LAO 75 YEARS OF SERVICE

The 2016-17 Budget:

The State's Drought Response

MAC TAYLOR • LEGISLATIVE ANALYST • FEBRUARY 5, 2016

LAO

EXECUTIVE SUMMARY

State Has Been Experiencing Exceptionally Dry Period. California has been experiencing a serious drought for the past four years. In fact, by some measures the current drought actually began in 2007, with one wet year—2011—in the middle. While there are optimistic signs that El Niño weather patterns will bring California a wet winter in 2016, how much precipitation will fall as snow in the state's northern mountain ranges—a major source of the state's water throughout the year—remains uncertain. Moreover, the cumulative deficit of water reserves resulting from multiple years of drought is sufficiently severe that some degree of drought conditions likely will continue at least through 2016. Scientific research also suggests that climate change will lead to more frequent and intense droughts in the future.

Drought Has Affected Various Sectors in Different Ways. Sector-specific water needs and access to alternative water sources have led to notable distinctions in the severity of the drought's impacts across the state. For example, while the drought has led to a decrease in the state's agricultural production, farmers and ranchers have moderated the drought's impacts by employing short-term strategies, such as fallowing land, purchasing water from others, and—in particular—pumping groundwater. In contrast, some rural communities—mainly in the Central Valley—have struggled to identify alternative water sources upon which to draw when their domestic wells have gone dry. Multiple years of warm temperatures and dry conditions have had severe effects on environmental conditions across the state, including degrading habitats for fish, waterbirds and other wildlife, killing millions of the state's trees, and contributing to more prevalent and intense wildfires. For urban communities, the primary drought impact has been a state-ordered requirement to use less water, including mandatory constraints on the frequency of outdoor watering.

State Funded Both Short- and Long-Term Drought Response Activities. The state has deployed numerous resources—fiscal, logistical, and personnel—in responding to the impacts of the current drought. This includes appropriating $3 billion to 13 different state departments between 2013-14 and 2015-16. State general obligation bonds (primarily Proposition 1, the 2014 water bond) provided about three-quarters of these funds, with state General Fund contributing around one-fifth. Some of the funded activities (such as providing bottled drinking water or rescuing fish) are to meet an emergency need stemming from the current drought, and then will conclude. Other projects, particularly those supported by bond funds (such as building new wastewater treatment plants), will be implemented over the course of several years, and therefore will be more helpful in mitigating the effects of *future* droughts. Lastly, other activities (such as lawn removal or water efficiency upgrades), often are intended to have noticeable effects in both the current *and* future droughts.

Drought Response Has Also Included Policy Changes and Regulatory Actions. In addition to increased funding, the state's drought response has included certain policy changes. Because current drought conditions require immediate response but are not expected to continue forever, most changes have been authorized on a temporary basis, primarily by gubernatorial executive order or emergency departmental regulations. For example, one of the most publicized temporary drought-related policies has been the Governor's order (enforced through regulations) to reduce statewide

urban water use by 25 percent. State regulatory agencies also have exercised their existing authority in responding to drought conditions. For example, the State Water Resources Control Board has ordered and enforced that less water be diverted from some of the state's rivers and streams, and the Department of Fish and Wildlife has closed some streams and rivers to fishing.

Governor Proposes Continued Funding for Drought Response Activities in 2016-17. The Governor's budget proposal provides $323 million for drought response efforts in 2016-17. This funding would primarily support the continuation of initiatives funded in recent years that address emergency drought response needs. For example, the proposal includes funding for increased wildland firefighting, to provide various forms of human assistance in drought-affected communities (such as drinking water, food, financial assistance, and housing and employment services), and to monitor and assist at-risk fish and wildlife. The proposal also dedicates cap-and-trade revenues for four conservation programs intended to improve water and energy efficiency.

LAO Recommendations for 2016-17: Adopt Most of Governor's Drought-Related Budget Proposals. We believe the Governor's approach to focus primarily on the most urgent human and environmental drought-related needs makes sense. The severity of enduring drought conditions supports the continued need for these response activities. As such, we recommend the Legislature adopt the components of the Governor's drought package that meet essential human and environmental needs and that are likely to result in immediate water conservation. We believe additional information is needed, however, before adopting the Governor's four cap-and-trade-funded conservation proposals. Whether these proposals represent the best approach to achieving water and energy savings and reducing greenhouse gases is unclear. We therefore recommend the Legislature delay deciding on whether to fund these programs until the administration has provided additional information to justify the request.

LAO Recommendations for Longer Term: Learn Lessons to Apply in Future Droughts. Given the certainty that droughts will reoccur, and the possibility that subsequent droughts might be similarly intense, we recommend the Legislature continue to plan now for the future. Such planning can be facilitated by (1) learning from the state's response to the current drought, (2) identifying and sustaining short-term drought-response activities and policy changes that should be continued even after the current drought dissipates, and (3) identifying and enacting new policy changes that can help improve the state's response to droughts in the future. We recommend the Legislature spend the coming months and years vetting various drought-related budget and policy proposals for their potential benefits and trade-offs, and enacting changes around which there is widespread and/or scientific consensus. This could include both changes that remove existing barriers to effective drought response, as well as proactive changes that improve water management across the state. The Legislature can gather such information through a number of methods, including oversight hearings and public forums, but we also recommend the administration submit two formal reports: one that provides data measuring the degree to which intended drought response objectives were met, and one that provides a comprehensive summary of lessons learned from the state's response to this drought.

INTRODUCTION

California has been experiencing a serious drought for the past four years. In fact, by some measures the current drought actually began in 2007, with one wet year—2011—in the middle. (As discussed in the box on page 7, drought can be defined in various ways.) While there are optimistic signs that El Niño weather patterns will bring California a wet winter in 2016, how much precipitation will fall as snow in the state's northern mountain ranges—a major source of the state's water throughout the year—remains uncertain. Moreover, the cumulative deficit of water reserves resulting from multiple years of drought is sufficiently severe that some degree of drought conditions likely will continue at least through 2016. Scientific research also suggests that climate change will lead to more frequent and intense droughts in the future.

The state has invested notable funding and effort in responding to the current drought. Given the likelihood that drought conditions will continue into the near future, the Legislature will need to decide which response activities require continued funding in 2016-17 and even in subsequent years. Moreover, now is a good time for the Legislature to ask the questions and seek the data it will need to make better decisions in the future. Assessing the effectiveness of the recent response and learning from successes and missteps are key to preparing both for the possibility of continued drought and the certainty of future droughts.

We begin this report by describing the current drought and its impacts across the state. Next, we summarize the state's drought-response activities and appropriations through the current year. We then describe and assess the Governor's drought spending proposals for 2016-17. Finally, we conclude by recommending steps the Legislature can take to address drought both in the coming year and future.

DROUGHT IMPACTS

In this section, we begin by describing the current drought, including the degree to which recent winter storms have affected statewide water storage levels, and scientific predictions for the characteristics of droughts in the future. We then describe how the current drought has impacted the state's agricultural, rural, environmental, and urban sectors.

State in Midst of Severe Drought

State Experiencing Exceptionally Dry Period. Figure 1 (see next page) shows annual precipitation rates for the past 40 years compared to the average across the period. As shown, rates were below average for the past four years, and only one of the past nine years was particularly wet. Even more notably, the recent four years are the driest consecutive four-year stretch since statewide precipitation record-keeping began in 1896. (Throughout this report, hydrologic data are reported based on "water years," which run from October 1 of the previous year through September 30 of the year cited. For example, the data contained in Figure 1 for water year 2015 consists of precipitation measured between October 1, 2014 and September 30, 2015.)

Figure 2 (see next page) shows how this lack of precipitation has affected conditions around the state. The maps, developed by the United States Drought Monitor, display the severity of drought conditions around the state based on key indicators such as soil moisture content, streamflow, and precipitation.

Figure 1

State's Precipitation Below Average in Recent Years

Statewide Precipitation in Inches

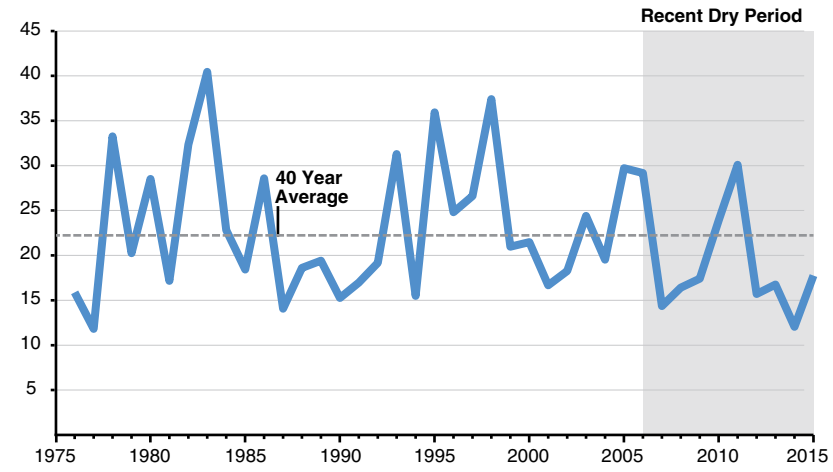


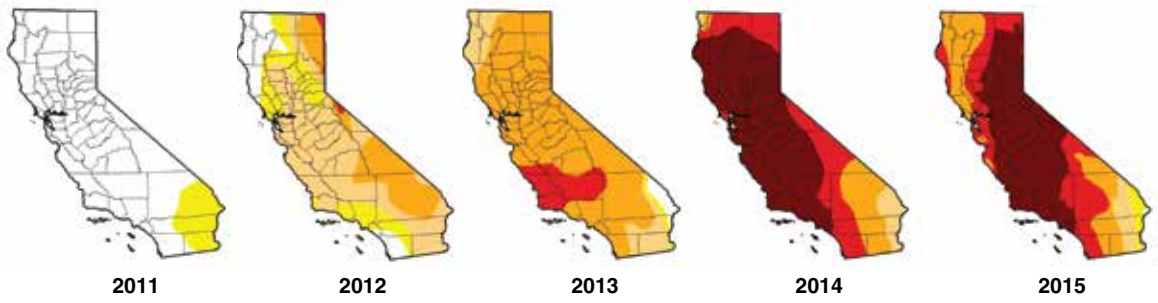
Figure 2 highlights how the drought's reach and intensity have expanded over the past five years. As shown, much of the state has experienced "exceptional drought" conditions for two years.

