; control of saline water intrusion; well construction policies, measures addressing conjunctive use; and a variety of other items.

After adoption of a GSP, the GSA submits the GSP to DWR for review and approval.[10] If multiple GSAs create multiple GSPs for a single basin, the GSPs cannot be submitted to DWR until the entire basin is covered by GSPs. Once submitted, DWR will post the GSP(s) to their website for public comment, and DWR has two years to issue an assessment of the GSP(s). This assessment may include advising the GSA(s) of deficiencies in the GSP or approval of the GSP.

5.4.1 Alternative Plans

If a local agency believes it can implement an alternative plan to the GSP process that will satisfy the conditions established by DWR, the local agency may submit the alternative to DWR for evaluation and assessment by January 1, 2017 and every five years thereafter. An alternative plan may be a plan developed pursuant to any law authorizing groundwater management, management pursuant to an adjudication action or an analysis of basin conditions that demonstrates the basin has operated within its sustainable yield for ten years or more.

5.4.2 Continuing Reporting and Review

Each year following adoption of a GSP, the GSA must submit a report to DWR providing information regarding groundwater levels, groundwater use, surface water use for recharge, etc. At least every five years after the initial submission of a GSP or alternative plan, DWR shall review the GSP or alternative plan and the implementation of the GSP or alternative plan, including the progress toward achieving the sustainability goal for the basin.

5.5 State Backstop

The Management Act allows for State intervention in particular circumstances. The Management Act allows the SWRCB to designate a groundwater basin as probationary if one or more of the following circumstances is identified: failure to designate a GSA; failure to adopt a GSP or alternative plan; an inadequate GSP. Dates relevant to these circumstances, which would allow for State intervention, are provided below.

[10] The California Environmental Quality Act ("CEQA") does not apply to the preparation and adoption of a GSP. However, any implementation actions taken pursuant to an adopted GSP are subject to CEQA, effectively requiring CEQA compliance.

GSA Designation or Alternative Plans

- **By July 1, 2017:** GSA(s) are not designated for the entire basin; AND a local agency has not submitted an alternative plan that has been approved or is pending approval by DWR;

High- or Medium Priority Basins in Critical Overdraft (as of 2017)

- **By January 31, 2020:** GSA(s) have not adopted GSPs or DWR has not approved an alternative plan for an entire basin categorized as high or medium-priority that is in a condition of critical overdraft (as of 2017);

- **After January 31, 2020:** DWR, in consultation with the SWRCB, determines a GSP developed for a basin in critical overdraft is inadequate or a GSP for the basin is not being implemented in a manner that will likely achieve the sustainability goal;

Other High- or Medium-Priority Basins

- **By January 31, 2022:** GSA(s) have not adopted GSPs or DWR has not approved an alternative plan for an entire basin categorized as high or medium-priority;

- **After January 31, 2022:** DWR, in consultation with the SWRCB, determines a GSP is inadequate or a GSP is not being implemented in a manner that will likely achieve the sustainability goal AND the SWRCB determines the basin is now in a condition of long-term overdraft;

- **After January 31, 2025:** DWR, in consultation with the SWRCB, determines a GSP is inadequate or a GSP is not being implemented in a manner that will likely achieve the sustainability goal AND the SWRCB determines the basin is in a condition where groundwater extractions result in significant depletions of interconnected surface waters.

If DWR changes the priority of a basin from low or very low to medium or high, the basin will have two years from the date of the change of the priority to form a GSA and five years to adopt a GSP or receive approval of an alternative management plan in order to avoid probationary status. In addition, if the SWRCB finds litigation prevented the formation of a GSA or prevented a GSP from being implemented, the SWRCB shall not designate a basin as probationary for the period of time equal to the delay caused by the litigation. The SWRCB is also directed to exclude from probationary status any portion of a basin or subbasin for which a GSA demonstrates compliance with the sustainability goal.

If designated as probationary, the local agency or GSA has 180 days to correct any deficiency. The SWRCB may provide additional time to remedy the deficiency if it finds the local agency or GSA is making substantial progress toward remedying the deficiency.

If the SWRCB designates a basin, or portion of a basin, as probationary and the GSA fails to remedy the deficiency within the 180 days (or the extension period), the SWRCB, after notice and a public hearing, may adopt an interim plan for the basin. The interim plan must: identify the actions necessary to correct a condition of long-term overdraft or a condition where groundwater extractions result in a significant depletion of interconnected surface waters; set a time schedule

for the actions to be taken; and a description of the monitoring to be undertaken to determine effectiveness of the interim plan. The Management Act does not require the SWRCB to create its plan in compliance with the regulations promulgated by DWR governing the elements a GSA must include in its GSP. Thus, the SWRCB's interim plan may be completely of its own design.

The SWRCB's interim plan must be consistent with water right priorities, but may include: restrictions on groundwater pumping; a physical solution; and principals and guidelines for the administration of rights to surface waters connected to the basin.

The SWRCB's interim plan will remain in effect until the SWRCB determines either: a GSP adopted by a GSA for the entire basin or portion thereof is adequate or an adjudication action and judicial order or decree is adequate. The SWRCB may decline to rescind an interim plan if the SWRCB determines adequate assurances have not been provided that the GSP or judicial order or decree for adjudication will be implemented.

The SWRCB may set fees to recover the costs of administering its interim plan including costs in connections with investigations, facilitation, monitoring, hearings, enforcement and administrative costs. The Management Act does not limit the amount of fees that may be imposed.

6.0 Comparison of California's Sustainable Groundwater Management Act to Groundwater Management in Arizona

Recognizing that groundwater is an invaluable resource in limited supply, many other Western states have had statewide groundwater regulation in place for many decades. The groundwater management approaches, regulations, and lessons learned by other Western states can be studied with respect to how groundwater management should occur in California, as the climatic conditions and reliance on groundwater are largely comparable. In particular, Arizona has an arid, extremely dry climate where approximately 40 percent of the population relies on groundwater as their primary source of water supply. Since the 1970s, Arizona has successfully managed groundwater through the implementation of sweeping changes to its water laws, enacted in response to population growth that threatened to exceed water supply availability. The state established a comprehensive water rights system to control the use of groundwater, including a permitting system for new uses, and prohibited increases in agricultural land use to reduce water use increases, among other measures (LAO, 2010).

