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Paying for Water in California

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Summary

California's water system provides many vital services: supplying clean water for homes, farms, and other businesses; protecting the quality of rivers, lakes, and beaches; preventing loss of life and property from devastating floods; and safeguarding the health and habitat of fish and other wildlife. By some accounts, our water system is in a deep financial crisis, with failing marks for essential infrastructure and with vast unmet spending needs. However, this system is both large—with annual expenditures exceeding $30 billion—and multifaceted, so it is important to take a closer look to identify the specific financial problems. To this end, we examine how well California is meeting various water management goals and identify areas where lack of funding is a key obstacle to success. This closer examination reveals a more nuanced picture of fiscal health for California's water system and pinpoints areas requiring urgent policy attention.

Contrary to many media reports, California's water supply and wastewater providers, which together account for over 85 percent of total spending, are performing reasonably well—providing safe, reliable levels of service and preparing for future needs. These utilities are almost entirely locally funded, and to date they have generally been able to raise rates to comply with new treatment requirements and replace aging infrastructure. However, they do face financial challenges. Rising regulatory standards carry new costs, and the water supply shipped through the Sacramento–San Joaquin Delta remains at risk because of the system's ecological decline and its seismically vulnerable levees. Yet from the perspective of fiscal health, a bigger concern is the potential for Proposition 218 (1996) to stymie local agencies' ability to pursue the modern water management techniques needed to maintain reliable water service in the face of population growth, climate change, and increasing water scarcity. Proposition 218's rigid requirement that fees must be specifically linked to the services for each property jeopardizes the implementation of conservation-oriented programs and the development of nontraditional sources of water supply. This requirement also limits water utilities' ability to provide "lifeline" discounts to low-income households, an important equity-oriented feature of most energy billing systems.

We find even more debilitating structural funding gaps in five other areas: small, rural water systems; flood protection; stormwater pollution; aquatic ecosystem management; and integrated water management. For small, rural drinking water systems with contaminated groundwater wells, the shortfall in funding is hard to bridge because prospective solutions have high costs per household and many households in these communities have limited means. In the four other areas, the key challenge is a legal environment for water funding that is out of sync with modern water management objectives. Again, Proposition 218 poses problems, requiring voter approval for fees and assessments for "property-related" flood protection and stormwater management. Moreover, anything not qualifying as a fee is a tax, and earmarked "special" taxes require a two-thirds supermajority of local voters since the passage of Proposition 13 in 1978. Proposition 26, a new constitutional reform passed in 2010, restricts the definition of other, non-property-related fees, potentially further hampering fundraising for stormwater management and ecosystem improvement. Crucially, these legal strictures make it harder to support a more integrated water management system—a necessary approach for effectively meeting the state's water system goals during times of water scarcity and climate change.

The overall funding gap in these five areas is on the order of $2 billion to $3 billion annually: $30 million to $160 million to provide safe drinking water in small, disadvantaged rural communities; $800 million to $1 billion for floods; $500 million to $800 million for stormwater management; $400 million to $700 million for

ecosystem support for endangered species; and $200 million to $300 million for integrated water management. Although filling this gap may seem daunting—particularly to cash-strapped program managers—it is not large relative to the sums California is already spending on water services. In other words, this is a fixable problem.

Since the early 2000s, the state has worked to fill some of the gap with general obligation (GO) bond funds, to the tune of about $1 billion annually. But these funds, which are reimbursed with general fund tax dollars, are running out, and it seems likely that California will be on a leaner bond diet in the years ahead. California will need a broader mix of funding to pay for the state water system. State GO bonds are less desirable for most purposes than are targeted funding sources (such as surcharges on water, chemicals, road use, and hydropower), especially those that tap contributions from the individuals and communities who share responsibility for the problems or who benefit most from this spending. Likewise, broader taxes (e.g., parcel taxes or sales tax increments) are suitable for some purposes.