Recent Storms Have Improved Statewide Conditions . . . Storms in December 2015 and January 2016 have brought much-needed precipitation to California. Between October 1, 2015 (the beginning of the 2016 water year) and January 31, 2016, the Northern Sierra region of the state received 32.8 inches of precipitation, which is 23 percent above average for that period (26.7 inches). This compares to a total of 23.1 inches received in that region across the same four month period in water year 2015, and just 4.5 inches in water

Figure 2

Drought Has Expanded, Intensified Across State

Statewide Drought Measurements From U.S. Drought Monitor, Taken Around October 1 Each Year[a]



[a] The U.S. Drought Monitor estimates drought intensity based on several indicators, including soil moisture, streamflow, and precipitation. October 1 is the beginning of the state's "water year" for annual precipitation calculations.

The U.S. Drought Monitor is jointly produced by the National Drought Mitigation Center at the University of Nebraska-Lincoln (NDMC-UNL), the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. Maps courtesy of NDMC-UNL.

year 2014. Additionally, as of February 1, 2016, the Northern and Central Sierra regions of the state recorded about 120 percent of historical average snow water content for that date. Forecasters predict a likelihood of continued precipitation throughout the spring from El Niño-influenced weather systems that could continue to add to these totals.

. . . But Drought Far From Over. Despite the recent storms, the drought is unlikely to end in the coming year. While 2016 precipitation totals are on track to exceed those of recent years, significantly alleviating statewide drought conditions would require *considerably* more rain and—most importantly—snow. As of January 31, additional accumulation of 17 inches is needed in Northern California just to meet average annual amounts of precipitation for that region for *this* water year, which still would not be sufficient to overcome the

Defining Drought Depends on Interplay Between Water Supply and Demand

No standard or statutory definition exists for delineating the presence, onset, duration, or conclusion of a drought. Generally, drought is thought of as a prolonged deficiency of precipitation, resulting in a shortage of water. Drought impacts, however, result from the interaction between natural events (such as rainfall) and the *demand* that people place on water. That is, whether precipitation rates result in a shortage depends in part upon how much water is needed for human, agricultural, and environmental uses. As such, determining the existence and severity of drought conditions depends on a number of factors, including: (1) the amount of water needed to maintain existing activities, (2) the amount of precipitation, (3) the amount of runoff, and (4) the amount of alternative sources of water available (such as reservoir storage, groundwater, or recycled water).

Additionally, the same shortage of precipitation might have differing impacts across the state. For example, as discussed later in this report, entities with a large, fixed need for water and fewer alternative sources upon which to draw (such as fish and wildlife, as well as residents in some areas of California's Central Valley) have experienced greater impacts during the current drought than those who can reduce their demand and turn to other sources (such as some urban areas that can modify outdoor landscapes and draw upon local reserves).

Because defining drought can be complicated, governmental agencies often use several sources of data to determine when conditions might merit an official response. For example, the U. S. Drought Monitor—a federal project that produces weekly maps of drought conditions—bases its determinations on an index comprised of data on precipitation, soil moisture, and streamflow, combined with "reported impacts and observations." These maps are used by some other government agencies, including the U.S. Department of Agriculture and the Internal Revenue Service, to determine eligibility for certain government assistance programs. Another tool upon which researchers and government agencies frequently rely to measure drought is the Palmer Drought Severity Index, which uses temperature and precipitation data to calculate water supply and demand.

When Governor Brown declared a State of Emergency in California due to drought in January 2014, he cited: (1) extremely low water levels in the state's snowpack, rivers, reservoirs, and groundwater basins; (2) the effects of dry conditions on drinking water supplies, animals and plants, farmland, and forests; (3) the extended timeframe of dry conditions; and (4) the strain that responding to such conditions was placing on local governments.

cumulative water shortfall from the past several years of drought. Figure 3 displays conditions for nine of the state's largest reservoirs as of January 31, 2016. As shown, even after the recent storms, storage levels remain well below average for this point in the year in most of the state's reservoirs. Experts also caution that precipitation rates alone cannot predict water conditions for the coming year. Statewide water supply is highly dependent on the amount of water content in the state's snowpack and on spring runoff rates—conditions about which firm conclusions cannot yet be drawn. The statewide map the U. S. Drought Monitor produced for the last week of January 2016 still looks similar to the one displayed for October 2015 in Figure 2, with much of the state continuing in exceptional drought status.

Science Indicates Warmer Temperatures Increase Drought Frequency and Severity. Temperatures in California also have been notably warmer in recent years compared to historical averages. Specifically, average annual statewide temperatures have been higher than normal in each of the past four years, and 2014 and 2015 were the warmest two years on record since 1895. These two years each recorded average temperatures of over 61 degrees Fahrenheit, which is roughly 5 percent (about 3 degrees) above the annual statewide average for the past 100 years.

Scientific evidence indicates these warmer temperatures have contributed to the severity of recent drought conditions by leading to more precipitation falling as rain rather than snow, faster melting of winter snowpack, greater rates of evaporation, and drier soils. These conditions decrease the amount of spring snowmelt runoff upon which the state historically has depended for its annual water supply. Warmer temperatures also increase demand for irrigation water in both agricultural and urban settings.

Numerous climate models predict such warmer temperatures are indicative of future trends. As such, many climate researchers warn that the state will experience more frequent and intense droughts in the coming years. For example, a recent study from Stanford researchers predicts that by around 2040, California's climate will have transitioned to one in which there is nearly a 100 percent likelihood that low precipitation years also will be severely warm.

Drought Has Affected Various Sectors in Different Ways

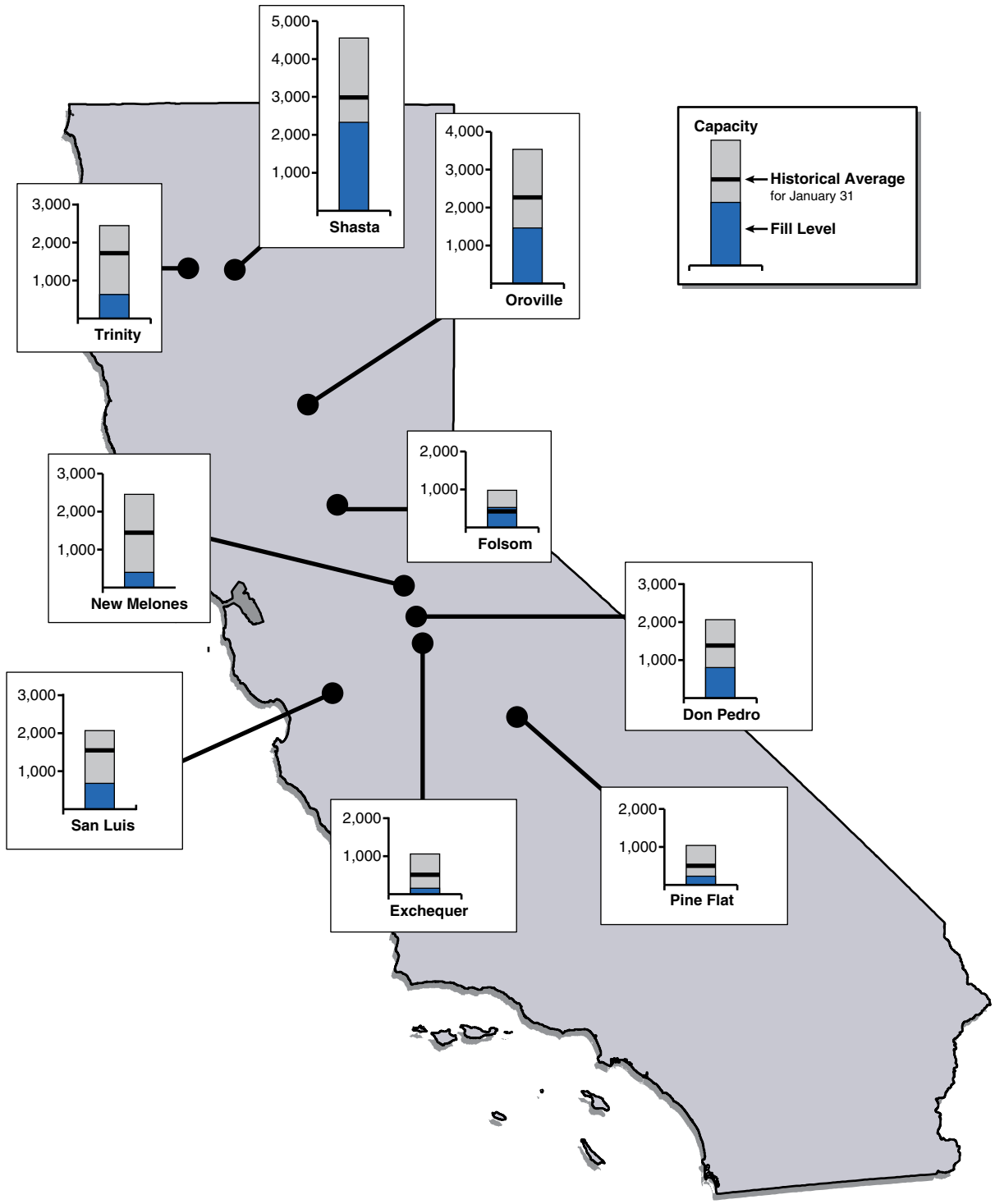
Although Figure 2 shows the prevalence of drought conditions in most areas of the state, these conditions have not had the same effects in all regions and sectors. Sector-specific water needs and access to alternative water sources have led to notable distinctions in the severity of the drought's impacts across the state. Below, we discuss drought impacts in the agricultural, rural, environmental, and urban sectors.