California and Arizona share similarities in terms of climate, supply resource limitations, and abundant urban growth. In 2010, California's Legislative Analyst's Office (LAO) conducted a review of Arizona groundwater law in order to identify similarities and differences between the ways these two states have chosen to manage groundwater resources (LAO, 2010). There are certainly unique circumstances that govern the groundwater management in each state, but the comparison affords a deeper understanding of potential future revisions or enhancements to California's recent Management Act.

Modern Arizona groundwater management law was enacted in 1980 with the passage of the 1980 Arizona Groundwater Management Code (Code), which sought to conserve, protect and allocate groundwater resources and provide a framework for the comprehensive management and regulation of the withdrawal, transportation, use, conservation, and conveyance of groundwater. The Code included three specific objectives: control overdraft; provide a means to allocate the state's limited groundwater to most efficiently meet the state's needs; and augment Arizona's groundwater through supply development. Several measures of the recently adopted Management Act and Arizona law are compared below.

6.1 Prioritization of Groundwater Basins for Management

California law now requires DWR to prioritize groundwater basins throughout the State, and to oversee the implementation of Groundwater Sustainability Plans for all high- and medium-priority basins (as administered by the GSA(s) for each basin). Low priority basins and currently adjudicated basins are not subject to the Management Act.

Arizona law also groups basins into three classifications: Active Management Areas (AMA), Irrigation Non-Expansion Areas (INA), and all other areas. The AMAs require the strictest level of management to address the most severe overdraft, subsidence, or water quality conditions. In the INAs, only land legally irrigated between 1975 and 1980 may be irrigated with groundwater, essentially prohibiting expansion of agriculture in these areas. All other areas are permitted to pump groundwater that is put to reasonable and beneficial use.

While both states utilize a similar approach to protect basins that are at the highest level of risk, Arizona law goes considerably farther in establishing restrictions on pumping and irrigated land use in AMAs and INAs. It is also worth noting that the Arizona law targets agricultural use of groundwater as a means of reducing groundwater demands, while California's Management Act does not treat agricultural use any differently than other beneficial uses of groundwater.

6.2 Formation of Groundwater Sustainability Agencies

California law allows for the formation of GSAs in groundwater basins by local agencies. Adjudicated basins are not required to form a GSA. In cases where GSAs are not formed or are not adequate, the SWRCB may intervene and manage the basin to protect groundwater resources. California law requires GSAs to attain basin sustainability within 20 years of adoption on of a GSP.

Arizona law puts more power in the state for formation of AMAs than California law does for the formation of GSAs. In Arizona, the state appoints an Area Director who is responsible for the development and implementation of the groundwater management plan. While this keeps the management responsibility with the state, there is also a groundwater users' advisory council in each AMA that is tasked with advising the area director on groundwater management policies. Arizona law dictates that AMAs create five management periods, each lasting 10 years. In each management period, water use restrictions and rules become more restrictive. This "ratcheting" approach under Arizona law seems to provide for a more gradual adjustment to existing levels of groundwater use than California's Management Act provides for.

6.3 Groundwater Rights Restrictions

California's Management Act is not specific as to individual limitations to pumping so long as the GSA is able to attain basin sustainability through implementation of the GSP within a 20-year timeframe. There are no specific blanket land use restrictions.

In comparison, Arizona law for AMAs prohibits additional expansion of irrigated agriculture that will depend on groundwater. In addition, only persons legally entitled to withdraw groundwater may do so as determined by the state. There are certain exceptions and means to "grandfather" in certain groundwater rights. Permits are required for seven different types of wells (such as general industrial, poor quality groundwater, drainage that serve as exemptions to allow pumping for non-grandfathered wells in AMAs).

Unlike Arizona groundwater law, California law generally delegates groundwater basin management and specific pumping restrictions to the determination of the GSAs, except in cases where the GSAs or GSPs are not formed or inadequate as determined by the SWRCB, in which case the SWRCB may take over basin management. California law ostensibly allows for a basin-by-basin determination as to the type and extent to which groundwater pumping will need to be managed to attain sustainability targets.

6.4 Groundwater Storage

Under the Management Act, California law now identifies significant and unreasonable declines in groundwater storage as an "undesirable result" that must be avoided, but the Management Act is non-specific as to groundwater storage accounting rules, and leaves that management aspect in the hands of the GSAs. Additional groundwater storage policy guidance could be developed by DWR. Many groundwater basins in the State already have established groundwater banking and exchange programs, which provide a way to utilize aquifer storage and protect the rights of those who store the water.

Arizona's 1986 and 1994 Underground Water Storage, Savings, and Replenishment Act define requirements for groundwater recharge and storage. Permits are required from the State of Arizona to develop a storage project and to store water, with assurances that storage of the water will not cause harm to other users in the groundwater basin. A groundwater savings facility permit is also required to put the water to use, with assurances that use of the stored water will reduce groundwater pumping in an AMA or INA. Long-term storage credits may also be obtained from the state. Arizona law goes much farther than California's Management Act in regulating groundwater storage and conjunctive use projects.

6.5 Data Management and Accessibility

The California's water laws limit the public release of certain personal information related to individual groundwater pumpers, including water usage. However, aggregated information on groundwater withdrawals in a basin will be made available through implementation of the Management Act, along with information on basin conditions and progress in meeting sustainability goals. California currently publishes certain available data on monitoring wells levels and some information on groundwater quality. Available water level data can be found on the CASGEM website or the California Water Data Library.

In contrast, Arizona law makes well driller's records publically available online in its Wells 55 Database. When the Groundwater Management Code was passed by the Arizona Legislature in 1980, all existing wells within the state were required to be registered with Arizona Department of Water Resources (ADWR). In addition, any person drilling a new well in Arizona must first file a Notice of Intent (NOI) to Drill a Well with ADWR. This registration data are stored in the WELLS-55 database. The well data are generally not field verified and information is therefore not always accurate or complete. However, records are publicly available through the ADWR website, and data is added to the WELLS-55 database daily. (ADWR, 2014). But in California,

making individuals' groundwater pumping information publically available has been, and remains, a controversial topic.