To fill the existing funding gaps, and to prevent new ones from forming, California will have to better align its funding laws with the goals of modern water management. The legislature will need to pass new special taxes and regulatory fees to tap a broader mix of funding sources. And alongside any new state GO bonds, California voters will also need to approve a suite of constitutional reforms to address the unintended consequences of Propositions 218, 26, and 13 for local governments' ability to manage water responsibly. These reforms would maintain the salutary aspects of these laws, such as their high standards of transparency and accountability, while enabling more efficient, equitable, and sustainable water management. In particular, they should provide a more flexible definition of fees, remove the local voter approval requirements for fees and assessments for flood protection and stormwater management (comparable to water and wastewater fees), and lower the local voter threshold for special taxes to a simple majority (comparable to fiscal measures in statewide elections and local general taxes). Local water agencies, for their part, should provide transparent, well-explained records of their rate decisions.

It will also be important to mind the funding gap by comparing the value of proposed spending with its costs. For instance, some proposed flood management investments do not appear to pass a cost-benefit test, and some ecosystem and stormwater investments provide little real benefit. To be sure we are using funds most effectively, California's water management agencies at all levels—local, regional, state, and federal—should aim to develop more coordinated, integrated approaches to management and regulatory oversight, drawing on scientific and technical analysis to support sound and balanced decisions.

Relative to current spending of over $30 billion per year on this vital sector, Californians need to raise an additional 7 to 10 percent—or $150 to $230 per household annually—to fill critical gaps. Although this is a fixable problem, it will not happen without a bold, concerted effort on the part of California's state and local leaders, who must convince California's residents to support the necessary changes with their votes and their pocketbooks.

Contents

Technical appendices to this paper are available on the PPIC website:
www.ppic.org/content/pubs/other/314EHR_appendix.pdf