Agricultural Sector Has Reduced Crop Acreage, Relied Upon Groundwater. While the drought has led to a decrease in the state's agricultural production, farmers and ranchers have moderated the drought's impacts by employing short-term strategies. In normal years, many of the state's farming operations—particularly those centered in the Central Valley—depend upon surface water deliveries from Northern California rivers fed by mountain runoff. In recent years, however, farmers received lesser amounts—and in some cases none—of their expected water deliveries through the state and federal water supply projects (as discussed later in this report). Farmers responded to the lack of precipitation and surface water deliveries by temporarily fallowing roughly 5 percent of farmland in 2014 and 2015. Researchers from the University of California, Davis (UC Davis) estimated that idling this land led to a loss of 3 percent to 4 percent (around $2 billion) in net statewide agricultural revenues in

Figure 3

State's Reservoir Levels Remain Low

In Thousands of Acre-Feet, as of January 31, 2016



each of these years compared to what they would have been absent the drought.

To maintain most of their agricultural production, farmers have turned to alternative sources of water. This practice has been particularly important for farmers growing fruit and nut trees and grapes—lucrative permanent crops which are becoming increasingly prevalent in the Central Valley and cannot be temporarily taken out of production. Some farmers paid abnormally high prices to acquire surface water from others. The overwhelming strategy farmers have used to maintain productive farmland, however, has been to turn increasingly to groundwater. Data from a sample of wells monitored by the Department of Water Resources (DWR) showed that between spring 2010 and spring 2015, groundwater levels dropped by at least 10 feet in nearly half of the wells, and by at least 2.5 feet in another one-quarter of the wells. This reliance on groundwater—combined with the transition to more profitable crops—allowed the agricultural sector to produce record revenues of over $50 billion in 2014 and in 2015, despite the reduction in surface water deliveries and increase in fallowed land. Yet, as discussed in the nearby box, such heavy usage of groundwater is not a sustainable practice. As such, the agricultural sector may experience more serious impacts from continued or future droughts compared to recent years.

Rural Communities Affected by Groundwater Shortages, Agricultural Cutbacks. The lack of precipitation and stream runoff, combined with increased groundwater pumping, has led to a drop in underground water levels in some areas of the state during this drought. This in turn has contributed to domestic wells going dry in some rural communities which depend on those groundwater aquifers and do not have alternative water sources upon which to draw. As discussed later, the state has funded emergency drinking water supplies in many of these areas (both bottles and large tanks of water). Many affected communities, however, ultimately will require more permanent solutions, as it could be several years before groundwater levels are restored. Such solutions might include drilling deeper wells, or connecting dry households to larger community water systems. The state has helped initiate permanent solutions for some individuals and communities, but many dry wells have yet to be addressed. For example, as of December 2015, a total of 1,130 households in Tulare County had reported running out of water, and of those, 700 reported obtaining an interim or permanent solution.

The impacts of these water shortages have compounded other challenges in some affected communities. Many of the areas where wells have gone dry were economically disadvantaged before the drought. Additionally, because many rural communities—particularly in the Central Valley—are home to large populations of agricultural sector employees, drought-idled farm fields have led to higher unemployment and lost incomes in these areas. For example, researchers from UC Davis estimate that 7,500 (4 percent) of the state's farm jobs were lost due to drought in 2014, and that this increased to 10,100 (5 percent) in 2015. As such, many residents in communities facing water shortages often lack the financial resources to move or drill new wells.

Water Shortages and Heat Have Impaired Habitats for Wildlife. Multiple years of low precipitation have compromised habitats for fish, waterbirds, and other wildlife across the state. Aquatic habitats have been affected by (1) low water levels in streams, lakes, and rivers; (2) abnormally high water temperatures; and (3) an increase in invasive species and plants—such as water hyacinth and algal blooms—that degrade habitats and water quality. While conclusive data are not yet available on how severely various fish and other aquatic species have been impacted by drought conditions, initial indications are concerning. Researchers

from UC Davis estimate that up to 18 native California fish species face a high risk of near-term extinction if severe drought conditions continue. For example, data indicate that at least 95 percent of the juvenile Sacramento River winter-run Chinook salmon preparing to migrate to the ocean in 2014 (referred to as the 2014 cohort)—already listed as endangered by both the federal and state governments—died in the river below Shasta Dam due to high water temperatures. The 2015 cohort appears to have experienced an even higher mortality rate—97 percent.

Waterbirds and terrestrial wildlife also have suffered from declining access to habitat due to lack of water and its impacts on sources of food. Overcrowding in reduced wetland areas can lead to illness for migrating and native bird populations. In some areas of the state, dry conditions also have sent wildlife such as bears into residential areas in search of food.

Heavy Reliance on Groundwater Can Result in Serious Consequences

While relying on groundwater has helped the agricultural sector temper the effects of the current drought, evidence suggests that maintaining current rates of groundwater withdrawal is not sustainable. Based on data from 2010, the Department of Water Resources determined that 21 of the state's 515 groundwater basins are in a state of "critical overdraft," where continuing current water management practices would result in "significant adverse overdraft-related environmental, social, or economic impacts." Given the rate of pumping during the recent drought, conditions likely have worsened in many groundwater basins since the data was collected for that assessment. Absent replenishment (which would require a notable influx of new water combined with sufficient time to refill the aquifer), the current rate of withdrawal will stress groundwater supplies in some areas for many years to come. In certain areas, the underground geology is such that rapid overdraft is likely to *permanently* deplete the groundwater basin, without capacity for replenishment. Water quality issues also have materialized in some areas where groundwater has been accessed by drilling more deeply, including salt water intrusion in coastal basins.

Moreover, state monitoring has detected certain areas where intensive groundwater pumping has led to notable land subsidence. For example, one area of the San Joaquin Valley near the town of Corcoran (south of Fresno) sunk by over 13 inches between May 2014 and January 2015. Another area near the town of El Nido (north of Fresno) sunk by 10 inches during the same eight month period. Land subsidence can result in dangerous damages to infrastructure such as roads, railways, bridges, and pipelines, and can increase flood risk by altering drainage patterns. State officials are particularly concerned about potential damage to the California Aqueduct, which transports water to millions of users in Southern California and runs through areas where significant land subsidence is occurring.

Recently passed state legislation—The Sustainable Groundwater Management Act—will require most regions to adopt and start to implement plans to better manage groundwater resources beginning in 2020. The potential implications of severe overdraft and subsidence, however, might make it necessary for the agricultural sector to reduce its reliance on groundwater pumping even sooner.

Additionally, warm temperatures and drought conditions have contributed to the loss of millions of the state's trees in recent years, with the potential for even greater losses if such conditions continue. Specifically, in fall 2015 the United States Forest Service estimated 29 million trees had died largely as a result of the drought. A subsequent study published by Stanford researchers in December 2015 reaffirmed such concerns. This research found that up to 888 million large trees experienced measurable loss in canopy water content between 2011 and 2015, including up to 58 million large trees that experienced *severe* canopy water losses of greater than 30 percent. In October 2015 the Governor declared a State of Emergency for the epidemic of statewide tree die-off.

Such dry forest and vegetation conditions also have been a factor in more prevalent and intense wildfires in recent years, with devastating effects on both humans and wildlife. Moreover, large fires can have lasting effects on watershed ecosystems, leading to greater amounts of sediment runoff that degrades downstream water conditions.

Urban Areas Required to Use Less Water and in Some Cases to Pay More. The primary drought impact on urban communities (including residential, commercial, and industrial water customers in cities and suburbs) has been a state-ordered requirement to use less water. Because the largest source of residential water use is outdoor irrigation, for most urban residents this requirement has resulted in a change in outdoor watering practices (including mandatory constraints on the frequency of outdoor watering), combined with adjustments to indoor uses (such as opting for shorter showers). Some residents have responded to the conservation requirements by permanently shifting to more water-efficient outdoor landscapes and/or indoor appliances. (As described later, the state and some local agencies have offered financial incentive grants to encourage these changes.) As a result, statewide urban water usage dropped by 25.5 percent from June to December of 2015 compared to the same period in 2013, slightly exceeding the statewide conservation target of 25 percent.

Using less water, however, has not necessarily translated into lower water bills for urban water users. In most cases, local water supply agencies must retain a minimum amount of funding to cover fixed costs for staffing, maintenance, and operations—regardless of water usage levels. Additionally, local agencies have experienced new drought-related costs from increasing public outreach and enforcing conservation. Yet on the natural, when water usage declines, so do corresponding revenues. Many water agencies around the state therefore have raised or are considering raising water rates or adding user fees to ensure they can continue to meet their operational costs despite lower per-capita usage.

STATE'S DROUGHT RESPONSE

The state has deployed numerous resources—fiscal, logistical, and personnel—in responding to the impacts of the current drought. In this section, we describe the state's response through January 2016, including funding appropriations, delegation of responsibilities across departments, activities, and major policy changes. (While this report deals primarily with state actions, the federal government and local governments and agencies also have responded to the drought, as highlighted in the nearby box.)

Federal and Local Entities Also Have Responded to Drought

Federal Government Has Provided Funding, Coordinated Support. The federal government authorized emergency funding to help states respond to the drought across the western United States in both 2014 and 2015, of which roughly $500 million was allocated within California. These federal drought monies have helped fund emergency support for drought-affected communities (including food, water, housing, and job training), and provided financial assistance for livestock producers who lost grazing or pasture land. Federal funds also have supported activities to assist fish and wildlife threatened by drought conditions.