7.0 Management Act's Responsiveness to Issues Identified by Water Leaders' Mentors

The 2014 Management Act has introduced a new era of groundwater management and stewardship in California. While this legislation represents a significant step toward sustainable groundwater management throughout the State, there remain several important components of groundwater management that were either not fully addressed in the Management Act, or have yet to be addressed by policymakers and regulators. This section evaluates whether and to what extent the Management Act is responsive to some of the management issues identified by the Water Leaders Class mentors.

As described in the Introduction to this report (Section 1), each 2014 Water Leaders Class mentor was asked a series of questions on groundwater management in California. One of these questions was, "If you had complete oversight of California's groundwater, what legislative or regulatory changes would you make to ensure effective groundwater management?" Mentor responses to this question were compared against the Management Act, which had not yet passed at the time the mentor interviews were conducted. The intention of this comparison was to evaluate whether or to what extent the Management Act addresses issues identified by the mentors. The issues that were identified fell into the five general themes presented in this section: funding; data availability; governance, regulatory oversight and enforcement; groundwater management; and education and communication. These themes are further explored below.

7.1 Funding

Multiple mentors identified inadequate funding as an ongoing barrier to effective groundwater management in the State and provided suggestions on how improved funding conditions could make both existing and future groundwater management efforts more successful. The range of responses received is summarized below.

- Lack of agency exercise of their enforcement authority (in the context of water quality). One mentor noted that this is rooted in agency budgets that are regularly inadequate to allow an effective implementation of these regulations.

- Reform state taxes to keep more money at the local level.

- Increase eligibility for / availability of grant funds.

Under the Management Act, a GSA is authorized to impose fees such as permit fees and fees on groundwater extraction or other regulated activity to cover the cost of the preparation, adoption, and amendment of a GSP; program administration; investigations; inspections; compliance assistance; and enforcement. The Management Act does not address the three items listed above

directly. Issues associated with practical implementation of the Management Act in terms of funding are discussed in Section 8, below.

On November 4, 2014 California voters approved Proposition 1: Water Quality, Supply and Infrastructure Improvement Act of 2014 by an overwhelming 66.8 percent, which will authorize $7.545 billion in general obligation bonds, including funding directly focused at addressing groundwater management and quality issues. The water bond's success is likely attributable to the crisis created by the recent drought conditions and an associated sense of urgency to invest in water resources. Every region throughout the State will benefit from the water bond whether it's through the regional conservancies, recycled water projects, groundwater cleanup, emergency drought relief or assistance with developing the GSPs.

The water bond is a positive step in investing in the State's water security; however, we still have a long road to meet California's water infrastructure needs. There are estimates that California is underinvesting in water infrastructure by six billion dollars per year, as discussed at the 2013 Santa Ana River Watershed Conference in a presentation titled "Changing Models: Collaborative Solutions". While this water bond is not the final solution, it offers a significant investment in water, and could serve as a successful platform to encourage the passage of other water bonds at the local, regional and state levels. Individual water agencies could look to pass a similar bond at the local level, or as the GSAs begin to form, collaboration could lead to the passage of regional water bonds across political and hydrologic boundaries.

7.2 Data Management and Accessibility

Data availability was an important topic to the majority of the Water Leaders Class mentors because it is crucial in resource management. Having high-quality data – both spatially and temporally – is important to get a clear, comprehensive picture of groundwater conditions. The characterization of a groundwater basin is the first step to fully understanding the basin. Monitoring wells can serve as a useful resource to make decisions about pumping, replenishment and water quality.

The Water Leaders Class mentors' concerns related to data availability are summarized below.

- There is a lack of high-quality data for:
    - quantifying groundwater demand/use;
    - characterizing groundwater quality;
    - aquifer characterization: size, composition and recharge area delineation, water elevation, age of the water, and hydraulic parameters such as conductivity;
    - determining the location of wells, but with consideration of property rights; and
    - characterizing land surface compaction and subsidence on a regional scale.
- There is a lack of understanding of:

  - what datasets currently exist;
  - how improved agricultural efficiency will affect recharge; and
  - how climate change will effect surface and groundwater quantity and timing of availability.

- Adequate models and planning tools are necessary to identify potential system improvements.
- Datasets must be stored and managed so that they are formatted consistently and easily accessible in a centralized location.
- Comprehensive basin studies are needed, and should be prepared by DWR.
- Well log information needs to be made available in a way that respects privacy.
- Rather than relying entirely on production wells, monitoring wells should be installed in logical places.

In accordance with the Management Act, each GSP must include a basin monitoring strategy with a 50-year planning horizon that includes measureable objectives to be achieved every five years. The Management Act authorizes GSAs to monitor water withdrawals, track the location of wells, and may adopt rules, regulations, ordinances, and resolutions as needed to implement the Management Act, including those related to data collection. Every GSP must describe historical data, groundwater levels, ground water quality, subsidence, ground-water surface water interaction, and a discussion of historical and projected water demands and supplies. Given these requirements, it is anticipated that the types of data listed above as well as an understanding of what datasets currently exist will be obtained during GSP development and implementation of the Management Act. The Management Act does not directly address the other concerns listed above. The GSAs would need to choose to address them unless follow-up legislation introduces requirements to do so.

7.3 Water Management

Opportunities for improvements in current groundwater management approaches along with suggestions on new approaches to groundwater management in the State were identified by the mentors. The range of responses received is summarized below.

- Groundwater storage opportunities should be maximized in wet years in preparation for dry years and droughts.
- Recharge projects and "new sources of water" need to be identified.
- Surface water management strategies such as increased use of recycled water need to be implemented to reduce demand on groundwater in combination with groundwater-specific strategies.

- Establish a water budget as well as short- and long-term planning programs that give agencies (particularly local agencies) the adaptability to remain poised to implement new ideas as they develop.

- Establish rules for a streamlined basin adjudication process.