Figures

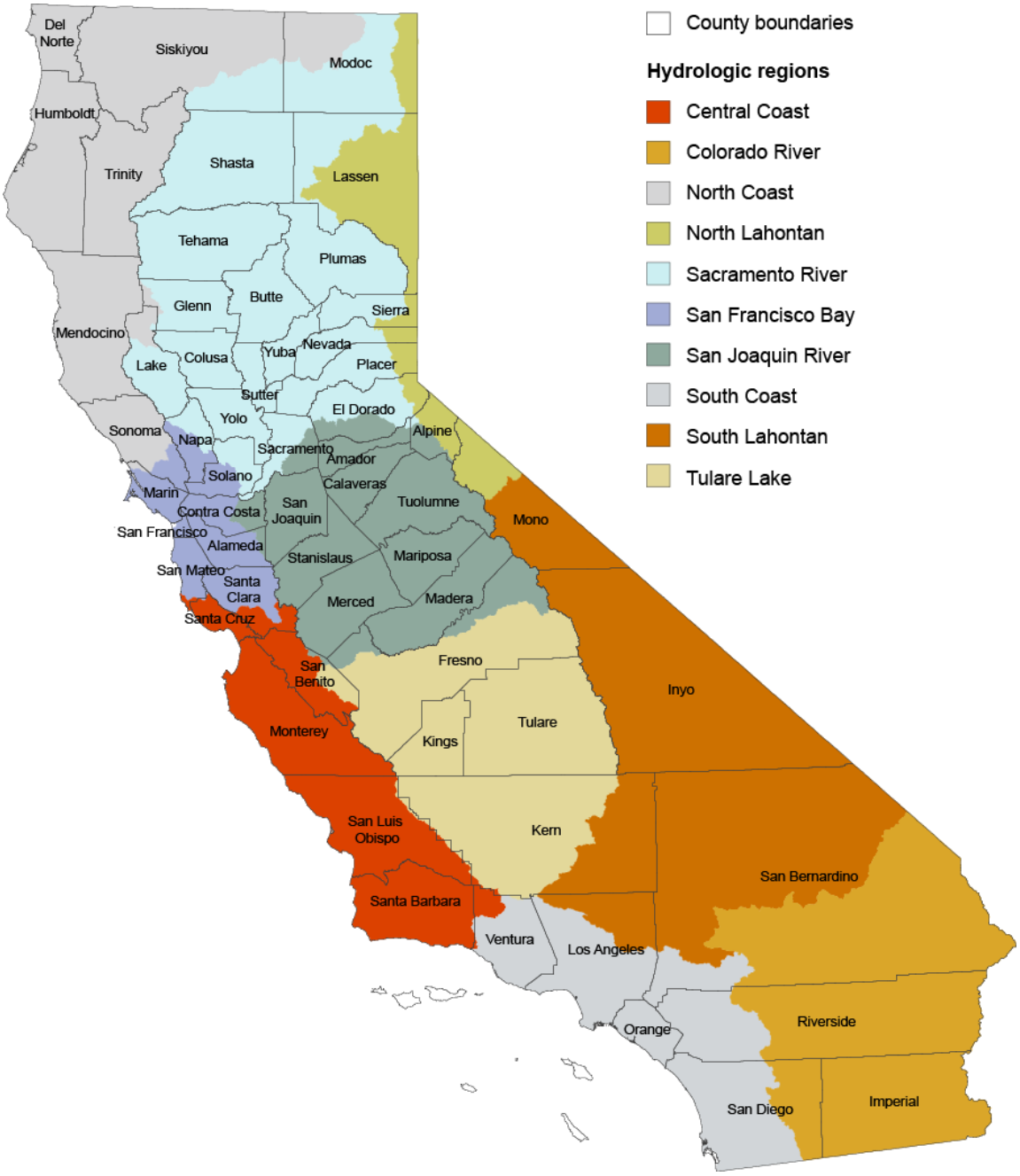
Tables

Boxes

Abbreviations

af	acre-feet
AB	Assembly Bill
BDCP	Bay Delta Conservation Plan
CCAG	City/County Association of Governments (San Mateo)
CVP	Central Valley Project
DPH	Department of Public Health
DWR	Department of Water Resources
FEMA	Federal Emergency Management Agency
IRWM	Integrated Regional Water Management
JPA	Joint Powers Authority
MCL	Maximum Contaminant Level
NCCP	Natural Community Conservation Plan
LAFCO	Local Agency Formation Commission
NFIP	National Flood Insurance Program
SAFCA	Sacramento Area Flood Control Agency
SAWPA	Santa Ana Watershed Project Authority
SB	Senate Bill
SWP	State Water Project
SWRCB	State Water Resources Control Board
USEPA	U.S. Environmental Protection Agency

California hydrologic regions and counties



SOURCE: California Department of Water Resources.

NOTES: In this report, counties that fall into more than one hydrologic region are assigned to the region where most of the population lives, as follows:

Bay Area: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano. Central Coast: Monterey, San Benito, San Luis Obispo, Santa Barbara, Santa Cruz. Colorado River: Imperial. Lahontan: Alpine, Inyo, Lassen, Mono. North Coast: Del Norte, Humboldt, Mendocino, Siskiyou, Sonoma, Trinity. Sacramento River: Butte, Colusa, El Dorado, Glenn, Lake, Modoc, Nevada, Placer, Plumas, Sacramento, Shasta, Sierra, Sutter, Tehama, Yolo, Yuba. San Joaquin River: Amador, Calaveras, Madera, Mariposa, Merced, San Joaquin, Stanislaus, Tuolumne. South Coast: Los Angeles, Orange, Riverside, San Bernardino, San Diego, Ventura. Tulare Lake: Fresno, Kern, Kings, Tulare.

Introduction

Everybody is always in favour of general economy and particular expenditure.