In addition to funding, federal agencies have supported California's drought response efforts through increased communication and coordination. For example, as discussed later in this report, the federal Bureau of Reclamation and the two federal fishery agencies (the U.S. Fish and Wildlife Service and the National Marine Fisheries Service) have worked closely with state agencies to adjust operations of the State Water Project and the federal Central Valley Project in response to decreased water availability and concerns about the environment and water quality. These federal agencies also have expedited review and permitting processes to facilitate drought response initiatives such as transferring water among users and trucking hatchery-raised fish for downstream release.

Local Response Has Focused on Reducing Water Use. Drought response has extended to local governments, water agencies, and community members. Many of these local efforts have stemmed from the statewide requirement to reduce urban water use. In addition to the state-run programs described later in this report, many local agencies and governments have funded outreach campaigns and rebate programs to encourage conservation. For example, in 2014-15 the Metropolitan Water District (a regional water wholesaler serving most of Southern California) and its member agencies invested nearly $180 million in conservation and outreach programs to help customers improve water use efficiency, resulting in total estimated water savings of 374,000 acre-feet over the lifetime of the devices or programs implemented. Coupled with amounts from prior years' investments, the estimated water savings in the region was about 180,000 acre-feet in 2014-15. (An acre-foot of water is the amount needed to cover one acre at a depth of one foot and is about the average amount used by two households in a year.)

Besides conservation efforts, many local water supply agencies have increased efforts and investments to secure alternative sources of water to meet local needs now and in the future. These include undertaking water supply projects (such as water recycling, groundwater clean-up and storage, desalination, and stormwater capture) as well as purchasing water from other sources.

Additionally, some water users have volunteered to divert less water from the state's rivers and streams during the drought. For example, a large group of farmers in the Sacramento-San Joaquin Delta offered to reduce their diversions from the Sacramento River by 25 percent between June and September 2015. In addition, some local landowners have entered into voluntary agreements with the state's Department of Fish and Wildlife to avoid diverting water from certain streams during sensitive fish spawning periods. In both of these cases, landowners received some additional assurances against future regulatory actions from state agencies in exchange for these agreements.

State's Response Has Been Multifaceted

State's Response Has Expanded as Drought Has Continued. Figure 4 displays a timeline of major steps the state has taken in responding to the current drought. As shown, drought-response efforts have increased and diversified over the past three years. Since 2013, the Governor has issued eight emergency declarations or executive orders related to the drought. These orders directed state departments to implement various conservation and regulatory activities, many of which also are displayed in the timeline (and described in greater detail below). The figure also displays legislative enactment of drought-related statutes and appropriations. (The appendix to this report provides additional detail regarding the policy changes implemented by executive order and legislation.)

Figure 4

Timeline of Major State Drought Response Activities

May 2013
- Governor issues Executive Order to streamline approvals for voluntary water transfers.

December 2013
- Governor establishes Interagency Drought Task Force.

January 2014
- Governor declares State of Emergency due to drought.
- SWRCB issues statewide notice of surface water shortage and potential for curtailments.
- SWRCB issues order temporarily modifying flow and water quality requirements for state and federal water project operations in the Delta. (Order later modified and extended.)

February 2014
- Legislature passes Senate Bills 103 and 104, including new statutory provisions and roughly $700 million for emergency drought response activities.

April 2014
- Collaborative of six state and federal agencies (including DWR and SWRCB) release Drought Operations Plan to guide operation of state and federal water supply projects.
- Governor issues Executive Order to extend State of Emergency, expedite drought response activities, and implement water conservation requirements.

June 2014
- SWRCB adopts general order expanding authorized uses of recycled water.
- Legislature passes 2014-15 budget package, including new statutory provisions and $200 million for drought response activities and projects.

July 2014
- SWRCB institutes new temporary restrictions on outdoor water use and new water use reporting requirements for urban water suppliers.

September 2014
- Legislature passes package of bills implementing the Sustainable Groundwater Management Act.
- Governor issues Executive Order to address drinking water shortages.

November 2014
- California voters pass $7.5 billion water bond, The Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1).

December 2014
- Governor issues Executive Order extending some provisions of earlier orders until May 2016.

Response Has Included New Funding, Involved Many Departments

State Has Appropriated $3 Billion for Drought Response. Figure 5 (see next page) shows the diverse array of appropriations the state has made specifically for drought response activities from 2013-14 to 2015-16. All of this funding was provided on a one-time basis for one-time activities. (Most of the state departments displayed also have deployed existing staff to work on drought response activities. The ongoing funding supporting such staff is not included in the figure.) As shown in the figure, drought response activities fall into four general thematic areas: water supply ($2.2 billion), emergency response ($504 million), water conservation ($275 million), and environmental protection ($62 million). Below, we discuss these funded activities in more detail.

Timeline of Major State Drought Response Activities *(Continued)*

March 2015
- Legislature passes Assembly Bills 91 and 92, including new statutory provisions and roughly $400 million for drought response activities and projects.
- SWRCB extends previous restrictions on outdoor water use and institutes new conservation requirements for restaurants and hotels.

April 2015
- DWR conducts annual Snow Survey, confirms statewide snowpack contains less water content than any comparable survey measurement since 1950.
- Governor issues Executive Order imposing 25 percent statewide urban water reduction and initiating state-funded turf removal and water-efficient appliance programs.

May 2015
- DWR installs temporary rock barrier at West False River to keep tidal salt water from flowing too far into the Delta.
- SWRCB establishes temporary water conservation standards ranging from 4 percent to 36 percent for communities throughout the state to achieve 25 percent reduction in statewide water use (compared to 2013 usage levels).

June 2015
- Legislature passes 2015-16 budget package, including new statutory provisions and $1.8 billion for drought response activities and projects.
- SWRCB issues notice of curtailment to pre-1914 water rights holders with a priority date of 1903 or later in the Sacramento-San Joaquin watersheds and Delta. (Lifted in October 2015.)

July 2015
- CWC adopts new Model Water Efficient Landscape Ordinance (developed by DWR), permanently increasing water efficiency standards for new and retrofitted landscapes.

October 2015
- Governor declares State of Emergency for epidemic of tree die-off.

November 2015
- Governor issues Executive Order to extend conservation restrictions if drought continues into 2016, and to expedite reviews of certain water projects.

January 2016
- SWRCB adopts emergency regulations for measuring and reporting water diversions.

SWRCB = State Water Resources Control Board; DWR = Department of Water Resources; and CWC = California Water Commission.

Figure 5

State Drought Response Appropriations

(In Millions)

Department	Activity	2013-14 (SB 103)	2014-15 Budget	2014-15 (AB 91)	2015-16 Budget	Totals
Water Supply		**$480**	**—**	**$267**	**$1,488**	**$2,235**
SWRCB	Clean up contaminated groundwater	—	—	—	$783	$783
DWR	Fund regional water management projects	$473	—	—	—	473
SWRCB	Improve drinking water infrastructure	—	—	$69	175	244
SWRCB	Improve/increase water recycling	—	—	132	161	293
SWRCB	Improve/increase wastewater treatment	7	—	66	158	231
SWRCB	Improve/increase stormwater management	—	—	—	101	101
DWR	Support sustainable groundwater management	—	—	—	60	60
DWR	Improve/increase water desalination	—	—	—	50	50
Emergency Response		**$108**	**$145**	**$68**	**$183**	**$504**
CalFire	Expand/enhance fire protection	$44	$112	—	$136	$292
DSS	Provide food to drought-affected communities	25	5	$17	—	47
SWRCB	Improve drinking water systems	15	—	16	—	31
DWR	Conduct drought assistance and response	—	16	12	—	28
OES	Provide emergency drinking water	—	—	—	22	22
HCD	Assist/relocate drought-affected households	10	—	—	6	16
DWR	Remove Delta emergency rock barriers	—	—	—	11	11
SWRCB	Monitor/enforce water rights and conservation	3	4	7	1	14
OES	Coordinate statewide drought response	2	4	4	—	11
CSD	Assist drought-impacted farmworkers	—	—	—	8	8
SWRCB	Provide emergency drinking water	4	—	4	—	8
SWRCB	Monitor use/quality of groundwater	2	4	—	—	6
DWR	Assist with drinking water shortages	—	—	5	—	5
CalFire	Address water shortages at fire stations	—	—	3	—	3
EDD	Provide job training in drought-affected areas	2	—	—	—	2
DWR	Monitor use of groundwater	1	—	—	—	1
Water Conservation		**$54**	**$13**	**$32**	**$177**	**$275**
DWR	Increase water efficiency, reduce energy use	$30	—	$20	$20	$70
CDFA	Increase agricultural water efficiency	10	—	10	40	60
DWR	Increase urban water conservation	—	—	—	56	56
DWR	Increase agricultural water conservation	—	—	—	42	42
DGS	Increase water efficiency at state facilities	—	$5	—	15	20
CCC	Conduct conservation outreach	13	—	—	—	13
DWR	Save Our Water campaign	1	2	1	4	8
DFW	Improve efficiency at wildlife refuges	—	5	—	—	5
CDFA	Study economic impact of drought	—	—	0.2	0.2	0.4
Environmental Protection		**$2**	**$33**	**$26**	**—**	**$62**
DFW	Emergency fish and stream activities	$2	$33	$19	—	$54
Parks	Eradicate water hyacinth	—	—	4	—	4
SWRCB	Study instream flows	—	—	2	—	2
DWR	Model Delta flows	—	—	1	—	1
Totals		**$643**	**$191**	**$393**	**$1,849**	**$3,076**

SWRCB = State Water Resources Control Board; DWR = Department of Water Resources; CalFire = California Department of Forestry and Fire Protection; DSS = Department of Social Services; OES = Office of Emergency Services; HCD = Department of Housing and Community Development; CSD = Department of Community Services and Development; EDD = Employment Development Department; CDFA = California Department of Food and Agriculture; DGS = Department of General Services; CCC = California Conservation Corps; DFW = Department of Fish and Wildlife; and Parks = Department of Parks and Recreation.