As stated above, the Management Act's focus is on establishing a framework for sustainable groundwater management in California. Several topics are listed as required in GSPs and specific groundwater management principles are included in the Management Act, but the items in the list above are not mentioned explicitly. The Management Act states that it is the intent of the Legislature to increase groundwater storage and improve impediments to recharge and that groundwater should be managed to protect against shortages in drier periods. Therefore, anticipating that maximizing storage opportunities in wet years will be a part of the management strategy in many if not all of the GSPs is reasonable. A map that identifies existing and potential recharge areas is a required part of every GSP. As such, the identification and implementation of recharge projects is likely in most basins. Within every GSP, measures related to surface water opportunities, including those for water recycling, are required. In basins where these opportunities exist, it is anticipated that surface water strategies will be identified and implemented along with groundwater management strategies. The Management Act does not address the need for local groundwater management planning programs to be nimble so that new ideas can be implemented quickly. The nature of multi-stakeholder resource management efforts will make implementing new ideas quickly a challenge. See Section 9.1, Potential Clean-Up Bills, for a discussion of the establishment of a streamlined adjudication process.

7.4 Governance, Regulatory Oversight, and Enforcement

The Water Leaders Class mentors offered many suggestions for how groundwater might be effectively regulated in California. The suggestions, listed below, covered many aspects related to the governance of groundwater resources.

- Change the focus from creating new anti-degradation regulations to developing real solutions for providing safe drinking water such as investment in treatment technologies and systems or in some cases drilling a new well that can access better quality groundwater.

- State should encourage non-subsidized water rates.

- Impose tiered pricing as a means to curtail demand.

- Provide flexibility on National Environmental Policy Act (NEPA) and CEQA regulations to provide expedited approval of cross-boundary water transfers during drought/times of need.

- Groundwater recharge needs to be considered a beneficial use by the SWRCB to avoid water rights vulnerabilities that are associated with recharge projects.

- Require groundwater levels be stabilized in the next 20 years, with predefined drought buffers.

- Allow some level of groundwater degradation, but impose fees for it.

- Establish 'soft' thresholds with an understanding that those thresholds will become hard thresholds with time to comply.

The focus of the Sustainable Act was to establish a framework for sustainable groundwater management in California. While the GSAs will identify projects that would improve groundwater management, the timeline for implementation is likely to be long. The Management Act also did not focus on water rates.

The GSPs themselves are not subject to environmental review, but projects associated with plan implementation will be. If a drought management strategy captured in a GSP includes a cross-boundary water transfer, standard CEQA and NEPA requirements would likely apply to such a transfer. No additional beneficial uses were established by the Management Act.

The timeframe for stabilized groundwater levels is 20 years, but defined drought buffers are not required by the Management Act. Allowing for degrees of groundwater degradation also is n't specifically addressed. Last, the framework laid out in the Management Act includes uniform deadlines; however, the GSAs have the authority to structure monitoring and other requirements, or thresholds, so that they become more stringent over time.

It is possible that some of the suggestions made by the Water Leaders Class mentors will be implemented in the future or in specific basins.

7.5 Education and Communication

In multiple instances, the Water Leaders Class mentors identified a primary challenge to groundwater management as a general low level of public understanding regarding the importance of and threats to groundwater resources across the State. The mentors also discussed the challenges created by a lack of communication between water users and the public within the same groundwater basins on changing groundwater conditions. The range of responses received regarding the need for education and communication includes the following:

- We need a better-informed public;

- It is important to fund community outreach and education;

- There is an overwhelming public perception that water is owned by the people; and

- Fragmentation of water users across a groundwater basin who do not communicate.

Although the Management Act does contain provisions regarding public notice and participation, it does not explicitly address the need for a broad public outreach program or providing a forum for stakeholder collaboration. The process of developing a GSP will require communication among many parties, which will result in some level of education of those parties. If the GSP development process has a public outreach component, it will serve to educate the members of the public who choose to participate. Implementation of a GSP will likely require the education

of water users and coordination among them in order to effectively manage groundwater. While each of these modes of education and communication will improve the situation that the mentors described, a more focused effort is needed.

8.0 Opportunities and Challenges in Implementing the Management Act

As described in the preceding sections, and particularly in the discussion of the Management Act provided above, this legislation will change the way groundwater is managed throughout the State. The Management Act introduces extensive and historic changes to groundwater management in California, and much is unknown regarding the immediate effect on local agencies, as well as the long-term implications of statutory and regulatory provisions authorized by the Management Act. There will be a variety of short- and long-term challenges and opportunities associated with implementing the Management Act. This section addresses the 2014 Water Leaders Class's assessment of the challenges and opportunities associated with the Management Act; this assessment is based on participants' diverse professional backgrounds, input provided by 2014 Water Leaders Class mentors, and independent research conducted throughout the year.

8.1 Potential Short-term Issues

Short-term issues associated with implementation of the Management Act may be varied, including but not limited to the formation of GSAs, and the clarification of key terms such as "sustainable groundwater management" and "sustainable yield". The discussions below examine these anticipated short-term issues.

8.1.1 Formation of Groundwater Sustainability Agencies

As described in Section 5.3 of this report, GSAs may be comprised by one or more local agencies within a given groundwater basin. On the short-term, the identification of GSAs may present a challenge to implementation. The Management Act recognizes that sustainable groundwater management is best achieved at the local level and establishes criteria for the development of local GSAs. The Management Act does not explicitly describe or dictate which local agencies and stakeholders will become the GSAs other than stating that agencies created by previous statute to manage groundwater shall be the exclusive local agency within their statutory boundaries and that counties are the default local GSAs in basins where no other entity steps forward.

The Management Act clearly leaves the decision-making power regarding the development of GSAs in the hands of local constituencies. This provides local entities with the greatest amount of flexibility and ability to define the GSA structure that can most adequately function within the specific basin. This also prevents basins from being forced into a standardized structure that does not suit local conditions. For basins that already have a water management entity that is clearly suited for the role of the GSA, the process will be relatively straightforward. The identification of a lead GSA in groundwater basins which cover large geographic and political boundaries, such as the San Joaquin, will likely be much more difficult, particularly where existing water entities have little or no coordination, and where there is a wide range of stakeholders. Such

complexities may make it difficult for locals to meet the necessary GSA formation requirements within the required timeframe.