—Prime Minister Anthony Eden, 1956

The sustainable management of water resources is vital to California's economic and social well-being. Water system management includes a variety of interrelated activities:

- Supplying water for drinking and household purposes, commerce and industry, agriculture, landscaping, and firefighting;
- Safeguarding water quality of estuaries, rivers, lakes, aquifers, and coastal beaches by collecting and treating wastewater and managing discharges of polluted stormwater and other runoff;
- Managing floodwaters and flood damage to keep people and property out of harm's way; and
- Protecting the aquatic ecosystems that are the sources of the state's water supply, essential habitat for fish and other wildlife, and venues for recreational activities.

Myriad governmental structures provide these services. State and federal governments supply water on a large scale through the State Water Project (SWP) and Central Valley Project (CVP), respectively; they also build and maintain extensive flood works, with regulatory oversight of the entire water system to protect public health and the environment. Thousands of special districts are in charge of water supply, sewage treatment, stormwater management, flood protection, and other water-related services within their geographic boundaries. Cities and counties also provide many of these services, and they have primary responsibility for managing stormwater. In addition, privately owned water utilities deliver drinking water to a fifth of California's population. Many farmers, households, and industries supply themselves with water directly from wells and surface sources.

In recent years, numerous concerns have been voiced about the ability of this complex system to raise the funds needed to maintain safe, reliable, and environmentally sustainable water service in California. One side of this funding challenge is rising costs. Much of the state's water supply, wastewater, and flood control infrastructure is aging, and rebuilding typically requires costly upgrades to meet increasingly high standards for water quality and infrastructure safety. Moreover, the last few decades have seen the arrival of new mandates—and added costs—for managing polluted stormwater runoff and protecting aquatic ecosystems. Climate change and other factors are also likely to raise costs and management complexity in the coming decades (Hanak and Lund 2012; California Department of Water Resources 2009). Rising temperatures will reduce the "free" seasonal water storage now provided by the Sierra Nevada snowpack and change the patterns of runoff, potentially increasing winter and spring flood risk. Although there is still great uncertainty regarding coming changes in average precipitation levels, the science is increasingly pointing to the likelihood of more "extremes"—more frequent droughts, floods, and wildfires—that will tax existing infrastructure and management systems. These changes will also increase the difficulty and expense of providing suitable habitat for endangered native fish species (Moyle et al. 2013).

The flip side of the cost challenge is shrinking revenue alternatives. A series of constitutional reforms adopted by the state's voters, starting with the landmark Proposition 13 (1978) and followed by Proposition 218 (1996) and Proposition 26 (2010), have made it increasingly difficult for local water agencies to raise funds from local ratepayers, and they have also set up higher hurdles for new local and state taxes to support this sector. Meanwhile, budget constraints have curtailed the largesse of the federal government, an important financial partner in times past. Since 2000, the state has stepped in with some supplemental funding, thanks to voter approval of six general

obligation (GO) water-oriented bonds, totaling nearly $20 billion. Although these bonds have provided welcome support, they have also generated concerns about fiscal tradeoffs: they are repaid with scarce general fund tax dollars that also support state programs with fewer local funding options, such as education, health, and social services. Recent experience raises doubts about the continued popularity of GO bonds for water: the legislature approved placing an $11 billion water bond on the ballot in late 2009, but weak polling has already led it to twice postpone the required popular vote. Even the smaller replacement bonds now under consideration have been polling weakly despite the strengthening economy, though the bond outlook could improve as the public takes stock of the severe drought now gripping the state.[1]

The prospect of large unmet funding needs has begun to spur a healthy debate about California's options for paying for water services: What is the right mix between state and local funding sources? What are the priorities for any future state bonds? What can be done to help local agencies pay for the many services they are expected to provide? Would new types of funding—such as a small surcharge on water bills or a small increase in the sales tax—help California better meet its water management goals? Do Californians need to revise the constitutional limits on raising money to support this vital sector? Can the federal government help, despite its own financial constraints, by changing the way it regulates the system and distributes available funding? And last, but not least—Are there ways to stretch existing water dollars further with more judicious management approaches?