Numerous State Agencies Involved in Responding to Drought. Figure 5 also highlights how widespread drought response has been across state government. As shown in the figure, 13 different departments received funding specifically for drought-related activities. The state's response has been coordinated by an Interagency Drought Task Force convened by the Governor in December 2013, which has met regularly throughout the past two years.

The largest amount appropriated to an individual department across the three years ($1.7 billion) has gone to the State Water Resources Control Board (SWRCB), mainly to allocate grants for improving groundwater basins and water supply infrastructure around the state, but also for emergency response activities. Roughly one-quarter of total drought appropriations ($805 million) has gone to DWR, primarily to allocate grants for water management planning and for improving water conservation and efficiency. The California Department of Forestry and Fire Protection (CalFire) received $295 million for emergency fire response between 2013 and 2016, which is the third largest departmental drought allocation. (This includes midyear funding from the state's Emergency Fund.)

In some cases, multiple departments were funded to respond to similar issues, but in different capacities. For example, SWRCB, DWR, and the Office of Emergency Services (OES) all received funding to respond to drinking water shortages. While all three agencies have funded provision of emergency bottled water, generally SWRCB's role has been to work on developing more permanent solutions for community water systems (such as extending water pipelines, intakes, or wells), DWR has worked on finding long-term solutions for individuals and water systems with fewer than 15 connections, and OES has helped residents in need of an interim solution (such as large refillable water tanks). Similarly, both SWRCB and DWR were funded to work on different components of improving groundwater management across the state.

Drought Activities Supported by Multiple Sources. Figure 6 summarizes the funding sources making up the state's $3 billion in drought appropriations. As shown in the figure, while the state has drawn upon multiple sources to support response activities over the past several years, about three-quarters ($2.3 billion) was provided from state general obligation bonds,

Figure 6

State Drought Funding by Fund Source

2013-14 Through 2015-16 (In Millions)

State General Fund	**$530[a]**
Bond Funds	**$2,329**
Proposition 1 (2014)	1,853
Proposition 84 (2006)	476
Special Funds	**$398**
Greenhouse Gas Reduction Fund	130
Clean-Up and Abatement Account	24
SRA Fire Prevention Fund	19
State Housing Funds	10
DGS Service Revolving Fund	11
Water Pollution Revolving Fund	7
Fish and Game Preservation Fund	6
Harbors and Watercraft Revolving Fund	4
Waste Discharge Permit Fund	3
Timber Regulation and Forest Restoration Fund	2
Total	**$3,076**

[a] Includes $182 million in midyear transfers from the state's Emergency Fund for higher-than-anticipated firefighting costs.

SRA = State Responsibility Area and DGS = Department of General Services.

including $1.9 billion from Proposition 1 (2014). As discussed below, most bond funding has been dedicated to water supply infrastructure projects that will help the state prepare for future droughts. The state General Fund contributed 17 percent ($530 million) of total drought appropriations, including $182 million in midyear funding from the state's Emergency Fund to support higher-than-anticipated firefighting costs.

State Funded Both Short- and Long-Term Drought Activities

While all of the drought response funding displayed in Figure 5 was provided on a one-time basis, the timeline for realizing the intended effects of the funded activities varies. Some activities (such as providing bottled drinking water) will meet an emergency need stemming from the current drought, and then will conclude. Other projects (such as building new wastewater treatment plants) will be implemented over the course of several years, and therefore will be more helpful in mitigating the effects of *future* droughts. Lastly, other activities, such as those that improve water conservation, often are intended to have noticeable effects in both the current *and* future droughts. (As we discuss later in this report, data on the effectiveness of these activities still is somewhat limited.) Below, we describe specific examples of these three categories of drought-response activities.

Emergency Response and Environmental Protection Activities Meet Immediate Needs. Nearly one-fifth of the funding shown in Figure 5 has been used to respond to the immediate effects of the current drought on people and the environment. In most cases, these are short-term activities both in duration and effects.

As shown in Figure 5, many such activities have assisted people living in communities particularly hard hit by the drought through the provision of drinking water and food, housing assistance, and job training services. Another notable state effort has been to expand CalFire's firefighting resources, given that drought conditions have contributed to more frequent and intense wildfires in recent years. Several departments (DWR, OES, SWRCB, and the Department of Fish and Wildlife [DFW]) also received short-term funding and staff for drought coordination and monitoring.

The DFW has taken the lead on emergency response to protect fish and wildlife during the drought. Specific activities supported by the $54 million in drought funding DFW received for environmental protection have included (1) intensive monitoring of how the drought is affecting at-risk fish species such as smelt and salmon; (2) monitoring of several threatened and endangered birds, amphibians, and small mammals; (3) responding to increased incidents of human-wildlife contact; and (4) trucking hatchery-produced fish downstream to avoid migratory hazards and improve survival rates. The department also has engaged in a number of rescue and relocation operations for at-risk fish and aquatic species, both from watersheds with deteriorated water conditions, as well as from DFW-hatcheries rendered unusable due to heat or disease. The department has modified some existing hatcheries to hold rescued fish by purchasing and installing equipment such as water chillers and recirculating holding tanks.

Water Supply Activities Focused on Future Benefits. The majority of drought funding is not likely to have much effect during the current drought. This is because the intended water supply projects (mostly supported with Proposition 1 bond funding) primarily represent larger infrastructure projects that will take several years to complete. These projects are intended to expand the state's water supply portfolio in order to improve resiliency in future droughts. Funding for such

projects has been or will be allocated primarily as grants for local entities to improve and increase groundwater storage, drinking water systems, water recycling, wastewater treatment, capturing and cleaning of stormwater, and water desalination. Additionally, the *2015-16 Budget Act* allocated nearly $800 million for SWRCB to administer loans and grants to prevent and clean up contamination in groundwater basins.

Proposition 1 also allocated $2.7 billion for water storage projects, which also will help bolster the state's resilience in future droughts. This program is still in the development stages, however, with the project eligibility criteria still being determined. Moreover, the funding for these water storage projects is continuously appropriated to the California Water Commission, and therefore not within the purview of the Legislature. As such, these funds have not been considered part of the Legislature's recent drought response efforts, and we do not include them in our discussion in this report.

Conservation Activities Yield Near-Term Results and Ongoing Impacts. Some of the funded activities are intended to help the state respond to droughts both in the near *and* longer term. This is true of the activities classified as water conservation in Figure 5. For example, the state has funded water efficiency upgrades at state buildings, state wildlife refuges, farms, cities, and even private residences (through rebates for turf removal and efficient appliances). Additionally, the statewide Save Our Water campaign and outreach activities conducted by the California Conservation Corps have encouraged residents to change their water-using practices. These efforts are intended to permanently reduce statewide demand for water—beginning now.

In addition to water conservation activities, some of the emergency response and environmental protection projects also represent near-term activities that will yield lasting effects. These include installing new equipment at DFW hatcheries, making emergency improvements to small community drinking water systems, restoring wetlands to expand wildlife habitats, and drilling new wells to address water shortages at fire stations.

Other Ways State Has Responded to Drought

Drought Response Has Included Both Temporary and Permanent Policy Changes. In addition to increased funding, the state's drought response has included both temporary and permanent policy changes. The appendix to this report summarizes the most notable of these changes.

Because current drought conditions require immediate response but are not expected to continue forever, most policy changes have been authorized on a temporary basis, primarily by gubernatorial executive order or emergency departmental regulations. These include expediting certain drought-response projects and activities by exempting them from meeting some state contracting requirements and from undergoing environmental impact reviews typically required by the California Environmental Quality Act (CEQA). For example, DWR and SWRCB have approved certain transfers of water between buyers and sellers, and DFW has undertaken several restoration and upgrade projects on its lands, all without conducting CEQA reviews.

One of the most publicized drought-related policies has been the Governor's call for a 25 percent statewide reduction in urban water use. In response to direction from the Governor's executive order, SWRCB passed regulations implementing temporary water conservation requirements for urban potable water users, including specific limitations on outdoor irrigation. Specific reduction requirements varied across water supply agencies from 4 percent to 36 percent

compared to 2013, depending on previous usage levels. Originally intended to be effective from June 2015 to February 2016, a December 2015 executive order authorized SWRCB to extend these restrictions if drought conditions continue. The board recently extended the conservation requirements until October 2016, however it made some modifications to how they are implemented. For example, water agencies that are located in particularly hot and dry areas, or that have invested in developing recycled or desalinated potable water supplies, will be eligible for somewhat lower conservation requirements. Board staff estimate this could have the net effect of lowering the statewide reduction target to between 20 percent and 25 percent.

The state also enacted some permanent statutory and regulatory changes in order to address both the current and future droughts. Two notable examples include legislation authorizing SWRCB to consolidate small water systems that consistently fail to meet drinking water standards and to require that surface water rights holders measure and report on the amount of water they divert from the state's streams and rivers. Additionally, DWR (working through the regulatory authority of the California Water Commission) increased state requirements for water efficiency in new and retrofitted outdoor landscapes.

Drought Has Triggered Curtailments and Other Regulatory Responses. In addition to the aforementioned policy changes, state regulatory agencies have exercised their *existing* authority in responding to drought conditions. In particular, SWRCB has ordered and enforced that less water be diverted from some of the state's rivers and streams. Over the past two years, the board has curtailed diversions for some users (particularly those holding more junior water rights) in portions of the Scott, Eel, Russian, Sacramento, and San Joaquin river basins, as well as for some users in the Sacramento-San Joaquin Delta (Delta). Pursuant to state law, SWRCB has prioritized surface water for users holding senior water rights, to meet health and safety requirements, and for environmental and wildlife preservation needs.