In the event that no other entity elects to become the local GSA for a basin, the Management Act identifies the overlying county as the default GSA. As described in Section 5.5, the deadline for identification or development of a GSA is July 1, 2017, after which point the State will assume authority over the basin in the absence of a locally-designated GSA. The Management Act identifies counties as the default GSA, should another local entity not be identified; counties are the sensible default GSA because they are the primary local entities which currently govern land use decisions. At the same time, challenges may arise in cases where a basin encompasses the jurisdiction of multiple counties. Additionally, many counties have never played a direct role in water management and do not currently have the staff expertise or resources to take on such a task. All of these issues will need to be worked through over the next few years, possibly with additional State guidance.

8.1.2 Local Stakeholder Outreach and Input

The Management Act provides unprecedented opportunities for cooperation and participation by all local stakeholders in the sustainable management of groundwater resources.

In particular, the Management Act requires that GSAs must:

- Consider the interests of all beneficial uses and users of groundwater;
- Coordinate with other GSAs in their groundwater basin;
- Establish a list of interested parties that will receive notices regarding plan preparation, meeting notices, etc.; and
- Describe in their GSPs how interested parties may participate in the development and implementation of the GSP.

The type of comprehensive coordination and cooperation among water stakeholders described above is generally unprecedented in California, and will ideally result in more effective management of groundwater resources throughout the State.

The Management Act is silent on how multiple basin interests will coordinate their efforts beyond the requirement that outreach efforts must include all the diverse stakeholder groups in the basin, including but not limited to: groundwater users, agricultural and environmental stakeholders, disadvantaged communities, and others. Particularly in large basins which encompass multiple political and geographic boundaries, ensuring that there is adequate stakeholder outreach or defining what “adequate” means may present another challenge to implementation of the Management Act.

8.1.3 Regional Cooperation and Coordination

Implementing the Management Act will necessitate cooperation and coordination amongst entities in many groundwater basins. Entities within the same groundwater basin will likely need to begin coordinating immediately in order to select a GSA by the July 2017 deadline specified

by the Management Act. In basins where more than one entity wishes to be a GSA, the entities will need to discuss management approaches and agree to either develop a single GSP for the entire basin, or coordinate separate GSPs administered by respective GSAs, in which case DWR would not approve the plans until the entire basin is covered by a GSP.

The GSPs would further regional management (through basins delineated under CASGEM) of water resources realized through the IRWMPs and other processes. Regional groundwater management rather than strictly entity-based decision making presents opportunities including coordinated operations and collaboration in completing projects with broad benefits. Water management entities can use coordinated operations to enable greater utility for set quantities of water than otherwise possible. Entities within a basin can experience significant differences in groundwater availability, recharge capacity, surface water contract supplies, demand patterns, etc. Some groups may find previously unrealized opportunities through innovative operations brought forward during the GSP process.

Regions can also pool resources to complete projects with broad regional benefits, and leverage funds to a greater extent. Many State and federal grant programs require matching local cost shares, while the costs to complete the most cost effective projects are too great for a single entity and would better serve all or a portion of the region. Large-scale regional projects meeting demands for multiple entities also have the ability to better distribute operations and maintenance costs and pass cost savings on to the end user. Specifically, managed aquifer recharge is a significant opportunity in some areas. Groundwater declines have left some storage opportunities available. Groundwater banking projects are typically much cheaper per acre-foot than proposed new surface storage.

However, in some regions, cooperation and coordination amongst management entities may prove challenging. Entities may have little experience working together or have conflicting views about management of the basin. To comply with the Management Act, entities will need to coordinate as early as possible and develop a coordinated plan for sustainable management of their groundwater basin.

8.1.4 Defining “Sustainable Groundwater Management” and “Sustainable Yield”

Another potential short-term challenge in implementing the Management Act may include clarification of key terms such as “sustainable groundwater management” and “sustainable yield.” The development of GSPs will include establishing measurable performance standards, which will rely heavily on the interpretation of these definitions. Leaving the definitions of these terms relatively broad potentially provides local GSAs with the opportunity to further define these terms in their GSPs in a manner that factors in their basin’s specific conditions. For example, “sustainable groundwater management” in a coastal basin may incorporate the need to address saltwater intrusion while an inland basin that currently relies heavily on surface water that is not reliable during periods of drought may need to focus more on stormwater capture and conjunctive use. At the same time the broadness of these definitions may pose as challenges in cases where there are conflicting perceptions of what the terms mean among stakeholders within a basin or between the local GSA and the State as it determines whether or not the GSP is adequate. Some groundwater stakeholders believe these terms are ambiguous and not well-

defined in the current legislation, which may lead to inconsistencies in how GSPs are developed and conflicts in the implementation of GSPs, possibly even leading to litigation.

8.1.5 Groundwater Sustainability Plan Development

The ability of GSAs to acquire existing data and utilize it in developing a GSP is significantly limited by the lack of accessibility and availability of groundwater data. California has only recently begun significant efforts to monitor groundwater through the CASGEM program, which only provides groundwater levels at a basin scale and has significant data gaps in some regions. Access to site-specific data associated with wells is significantly limited, despite the recording of well information, due to a State law that prohibits the distribution of well completion reports without written permission of the landowner to anyone but the landowner, his or her designee, or a government agency. While there are a variety of entities (e.g., U.S. Geological Survey, DWR, SWRCB, etc.) that collect publically available groundwater data, this information is not collected in a consistent manner. It is also stored in a variety of formats and locations, making it challenging and time-consuming to piece the information together in a comprehensive manner. The limitations on available data may make it difficult for a GSA to acquire or develop the information necessary to support a GSP.