This report tackles these questions by taking a broad, multifaceted look at California's water funding challenges and potential solutions. Our work is informed by a series of small regional workshops held in late summer 2013 with water managers and legal experts from around the state, and by in-depth legal, financial, and economic analyses.[2] We first set the stage with a brief history of local, state, and federal roles in paying the water bill and with a primer on the evolving legal framework for raising money from different sources. We then compare estimates of recent spending levels and the funding needs for different services to identify critical funding gaps. We next look at options for filling the critical gaps, considering incentives, affordability, reliability, and the legal and institutional hurdles that must be overcome for different funding sources. We conclude with our recommendations: a road map for how California can put its water system on more solid financial footing in the 21st century.

We find grounds for hope alongside grounds for serious concern. Those parts of California's water system that have had continued access to flexible funding from local sources—the massive water supply and wastewater networks run by local and regional utilities—have been doing a relatively good job of providing clean, safe, and reliable water. Yet these agencies risk future failures from constitutional restrictions on their funding options. In addition, California is already failing to meet societal objectives with respect to flood protection, stormwater management, and aquatic ecosystem management, owing to overwhelming legal constraints on local and regional funding. To enable sustainable management of the state's water resources, California's legislature and the voting public will need to enact a series of bold legal reforms to broaden and diversify the funding base. The annual spending gap that needs filling is on the order of $2 billion to $3 billion per year—7 to 10 percent above current spending. It's a large but fixable problem. For their part, water agencies at all levels will need to rise to the challenge of adopting more integrated management approaches to use both existing and new financial resources to greatest effect.

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[1] For recent polls see Baldassare et al. 2013 and University of Southern California and Los Angeles Times 2013.

[2] Appendix A documents our analysis of the legal context for state and local funding; Appendix B provides our estimates of expenditures, revenues, and funding needs; Appendix C documents the uses of recent bond funds; Appendix D provides a comparison of "who pays" under a series of funding alternatives, using integrated regional water management as an illustration; and Appendix E describes patterns in local ballot measures to fund the water system. Two online data sets, State General Obligation Bond Spending on Water and Local Water-Funding Ballot Measures, provide additional information on the data used in Appendix C and Appendix E, respectively.

Locals Rule: A Brief History of Water Spending

In recent years, water management agencies in California have spent more than $30 billion annually, or about $2,350 per household, to deliver supplies, prevent water pollution, provide flood protection, and manage aquatic ecosystems (Table 1). Although these estimates are approximate (for instance, some spending on ecosystem management occurs as part of other water management functions shown here), they provide a good sense of the scale of operations and the relative roles of different levels of government. Local entities (including private water utilities and private sector spending on flood insurance) are the predominant players, accounting for 84 percent of total spending. The state comes in a distant second (12%), and the federal government is firmly in last place (4%).

TABLE 1
Yearly water-related spending in California by source, 2008–2011 (2012 $, millions)

	Local	State	Federal	Total
Water supply[a]	14,777	1,603	477	16,857
Water pollution control[b]	9,458	434	222	10,114
Flood management	1,324	574	254	2,152
Aquatic ecosystem management	25	405	241	671
Debt service on GO water bonds	—	689	—	689
Total Spending	**25,584**	**3,703**	**1,193**	**30,480**
Total Spending (%)	84%	12%	4%	100%

SOURCE: Authors' estimates using SCO local government data files (local public water, wastewater, and special district expenditures) and data from the CPUC (local private agencies), the governor's budgets (state agency expenditures), and individual federal agencies (federal agency expenditures). See Appendix B.

NOTES: These estimates summarize expenditures by federal and state agencies and local entities including cities, counties, special districts, private water utilities, and private individuals (for flood insurance). State and local expenditures are net of grants from higher levels of government.

[a] This category excludes $2,575 million in wholesale water sales from local spending to avoid double counting (see Appendix B).