DFW also has been active in drought-related regulatory activities. For example, the department has closed some streams and rivers to fishing in order to protect fish in low water flows. Specifically, DFW and the state's Fish and Game Commission implemented emergency fishing closures on 11 distinct stretches of creeks, streams, and rivers across the state for portions of 2014, and in parts of the Lower Merced and Sacramento rivers for portions of 2015. (The Fish and Game Commission enacted emergency regulations for the latter half of 2015 allowing DFW to close *any* water to anglers in cases of significantly degraded environmental conditions for fish. Previous DFW authority was limited to certain waters and certain times of year.) These instances represent the first time the state has ever implemented emergency fishing closures due to drought. Additionally, DFW has enhanced enforcement of existing laws to protect fish and wildlife that drought conditions have rendered especially vulnerable. Efforts have included increasing investigations and citations of poachers and of marijuana growers who illegally divert water from streams.

State Has Limited Deliveries From Water Supply Projects. The drought also has affected the State Water Project (SWP) and federal Central Valley Project (CVP). Since the construction of the projects several decades ago, agricultural and municipal users from the central and southern parts of the state have contracted with the SWP and CVP to provide them with a specified amount of water from Northern California rivers channeled through the Delta. The amount of

water the projects actually are able to deliver in a given year, however, is affected not only by the quantity of mountain snowmelt, but also by regulatory requirements to protect river conditions for endangered fish species and to preserve water quality. The drought's adverse effects on both runoff and aquatic ecosystems therefore have combined to restrict the amount of water available for export.

Figure 7 shows how much water the SWP delivered to its contractors in 2000 through 2015 as a percent of total contracted amount. As shown, water scarcity and regulatory restrictions resulted in notably decreased allocations in recent years, including a historically low delivery of 5 percent of contracted amounts in 2014. The SWP has announced plans to allocate 15 percent of contracted amounts for 2016, although that amount could increase or decrease depending upon how much water ultimately is available for export this year. Federal CVP deliveries also have been curtailed, including delivering 0 percent of contracted amounts to agricultural contractors in 2014 and 2015.

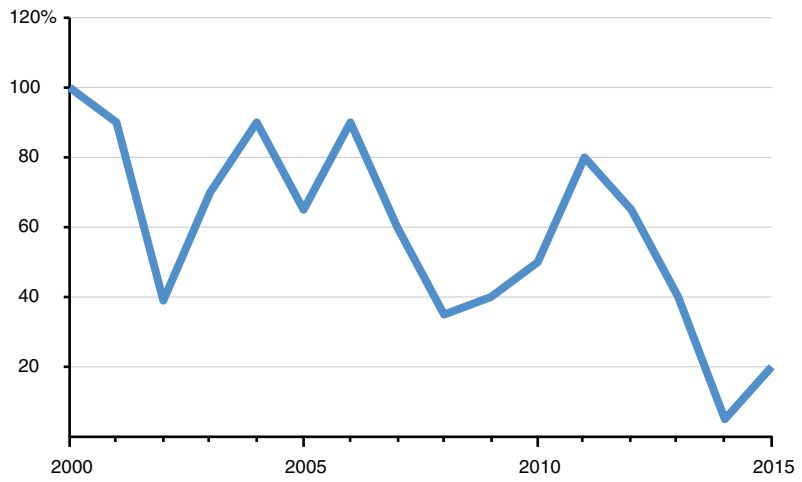
Throughout 2014 and 2015, the SWP and CVP have been managed based on a special Drought Operations Plan developed collaboratively by a "Real-Time Drought Operations Management Team" consisting of SWRCB, DWR, DFW, the federal Bureau of Reclamation, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service. This group also has met frequently during the past two years to make day-to-day operational decisions for the projects based on water conditions and fish needs.

SWRCB Relaxed Delta Water Quality Standards. The Drought Operations Plan that state and federal agencies developed for the SWP and CVP included releasing less water from upstream reservoirs than was needed to meet existing Delta outflow and water quality standards. The interagency team determined that additional water should be held in reserve to enable future fresh water releases to support migrating fish needing cold water, meet health and safety needs south of the Delta, and repel salt water from intruding into the Delta from the San Francisco Bay. The SWRCB enabled this by approving (with some modifications) several petitions from the Bureau of Reclamation and DWR to temporarily relax flow and water quality requirements within the Delta and allow the projects to modify the volume and timing of reservoir releases. The board also allowed short-term installation of a rock barrier to keep salt water from flowing too far into the Delta and affecting water quality.

Figure 7

State Water Project Delivers Less Water in Dry Years

Percent of Contract Amount



2016-17 BUDGET PROPOSALS AND NEXT STEPS

Despite storms in the early part of 2016, the current drought's impacts likely will persist into at least the budget year. Even when the current drought dissipates, history has shown that droughts will reoccur, and science indicates future droughts may be more frequent and intense. Below, we discuss some of the decisions and considerations the Legislature faces related to drought. We begin by describing the Governor's drought-related budget proposals for 2016-17, then provide our analysis and recommendations both for those proposals and for steps the Legislature can begin taking now to prepare for future years of drought.

Governor's 2016-17 Budget Proposals

Governor Proposes $323 Million for Drought Response Activities in 2016-17. Figure 8 summarizes the Governor's drought response

Figure 8

Governor's 2016-17 Drought Spending Proposals

(In Millions)

Department	Activity	General Fund	GGRF	Other Funds	Totals
Emergency Response					
CalFire	Expand/enhance fire protection	$74.5	—	$2.9[a]	$77.4
DWR	Install/remove Delta emergency rock barriers	42.0	—	—	42.0
OES	Provide emergency drinking water	22.7	—	—	22.7
DSS	Provide food to drought-affected communities	18.4	—	—	18.4
SWRCB	Provide emergency drinking water	—	—	16.0[b]	16.0
DWR	Conduct drought assistance and response	12.0	—	—	12.0
CSD	Assist drought-impacted farmworkers	7.5	—	—	7.5
SWRCB	Monitor/enforce water rights and conservation	5.4	—	—	5.4
DWR	Assist with drinking water shortages	5.0	—	—	5.0
OES	Coordinate statewide drought response	4.0	—	—	4.0
CDFA	Study economic impact of drought	0.2	—	—	0.2
Subtotals		($191.7)	(—)	($18.9)	($210.6)
Water Conservation					
CEC	Rebates/install efficient appliances	—	$30.0	—	$30.0
CEC	Water and energy technology program	—	30.0	—	30.0
CDFA	Increase agricultural water efficiency	—	20.0	—	20.0
DWR	Increase water efficiency, reduce energy use	—	10.0	—	10.0
DWR	Save Our Water campaign	$5.0	—	—	5.0
DFW	Improve efficiency at wildlife refuges	3.0	—	—	3.0
Subtotals		($8.0)	($90.0)	(—)	($98.0)
Environmental Protection					
DFW	Emergency fish and stream activities	$12.7	—	$2.0[c]	$14.7
Totals		**$212.4**	**$90.0**	**$20.9**	**$323.3**

[a] State Responsibility Area Fire Prevention Fund.
[b] Clean-Up and Abatement Account.
[c] Hatchery and Inland Fisheries Fund.
GGRF = Greenhouse Gas Reduction Fund; CalFire = California Department of Forestry and Fire Protection; DWR = Department of Water Resources; OES = Office of Emergency Services; DSS = Department of Social Services; SWRCB = State Water Resources Control Board; CSD = Department of Community Services and Development; CDFA = California Department of Food and Agriculture; CEC = California Energy Commission; and DFW = Department of Fish and Wildlife.

proposals for the budget year. The total proposed ($323 million on a one-time basis) is notably lower than the amount provided in the current year's drought package ($1.8 billion). The primary difference is the absence of Proposition 1 bond funds for drought-related projects, which made up the majority of the 2015-16 totals. As shown in Figure 8, the 2016-17 proposal primarily consists of $212 million from the General Fund, along with $90 million from the Greenhouse Gas Reduction Fund (GGRF)—auction revenue from the state's cap-and-trade program. The remainder comes from three other special funds.

Activities Primarily Focus on Continued Emergency Response. Nearly all of the drought-related activities the Governor proposes funding in 2016-17 are continuations of initiatives funded in recent years (and described earlier in this report). Unlike the 2015-16 budget, the Governor does not propose any new funding for major long-term water supply infrastructure projects. Rather, the majority of funds and activities would be dedicated to addressing the anticipated continuation of emergency drought response needs. Specifically, the proposal includes a one-time augmentation of $77 million for CalFire based on assumptions that dry conditions and dead trees will again contribute to prevalent and intense wildfires in the coming year. The Governor also dedicates $70 million to continue various forms of human assistance in drought-affected communities (such as drinking water, food, financial assistance, and housing and employment services). The proposal also allocates a combined $21.4 million to DWR, SWRCB, and OES to continue statewide drought coordination and response activities.

Proposal Also Includes Funding for Water Conservation Projects. As shown in the figure, the budget includes $98 million for water conservation and efficiency efforts. This consists primarily of $90 million from the GGRF for four programs. These programs would provide rebates for water efficient appliances or allocate grants for projects that reduce both water and energy usage and therefore are estimated to result in reduced greenhouse gas (GHG) emissions. Specifically, the budget proposes appropriating $20 million to the Department of Food and Agriculture for an existing program that allocates competitive grants to agricultural operations for purchasing more efficient water irrigation treatment and/or distribution systems. Another program ($10 million through DWR) would modify a previously funded initiative and provide grants for water and energy efficiency upgrades in the commercial and institutional sectors. (The previous program focused on the residential sector.)