Due to the wide variety of stakeholders that would be involved in the development of a local GSP, there may be challenges associated with developing a GSP in terms of local conflicts. The Management Act provides some motivation for local entity finalization of a GSP by including backstop provisions that give the SWRCB the authority to step in and develop an interim GSP if the local GSA is unable to do so within the defined timeframe. These provisions may help provide the local GSA with negotiating power to settle local disputes that they would not otherwise have if there wasn't the threat of State intervention. It is possible that some conflicts may result in lawsuits, which could derail the timing of GSP development and implementation.

8.2 Potential Long-term Issues

Implementation of the Management Act is anticipated to face both short-term and long-term issues. In some cases, short-term issues may have long-term implications. Effective implementation of the Management Act will be dependent upon the early identification and addressing of both short- and long-term issues. Some of the anticipated long-term issues, as discussed in detail below, are: enforcement powers and water rights; funding for management and data collection; and determination of surface water-groundwater connectivity.

8.2.1 Enforcement Powers and Water Rights

The Management Act offers regional water stakeholders new tools to manage groundwater in a sustainable manner. Prior to this Management Act, local agencies lacked clear authority to take specific actions to manage groundwater such as, for example, curtailing groundwater pumping to prevent overdraft. The GSP develops a road map for deliberate actions which are intended for long-term collaboration and management efforts, ideally leading to groundwater sustainability for all water users. The Management Act requires GSPs to include specific types of data, the obtaining of which will require new collection and coordination efforts. As a result, implementation of the Management Act will include development of new information sources

and relationships which can be used by local agencies to more effectively manage their groundwater resources.

Additionally, the Management Act clearly states that the impacts of surface water flows must be evaluated as part of a GSP. The authority to issue well permits already rests with the local county, and groundwater management via this Management Act will be a local responsibility; therefore, there is a local incentive to take steps to manage both groundwater and surface water in a more responsible and coordinated manner. While these new considerations provide local entities with incentives for improving management of existing water rights and can potentially restrict the development of new groundwater wells, they do not provide local entities with the authority to change valid existing surface or groundwater rights.

The SWRCB does not have permitting authority for groundwater rights and only has enforcement authority to the extent that there is a waste or unreasonable use of groundwater; however, they do have authority over surface water rights. California water law separates groundwater and surface water into two distinct silos, although surface water and groundwater is often not actually physically separate. In areas where there is not a distinct physical barrier between groundwater aquifers and surface water flows, questions about when or whether a shallow groundwater well requires an appropriative surface water right are likely to arise. While this issue is not one that is created by the Management Act, it is one that is likely to come into focus more as elements of the Management Act are implemented.

The Management Act states that GSAs and the SWRCB are to respect all rights to surface water and groundwater. Still, in the longer term, the Management Act is likely to have varied impacts on individual water rights holders. For some, implementation of the Management Act may provide much-needed assurances that long-established wells that are relied on for community drinking water supply will not go dry as a result of another entity drilling a new and deeper well or wells. For others, while the Management Act purports to not change groundwater rights, the ability to specify allowable uses of groundwater and regulate aspects of its use may, in fact, affect the exercise of such rights. For example, a GSA could conceivably establish allowable pumping rates, which would directly affect the exercise of groundwater rights.

It is possible that if the Management Act spawns too much litigation it will have the effect of triggering basin adjudications. Parties may simply elect to adjudicate rights rather than endure years of procedural litigation related to plans. Adjudication itself typically takes many years, under current State guidance and procedures. It is also possible that DWR could develop procedures for expedited adjudication (further discussed in Section 9.1.1); however, protracted litigation of one kind or another is likely in many basins or subbasins.

8.2.2 Funding

Funding new management programs is generally a challenge and concern for implementing entities. The Management Act recognizes this and grants authority to GSAs to impose fees for permitting, groundwater extraction, and other regulated activities to fund GSP development and implementation (e.g., preparation of the plan, adoption, amendment, investigations, inspections, compliance assistance, enforcement, and program administration). Some estimates show the potential costs of GSP development to be from $1 million to $3 million, including costs for data collection, organization, interpretation, and management. While the ability to charge fees to

offset GSA costs is helpful, the initial costs of initial efforts alone could be a significant challenge for GSAs, particularly in less affluent areas of the State. Additionally, raising fees may cause undue hardship on some communities, particularly rural and disadvantaged communities. In these instances, State assistance will be critical.

8.2.3 Determining Surface Water-Groundwater Connectivity

The greater availability and transparency of groundwater data that will occur under successful implementation of the Management Act will help to identify and characterize connectivity between surface waters and groundwater resources. Theoretically this will facilitate better management of all waters. However, associated long-term challenges may include uncertainties regarding water rights and priority of use. For example, if it is determined that water drawn from a particular well is hydrologically connected to a particular surface waterbody, and that water use in one is negatively affecting the other, litigation may result as water users seek to clarify rights. Complex and expensive hydrologic models will also become necessary to characterize interactions and connectivity; in the long-term there may be disagreements as to how such models should be developed and funded, and who should be responsible for their development and assessment. As mentioned, the determination and clarification of connectivity between surface waters and groundwaters should ultimately have a positive effect on groundwater management, but there will be challenges along the way.

8.2.4 Gradual Steps toward Groundwater Sustainability

In many regions throughout the State, Californians have historically used more groundwater than has been replenished. The Management Act mandates the creation of regionally controlled groundwater management agencies responsible for achieving sustainability of local groundwater basins within the next 25 to 35 years. The intent of this legislation is to gradually achieve sustainability for groundwater resources in California.

Difficult choices are needed in some areas where groundwater has experienced long-term negative trends leading to serious concerns about eventually exhausting the resource as a viable source. Some of the opportunities created by the Management Act may not be unique but the success of the Management Act will depend on the ability to incentivize managers to confront long-term regional issues that previously went unaddressed. Some of those issues are addressed in Section 4.1 of this report.

8.2.5 Ability to Address Future Droughts

Groundwater management is especially important in light of the frequent droughts which affect water supply for Californians. Many communities and agricultural interests throughout the State that established their wells decades ago have had their wells go dry in the most recent drought. Locals and the State have historically had a limited ability to address this issue comprehensibly and over the long-term. This Management Act could create the opportunity for locals and the State to work together on proactive measures that assure drought impacts are planned for and mitigated appropriately. By developing plans that require basin management to achieve sustainable levels over the long-term, as required by the Management Act, it helps to reframe water management from the year-to-year approach to a more long-term vision that acknowledges both seasonal and annual variations in water availability and incorporates those conditions into management strategies.