[b] This category includes management of wastewater and polluted stormwater and other runoff, including author estimates of $500 million for local stormwater management (see Appendix B).

This picture looks very different from the one an observer might surmise if following water policy discussions in Sacramento or Washington, DC. In those circles, the money talk is mostly about the importance of new state and federal funding authorizations to keep the system afloat. To be sure, such funds have long provided welcome support. But the surprising fact is that California's water system has nearly always relied primarily on funding by local residents, farmers, and nonfarm businesses, who pay for these services through their water and sewer bills and a variety of other local fees and taxes.

Water system development from statehood to the early 20th century was almost entirely locally funded, including flood works, irrigation canals, and large-scale storage and conveyance systems to bring water and hydroelectric power to growing urban areas in the Los Angeles and San Francisco Bay regions.[3] Beginning in the 1910s, the state and federal governments undertook investments to support regional flood control in the Sacramento Valley.

[3] This discussion draws on Hundley (2001), Hanak et al. (2011), ch. 1, and Lund et al. (2010), ch. 2.

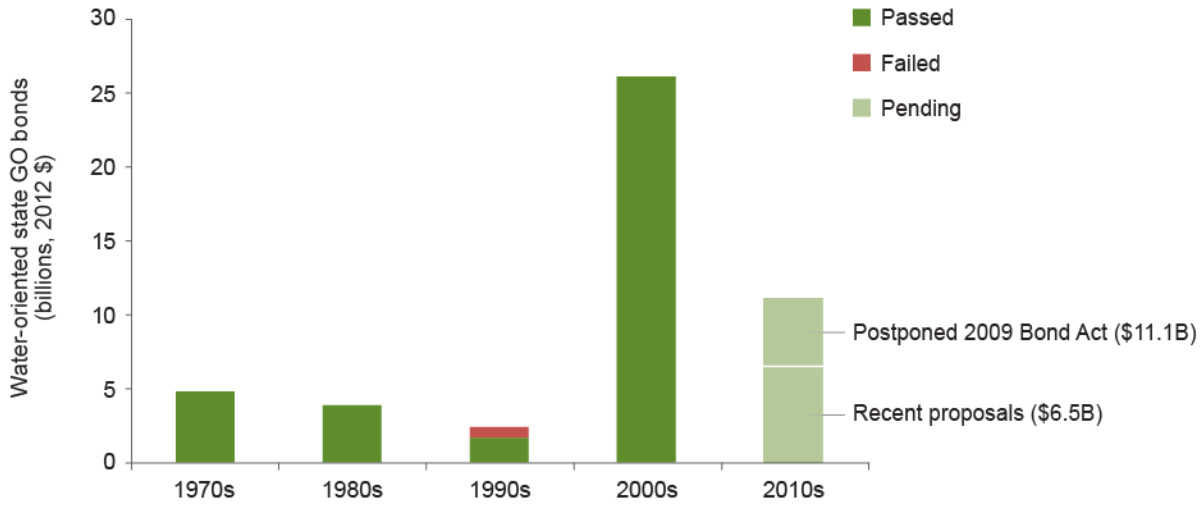
Federal involvement increased dramatically during the Great Depression, with investments in water infrastructure projects throughout the West to stimulate economic recovery. For California, this notably included the development of the Central Valley Project (originally a state project focused on farms in the Central Valley) and the building of some key Colorado River infrastructure to supply water to California and neighboring states. This era also marked the onset of more intensive federal involvement in flood control in the Sacramento region and nationwide (Kelley 1989; Mount 1995). Local beneficiaries were expected to help pay for these investments through water purchases and local matching funds for flood works, but they were not necessarily expected to cover the full costs.[4] Significant federal subsidies later accompanied the transformation of urban sewer systems following the passage of the Clean Water Act in 1972, with the federal government covering up to 85 percent of the required investments in the first generation of new wastewater treatment plants and associated facilities like pump stations.