The other two GGRF-funded efficiency programs ($30 million each) would be run by the California Energy Commission (CEC), and are the only entirely new activities included in the 2016-17 drought proposal. One program would (1) issue rebates to residents who purchase efficient washing machines and (2) install water-efficient fixtures and appliances for low-income households in disadvantaged communities. (The latter effort would use the existing CalEnviroScreen process to determine eligible residences.) The other program would fund emerging technologies to save water and energy across various sectors. (In April 2015, a gubernatorial executive order directed CEC to initiate such a program, however associated funding has not yet been provided.)

In addition to the four GGRF-funded initiatives, the budget includes $5 million to continue the Save Our Water public education campaign designed to improve statewide water conservation, and $3 million for DFW to continue improving water supply and water use efficiency at state wildlife areas and ecological reserves.

Continues Funding to Address Drought's Effects on the Environment. As shown in Figure 8,

the Governor also proposes to allocate $14.7 million for DFW to continue urgent and immediate drought-related environmental protection activities. This amount includes: (1) $5.4 million to continue monitoring and providing emergency services for at-risk aquatic and terrestrial species as needs arise, (2) $4 million to upgrade equipment at state hatcheries to help eliminate disease and develop safe refuge locations for fish in need of relocation, and (3) $3.5 million for increased monitoring and assistance for specific endangered native fish species that have experienced particular stress during the drought (winter- and spring-run Chinook salmon in the Sacramento River, and delta and long-fin smelt in the Delta).

LAO Analysis

Funding Continued Drought Response Makes Sense. We believe the Governor is prudent to budget for continued drought response needs in 2016-17. While winter storms have brought some much-needed precipitation in the early part of the year, how much snow and rain the state ultimately will receive in 2016 remains uncertain. Additionally, as discussed earlier in this report, the severity of the current drought is such that an extensive accumulation of precipitation—likely across multiple years—will be needed to fully mitigate drought impacts. Specific conditions indicating the current drought will continue to have effects in the coming year include: (1) below average reservoir storage levels; (2) dry conditions and dead trees in the state's forests that diminish wildlife habitats and increase fire risk; (3) degraded aquatic conditions in the state's rivers; and (4) depletion of groundwater basins, including dry wells in several residential communities in the Central Valley.

While most of the proposed funding likely will be needed even if the state experiences notable storms this winter, high precipitation rates could diminish the need for a few of the proposals. For example, high flows in the Sacramento River would negate the need to install and remove a salinity barrier in the Delta, for which the Governor budgeted $42 million. Conclusive information as to which drought response activities ultimately will be needed may not be available by the legislative budget deadline, however. The administration has indicated it may adjust some proposals at the May Revision based on precipitation rates and snowpack levels this spring, but it anticipates a continued need for most of the proposed funding.

Governor's Proposals Mostly Well-Focused. We believe the Governor's approach to focus primarily on the most urgent human and environmental drought-related needs makes sense. Evidence supports the continued need for these response activities. Groundwater basins can take many years to replenish. As such, drinking water shortages and other emergency needs for residents living in the most severely drought-affected communities likely will continue in the coming year and should be a high priority for the state. Supporting the state's vulnerable fish and wildlife also should be prioritized, particularly given recent evidence of high mortality rates for several already endangered salmon and smelt species. The prolonged dry conditions, proliferation of dead trees, and anticipated new vegetation growth from recent rains all suggest the state could experience another extreme fire season.

The Save Our Water campaign and improving efficiencies at state wildlife refuges also seem worthy of continued funding support in 2016-17. These activities likely would result in immediate benefits by reducing water usage during this current drought, and have the potential for long-lasting effects in future years.

We also believe the Governor's focus on near-term, rather than longer-term, projects in this budget has merit. Although large water

supply infrastructure projects will help the state mitigate the effects of future droughts, they have little influence on current conditions. Moreover, given the large amount of Proposition 1 funding appropriated in 2015-16 and the often lengthy process for developing, soliciting, and allocating grants, we believe appropriating additional funding for longer-term infrastructure now would be premature. Waiting to appropriate additional Proposition 1 funds provides time for the grantees to incorporate the 2015-16 funding and plan for future projects, for departments to complete allocations for the initial projects, and for the administration and the Legislature to gather information about outstanding needs and about how best to roll out remaining funds.

Case for Specific Cap-and-Trade Funded Proposals Is Less Conclusive. While conservation projects can lead to both immediate and persistent reductions in water use, we have some questions about the merits of the Governor's four GGRF-funded proposals. Specifically, whether the proposals represent the best approach to achieving water and energy savings is unclear. For example, research has found that a similar appliance rebate program administered a few years ago rarely resulted in behavioral changes, but rather largely subsidized purchases that consumers would have made without the rebate. Moreover, while the agricultural efficiency program provides incentives for grantees to save water in one area of their farm, the program does not monitor whether they then use that freed up water to grow additional crops in another area, which would not result in net water or energy savings. Additionally, the state already supports separate agricultural and urban water efficiency programs with Proposition 1 funds through DWR, raising questions about duplicative efforts and the need for multiple similar programs. Unlike the rest of the Governor's drought package, three of these four projects represent new or significantly modified initiatives. As such, details still are lacking as to exactly how they would be structured, and their potential effectiveness remains unproven.

In addition to uncertainty about the water and energy savings associated with these programs, we also have questions about how effective the proposed initiatives would be at reducing GHGs—the primary requirement of the existing law that governs expenditures of cap-and-trade auction revenues. We will discuss these proposals in the context of the state's broader GHG-reduction efforts as part of our upcoming analysis of the Governor's 2016-17 cap-and-trade expenditure plan.

Governor Proposes One-Time Funding, but Some Needs May Be Ongoing. All of the proposals in the Governor's drought package represent one-time funding to support limited-term activities. This approach is consistent with previous drought appropriations in recent years. Some statewide needs that have emerged during the drought, however, may persist even after the current drought dissipates.

For example, dry residential wells in the Central Valley may take many years to naturally recharge, and the geology is such that some overdrafted wells may never recover. While the state has both provided temporary support (such as water bottles and tanks) and helped initiate permanent solutions in certain areas, ensuring residents have a dependable source of safe drinking water likely will require additional state staff and funding for a number of years. (Although recently passed legislation *eventually* should result in more sustainable management practices for groundwater basins, addressing dry residential wells requires more near-term action.) Additionally, the state likely will want to continue funding some of the fish monitoring DFW has undertaken during the drought to ensure at-risk

species recover and identify if additional action might be needed. The SWRCB's drought-related efforts to gather information about water rights and develop minimum flow criteria for streams around the state are other activities that likely would be worth sustaining and may require some ongoing resources.

There is a notable example within the Governor's budget of providing ongoing funding for drought-identified needs. Separate from his one-time drought package, the Governor has proposed $550,000 from the General Fund to support three positions at DWR to plan for how the state might effectively manage water shortages (due to drought or other causes such as earthquakes or climate change) in the future. We believe this makes sense, but that some additional activities supported with one-time drought funds also may merit sustained funding.

Limited Data Available on Effectiveness of State's Drought Response. Because the state still is in the midst of addressing the drought crisis, evaluating the effectiveness of the overall response is both difficult and somewhat premature. Yet ensuring that such an evaluation takes place is essential to informing and improving the state's approach to handling future droughts. Formal reflection and documentation of "lessons learned"—such as which specific state activities were successful and essential, which proved to be unnecessary or ineffective at meeting needs, and what issues emerged that were unanticipated—can help the state be better prepared in the future. For example, alarming numbers of fish have died during this drought due to high temperatures in the state's rivers. Knowing this might happen again, what kinds of monitoring procedures, flow criteria, and rescue contingency plans has the state ultimately employed that might be initiated sooner in a subsequent drought? Other examples of recent activities the state should carefully examine include efforts to reduce urban water consumption (for example, how best to structure conservation incentives and requirements across the state) and how to coordinate responses to water shortages in rural communities (for example, which agencies should assume which roles).

In addition to evaluating the effectiveness of the state's urgent response efforts, reviewing the bond-funded water supply infrastructure projects undertaken during this drought also is important. Detailed oversight over the outcomes from the initial allocations of Proposition 1 funding can help guide the Legislature in how best to appropriate remaining bond funds. Again, data collection will be essential to this exercise, including the specific characteristics of funded projects and what quantifiable results they have accomplished in terms of water saved or made available. Formal gathering of feedback from stakeholders as to remaining statewide needs and projects showing effective results also can help inform statewide decisions for future allocations.

Additional Policy Changes May Be Needed to Help State Prepare for Future Droughts. As shown in the appendix, the state has implemented numerous policy changes to facilitate drought response efforts. The majority of these actions, however, were enacted on a temporary basis. Along with continuing some funding and activities, the state also may benefit from extending some short-term drought-related policies, such as certain reporting requirements. Moreover, there likely are initiatives not yet enacted that could be put in place now to improve the state's ability to respond to future droughts. For example, the Public Policy Institute of California recently released a report suggesting several ways the state could improve its approach to allocating water. Those recommendations included requiring that all surface water rights holders be brought under SWRCB's permitting system, streamlining the process for

approving voluntary transfers among water users, and allocating more water for environmental purposes. Additionally, many local governments and water agencies have expressed a need for additional tools to generate local funding to support stormwater infrastructure, and for greater ability to set water rates that encourage conservation.

There may be other drought-related issues that could be expedited, facilitated, or clarified by additional legislation or permanent regulation. For example, are there statutory barriers to maximizing recharge of groundwater basins during strong rain events? Are policies needed to clarify how far the state's responsibility extends related to privately owned individual wells? Does SWRCB need additional authority to collect evidence of water rights held to inform permitting and (when needed) curtailments? Identifying such issues and enacting needed statutory changes now would help position the state to respond more effectively in future droughts.