9.0 Potential Future Actions

This report extensively discusses the Management Act, largely with regards to what implications this new legislation may have for groundwater management efforts and various water entities throughout the State. The 2014 Water Leaders Class collaborated with each other, and considered the views of the Water Leaders Class mentors and other water industry professionals, to project what potential future actions may occur as a result of the Management Act. This section addresses those potential future actions, including: potential clean-up bills such as expedited and streamlined adjudication processes, refined access to public data, refinements on functional equivalency; and other potential actions such as regional collaboration and coordination, facilitation of conjunctive use, and planning for climate change and prolonged drought scenarios.

9.1 Potential Clean-Up Bills

As previously mentioned, this report was compiled by the 2014 Water Leaders Class using input from mentors, as well as independent research efforts. Input provided by the Office of Assemblymember Roger Dickinson (D-Sacramento), one of the authors of the Management Act, included a description of three potential bills that would make subsequent changes to the recently enacted legislation. These recommendations were developed from the series of stakeholder meetings and input that Assemblymember Dickinson's office received from affected stakeholders. In addition other information was gathered from consultants in the Assembly Committee on Water, Parks and Wildlife and the Senate Committee on Natural Resources and Water. At the time of this report's development, at the end of the 2013 to 2014 legislative session, the legislative concepts described in this section have neither bill numbers nor bill authors. Nonetheless, once the Legislature reconvenes for the 2015 to 2016 legislative session, it is likely that one or all of these measures will be introduced.

9.1.1 Expedited and Streamlined Adjudication Process

Given that the Management Act will substantially affect California's water supply landscape and the economies that depend on this landscape, there is political will on behalf of many affected stakeholders to improve the process to efficiently determine groundwater rights. The most likely mechanism for determining groundwater rights is through groundwater adjudications.

One benefit of the current political will to adjudicate water rights in affected groundwater basins is the potential for water users to come together to identify groundwater management solutions. A court judgment would spell out the rules and regulations on basin management. The benefit of having adjudicated rights is that it quantifies and confirms water rights and gives water rights holders certainty in order to plan for the future, whether they want to keep, lease, or sell their water rights. As referenced in Section 3.2.1, adjudication could provide for a flexible locally-managed governance structure and a framework for water supply and water quality data collection. This information will help water managers better understand the basin and thus make good regulatory decisions to help improve the basin's supply-demand balance.

In an effort to investigate how groundwater adjudications could be streamlined, Senator Fran Pavley (D-Agoura Hills), Chair of the Senate Committee and Natural Resources and Water, held an Informational Hearing on November 20, 2014 titled "Resolving Disputes Regarding Groundwater Rights: Why Does It Take So Long And What Might Be Done To Accelerate The Process." During the hearing, a panel of speakers offered the following recommendations on ways to cut down the adjudication procedural process by 35-50%.

- Basin Boundaries
  Observation: Defining basin boundaries is often a contentious and lengthy process.
  Recommendation: Use Bulletin 118 as a starting point to define basin boundaries.

- Noticing
  Observation: The due process requirement for notice to affected parties is very time consuming and could cost up to $100/person and requires notice be provided three times, if not provided by publication.
  Recommendation: Include a notice approved by the court in the property tax bill in order to comply with the constitutional due process. This notice solution addresses the cost issue, however it leaves out renters and other stakeholders.

- Understanding and quantifying the problem
  Observation: Trials tend to segregate evidentiary issues.
  Recommendation: The courts could copy the federal rules of civil procedure and require parties to come in with relevant documents such as pumping data and water rights information. The owner may present an equivalent to pumping data, such as a crop duty to estimate water use.

- Phasing, making it manageable
  Observation: Some may try to re-litigate an issue that was already settled upon.
  Recommendation: Parties should be bound by the court decision, with the right for an appeal to avoid unnecessary re-opening of matters as a delay tactic towards implementation.

- Disqualification of Judges
  Observation: In the case of Antelope Valley adjudication, five years passed just on deciding who was going to handle the case and where.
  Recommendation: Putting cases in a neutral venue will resolve this matter.

- Referees
  Observation: highly technical issues involved are difficult and burdensome for the courts.
  Recommendation: Keep a short list of referees, a qualified person appointed by the court used for fact finding, to relieve the courts from this complex process.

- Statutory Adjudication Process
  Observation: Five western states already have statutory groundwater adjudication process, including Idaho, Nevada, Utah and Washington. In these states most of work is

done by a state agency or board but the judicial system reviews it. The Brown administration would like to see a more cost effective system for adjudication, while still complying with the due process. Adjudication will always be slow and costly. There is a limit as to how much faster you can go, considering due process requirements. *Recommendation*: The State already has an administrative process for the adjudication of surface water according to Water Code 2500. Extending the statute to groundwater, and combining surface and groundwater rights could modernize and make things more efficient. There is an institutional benefit to this - the agency can get better at it, and agency personal can grow with the process and learn from it.

The possibilities for streamlining groundwater adjudications could include an administrative process through the SWRCB, State-level legislation, a priority judicial procedure through courts, or a combination of all three processes. Any of these methods should involve a stakeholder process that addresses existing community needs.

9.1.2 Refine Public Access to Data

Assembly Bill 1739 states that it is the intent of the Legislature: "To require the development and reporting of those data necessary to support sustainable groundwater management, including those data that help describe the basin's geology, the short- and long-term trends of the basin's water balance, and other measures of sustainability, and those data necessary to resolve disputes regarding sustainable yield, beneficial uses, and water rights." AB 1739 makes two references to the groundwater data and privacy protections in Water Code §5206 and §10730.8(b). The information made public includes: aggregated information on groundwater extractions; basin conditions; and progress in meeting sustainability goals. However, the legislation limits public access to proprietary information submitted pursuant to the Management Act, as "it is the state's interest to limit public access to this information". A debate over how much access to this information should be made available to the public continues. Individual well owners and well drillers have privacy protection concerns for well information including characterization of the geology, well depth, historical depth to groundwater, and pumping rates, while at the same time many interest groups (environmental/ environmental justice groups, scientists, practitioners) and communities are seeking additional access to this data. As a bill develops to address this issue, the Legislature will have to balance the public's interest in the protection, management and reasonable beneficial use of our water supply along with the protection of personal information.