Recommendations

Based on our analysis, we offer five drought-related recommendations, which are summarized in Figure 9 and which we discuss in more detail below.

Adopt Governor's Emergency Response and Environmental Protection Funding Proposals for 2016-17. Because of the likelihood of continued drought conditions, we recommend the Legislature adopt the components of the Governor's drought package that meet essential human and environmental needs and that are likely to result in immediate water conservation. This would include all of the proposals supported by General Fund ($212 million) and non-GGRF special funds ($21 million). Before final adoption of the budget later this spring, however, we recommend revisiting these proposals to assess whether winter storms have negated the need for certain components (such as the Delta salinity barrier).

Request Additional Information to Evaluate Merit of GGRF-Funded Conservation Proposals. We recommend the Legislature delay deciding on the Governor's four water and energy efficiency programs until the administration has provided additional information to justify the request. Specifically, we recommend that the administration provide additional information as to (1) how specifically the programs would be structured (such as criteria by which projects would be selected for funding); (2) what specific outcomes are expected (such as the levels of anticipated water and energy savings and GHG reduction); (3) how outcomes will be measured, evaluated, and reported; and (4) how these programs would differ from other existing efficiency programs. Once this information is provided, we recommend the Legislature weigh the anticipated benefits of these proposals against

Figure 9

Summary of Recommendations

- ✓ Adopt Governor's emergency response and environmental protection funding proposals for 2016-17.
- ✓ Request additional information to evaluate merit of Greenhouse Gas Reduction Fund conservation proposals.
- ✓ Identify issues that require longer-term funding and strategies.
- ✓ Require departments to assess and report on effectiveness of state's drought response.
- ✓ Identify and enact additional steps the state should take now to prepare for future droughts.

potential benefits that could be achieved by funding other GHG-reduction projects.

Identify Issues That Require Longer-Term Funding and Strategies. We recommend the Legislature ask the administration and stakeholders to report on activities supported by temporary drought funding that may represent ongoing needs. While such issues represent funding decisions for 2017-18 and future years, the Legislature could consider signaling now that certain funding will continue. This could help departments prepare for longer-term efforts (such as by assigning more permanent staff and developing multiyear implementation plans).

Require Departments to Assess and Report on Effectiveness of State's Drought Response. We recommend that the administration report on how it plans to evaluate and document the state's drought response efforts. While this could be done informally during legislative hearings, we also recommend requiring that the administration submit two formal reports.

First, we recommend requesting a formal update of the "Outcomes of Drought Expenditures" report the Legislature requested through the *Supplemental Report of the 2015-16 Budget Package*. That report (submitted in December 2015) described *projected* outcomes and benefits from the 2015-16 drought expenditures as well as the metrics the administration *intended* to use to measure such effects. Subsequent updates should include *actual* data measuring the degree to which those intended objectives were met. Data reported on the numerous Proposition 1 projects funded in 2015-16 would be particularly helpful for informing future bond allocation decisions. The Legislature could request such updates on an annual basis for the next several years, as the drought dissipates and departments have time to reflect on response efforts, and as longer-term projects are more fully implemented. To allow for a more comprehensive assessment of the drought response, the Legislature could expand this reporting requirement to encompass outcomes from activities funded prior to 2015-16 as well.

Second, once the major effects of the current drought have concluded, we recommend requiring that the administration compile and submit a comprehensive report on lessons learned from the state's response to this drought. This requirement would ensure that departments undertake the vital task of reflecting on and documenting how the state can improve its response to future droughts. Such an effort could be coordinated by the Governor's Interagency Drought Task Force and could include a compilation of reports that individual departments already have initiated (such as the SWRCB's "Dry Year Program Report" that summarizes and assesses its implementation of water rights in 2014, and DFW's Drought Response quarterly reports).

To the degree possible, departments should collect, evaluate, and report data to support this assessment of drought response effectiveness. Additionally, departments should recognize information gaps and identify data that should be collected to improve drought response in the future. Examples of data that could be used to evaluate drought response include: the number and locations of dry wells in each county (including how many have been addressed and how many remain); a comprehensive summary of water rights holders, diversions, and curtailments by watershed; rates of groundwater extraction and rates of land subsidence by location; stretches of rivers and streams where fish and wildlife experienced severe stress or die-offs; the number and location of water transfers that occurred among users during the drought; and areas of the state that conserved the most water and the specific strategies they employed.

Identify and Enact Additional Steps the State Should Take Now to Prepare for Future Droughts. We recommend the Legislature continue to gather information from departments and stakeholders regarding policy changes that would improve the state's ability to manage drought. Legislative committees have held several informational hearings in recent months to begin exploring this topic, and researchers such as the Public Policy Institute of California have put forth several recommendations. We recommend the Legislature spend the coming months and years vetting proposals for their potential benefits and trade-offs, and enacting changes around which there is widespread and/or scientific consensus. This could include both changes that remove existing barriers to effective drought response, as well as proactive changes that improve water management across the state.

CONCLUSION

Despite welcome storms early this winter, statewide drought conditions appear far from over. We recommend that the Legislature's first priority be continuing to address the urgent drought-related needs of residents and wildlife. Given the certainty that droughts will reoccur, however, and the possibility that subsequent droughts might be similarly intense, we also recommend the Legislature continue to plan for the future. Learning from the state's response to the current drought can help California be even more prepared to endure the inevitable return of dry conditions in future years.

APPENDIX: SIGNIFICANT DROUGHT-RELATED POLICY CHANGES

Below, we summarize major policy changes the state undertook in response to the drought. We begin with those that were implemented on a temporary basis, then describe permanent actions. In most cases, regulations adopted by state departments were in response to direction contained in gubernatorial executive orders.

Temporary

Implemented by Gubernatorial Executive Order

- Suspend California Environmental Quality Act (CEQA) review requirements for several categories of drought-related projects (including changes to Central Valley Project [CVP] and State Water Project [SWP] flow requirements, adoption of statewide water recycling requirements, certain water transfers, habitat restoration projects, projects to address drinking water shortages, and installation of Delta salinity barriers).
- Suspend certain provisions of the state Water Code—such as certain requirements related to water quality control plans and the Delta Plan—for several categories of drought-related projects (including certain water exchanges, habitat restoration projects, and installation of Delta salinity barriers).
- Suspend certain state contracting requirements—such as provisions related to advertising and competitive bidding—for several categories of drought-related projects (including certain habitat restoration projects and provision of emergency drinking water).
- Suspend certain statutory noticing and approval requirements for landowners to remove dead, dying, or diseased trees.
- Prohibit homeowners' associations from fining or penalizing residents for implementing water conservation measures.
- Expedite timeline for reviewing and permitting certain projects, including water transfers, Delta salinity barriers, and projects to increase local water supplies and improve drinking water systems.
- Require 25 percent reduction in urban water use compared to 2013.

Implemented by Regulation or Administrative Agency Order

- Require urban water suppliers to decrease water use in service area by specified amount (between 4 percent and 36 percent compared to 2013, depending on previous usage) to meet statewide mandate of 25 percent.
- Require urban water suppliers to report water use and water conservation enforcement efforts each month.
- Prohibit certain outdoor uses of potable water, including watering sidewalks or driveways, irrigating after rainstorms, and watering ornamental turf on public street medians.
- Prohibit certain business uses of water, including requiring restaurants to serve water only on request and hotels to offer guests the option of not laundering linens every day.

- Allow water rights holders to temporarily deviate from the terms of their existing permits in order to provide relief from drought conditions. (Includes modifying Delta flow and water quality requirements for SWP and CVP.)
- Require immediate compliance for junior water rights holders who receive orders to stop diverting water.
- Increase Department of Fish and Wildlife's (DFW's) authority to close waters to fishing based on drought conditions.

Implemented by Legislation

Chapter 2 of 2015 (AB 92, Committee on Budget)

- Suspend certain state contracting requirements—such as provisions related to advertising and competitive bidding—for drought-related projects.

Chapter 27 of 2015 (SB 88, Committee on Budget and Fiscal Review)

- Suspend CEQA review requirements for several categories of drought-related projects (including certain groundwater, recycled water, and well projects).

Permanent

Implemented by Regulation or Administrative Agency Order

- Expand authorized uses of recycled water.
- Increase water efficiency standards for new and retrofitted landscapes.

Implemented by Legislation

Chapter 3 of 2014 (SB 104, Committee on Budget and Fiscal Review)

- Increase penalty amounts for illegally diverting water during drought conditions.
- Expand emergency drought rulemaking and enforcement authority for the State Water Resources Control Board (SWRCB).

Chapter 2 of 2015 (AB 92, Committee on Budget)

- Authorize DFW to issue penalties for obstructing fish passage in streams and rivers.

Chapter 27 of 2015 (SB 88, Committee on Budget and Fiscal Review)

- Authorize SWRCB to require water systems that consistently fail to meet standards to consolidate with, or obtain service from, a public water system.
- Require measurement and reporting of water diversions exceeding ten acre-feet per year.
- Enhance penalty authority for local public entities to enforce water conservation
- Expand emergency drought rulemaking and enforcement authority for SWRCB.

Chapter 62 of 2015 (AB 1, Brown)

- Prohibit municipalities from imposing fines for failure to water a lawn or for brown lawns when the Governor has declared a drought state of emergency.

LAO Publications

This report was prepared by Rachel Ehlers and reviewed by Brian Brown. The Legislative Analyst's Office (LAO) is a nonpartisan office that provides fiscal and policy information and advice to the Legislature.

To request publications call (916) 445-4656. This report and others, as well as an e-mail subscription service, are available on the LAO's website at www.lao.ca.gov. The LAO is located at 925 L Street, Suite 1000, Sacramento, CA 95814.