SB 263 (Pavley) introduced in the 2011-2012 legislative session would have required such public disclosure of well data; however, the bill was vetoed by the Governor because of the enormous penalties it would have imposed. Perhaps a reasonable compromise between the interests could include full disclosure of data from monitoring wells strategically placed to better understand the conditions of the basin, while protecting data from private well owners. A good example of a monitoring well that provides a shared picture of the basin is the Baldwin Park Key well in the Main San Gabriel Basin.

9.1.3 Refinements on Functional Equivalency

Local agencies in high- and medium-priority groundwater basins that demonstrate current groundwater management practices consistent with the Management Act have the option to submit an alternative plan to DWR, in lieu of developing a GSP. It is unclear how many basins subject to the Management Act already have alternative plans that would qualify for functional

equivalency, although some regions already have voluntary groundwater management plans under the laws described in Table 3.1. However, it is likely that most existing plans would need to be revisited to ensure they meet the objectives of the Management Act. The Management Act does not specify the criteria that DWR will use to assess their success and functional equivalency to the Management Act; instead, the Management Act allows DWR to develop regulations regarding the criteria for alternative plans. In the interim, some agencies will be left wondering if they should develop a GSP or rely on an existing plan to satisfy the Management Act. Some stakeholders, arguing these existing plans currently work and thus no need to create a new plan, have already started to ask for more clarity as to what criteria DWR will use to determine their functional equivalency. Other parties have expressed that the alternative plans are not rigorousness enough. Ultimately, under the Management Act DWR is responsible for making it a fair and public process.

9.2 Other Potential Future Actions

Although there are a number of challenges associated with implementing the Management Act, its enactment marks a new era for California groundwater management. As discussed throughout this report, the Management Act provides new opportunities to address the declining physical conditions of California's groundwater and provide a better framework for local groundwater management across the State. In addition to the potential "clean-up" bills discussed above, the Water Leaders Class projects that other potential future actions and opportunities associated with implementation the Management Act may include: regional collaboration and coordination; facilitation of conjunctive use; and planning for climate change and prolonged drought conditions.

9.2.1 Regional Collaboration and Coordination

As discussed above, collaboration and coordination amongst stakeholders and regulatory entities will be critical to the successful implementation of the Management Act. Regulatory entities and water users will need to act quickly to consider and assess the best framework for their groundwater basin in terms of who will serve as the GSA and how the GSP will be developed. The Water Education Foundation can play a critical role in bringing stakeholders together in a non-partisan manner to facilitate education, collaboration, and the exchange of ideas on groundwater management and groundwater conditions across the State. The Annual Executive Briefing could serve as a platform for that forum. In addition, the water tours could take an approach to highlighting well-managed groundwater basins. This would give water managers throughout the State the opportunity to learn from other regions and foster more cross-agency collaboration.

Local regulatory entities can also facilitate coordination through early outreach to both the public and other entities within their groundwater basin. Each GSA will have to take a proactive approach to hold community forums, informational events and some kind of public venue where non-owners can participate in the process as well. Everyone within the basin will be best served by this early collaboration, because the Management Act requires a GSP or combination of GSPs that cover the entire basin and that are coordinated to achieve sustainability.

The Senate Committee on Natural Resources and Water and the Assembly Committee on Water, Parks and Wildlife could also hold joint informational hearings throughout the development of the legislative proposals that will serve as "clean-up" bills to the Management Act. Legislators making these important decisions will benefit from listening to the testimony from basins throughout the State ranging from adjudicated basins, special act districts, to high, medium and low priority basins. Each region is unique and has its own set of stakeholders, basin conditions and needs.

9.2.2 Facilitating Conjunctive Use

The Management Act anticipates that conjunctive use of groundwater supplies and surface water supplies will be an integral part of sustainable groundwater management. However, California continues to have separate regulatory frameworks for these two sources of water and this separation can act as an impediment to expanding conjunctive use throughout the State. For example, appropriative surface rights have a designated place of use that may make it difficult to transport and bank surface water in different regions. In addition, there remains large uncertainty regarding the rules and rights associated with groundwater banking. Without statewide policies or parameters for clarifying and regulating groundwater banking, it may be difficult to significantly expand conjunctive use in California. Issues include what constitutes beneficial use of water and whether groundwater banking is a beneficial use, as well as issues of ownership and priority to banked water.

9.2.3 Planning for Climate Change and Prolonged Droughts

It is widely accepted in the scientific community that global climate change is occurring and will likely alter California's hydrology in the future. In fact, Governor Jerry Brown and Senate Pro Tem Kevin De Leon have publicly made climate change a legislative priority in developing the next phase of regulations post 2020. If extreme weather patterns, including prolonged droughts or more intense winter storms, are going to be the "new normal" for California, the State will need to plan for these changes as part of its groundwater management. It may be that DWR specifically identifies climate change as an issue that should be addressed in GSPs. Alternatively, it would be prudent for each GSA to anticipate how climate change may affect groundwater supplies and future plans for groundwater management. Considerations may include anticipated changes in snow pack, spring run-off timing and magnitude, stormwater management and capture, and planning for multi-year droughts.

10.0 Conclusion

The Management Act will revolutionize groundwater management in California. Although there remain many questions surrounding implementation of the Management Act, it is clear that sustainable management of groundwater resources is now a State mandate. There will be opportunities and challenges in responding to the Management Act's requirements, particularly in acquiring and developing the information necessary to develop GSPs and in addressing the State's dependence on groundwater during times of drought. The Water Leaders Class of 2014 was fortunate to examine such an important and timely topic as groundwater management in California. The Water Education Foundation can play an important role in facilitating implementation of the Management Act by fostering education and collaboration regarding groundwater resources.

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