Even though these federal subsidies have been important, local dollars have still been the norm. For its part, and contrary to popular perceptions, the state has rarely provided much financial support. In the 1960s and 1970s, California initiated the State Water Project—built to complement the CVP and deliver water to urban areas and southern San Joaquin Valley farmers—but that project is being repaid primarily by local water users.

The state water bonds passed in the 2000s, which made nearly three times as much money available in real terms as in the three previous decades combined (Figure 1), are often cited as evidence of the important state role in financing water resource projects.[5] Nearly 80 percent of the authorized funds from these bonds have been directed to water-related services: water supply (drinking water quality and activities to manage and expand the amount of water available), pollution prevention (especially in regards to stormwater and other runoff), flood protection, ecosystem management, and regional integration of water management activities (Figure 2). Some of these activities, like flood control, stormwater management, and ecosystem restoration, are not easy to fund from other sources, making the bond money particularly welcome (see Box 1). Yet the sums from state bonds are still small when compared with the size of the water sector: from 2008 to 2011, about $940 million per year came from bonds, which amounted to only 3 percent of total water-related spending.[6]

[4] Lower Colorado River infrastructure investments were ultimately repaid by local sources, primarily from hydropower revenues from Arizona and California.
[5] The 2000s were, more generally, a decade of heavy state GO bond borrowing, with almost $112 billion authorized for a variety of sectors, including education, transportation, parks, low-income housing, and stem cell research (Legislative Analyst's Office 2010).
[6] These figures exclude spending on parks and public access that are not directly water-related. See Appendix C, Figure C8, for annual trends in bond-funded spending and debt service. Local assistance is an important use of these bonds, and a review of awards from the last four bonds suggests a local match rate of three dollars for every dollar provided by the state (authors' estimate using annual bond expenditure reports). However, some of these projects would have been fully funded locally if the state grants were not available.

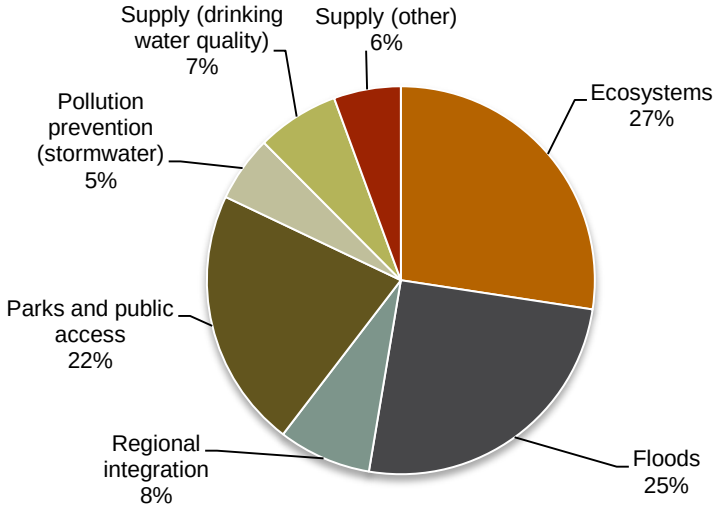
FIGURE 1
The 2000s saw unprecedented growth in state water bonds



SOURCE: Hanak et al. (2011), Table 2.9. See Appendix C, Table C1.

NOTES: The nominal value of bonds passed in the 2000s was $19.6 billion, and the higher value shown here ($26 billion) reflects the adjustment of all bonds in the figure to 2012 dollars using the Construction Cost Index from the Engineering News-Record. Because bond spending typically extends over five or more years, the 2012 $ totals somewhat overstate the real value of spending. During this period, voters rejected one water supply-oriented bond for $380 million ($747 million in 2012 $) in November 1990. In 1960, voters approved a $1.75 billion GO bond ($20.1 billion in 2012 $) for the construction of the State Water Project, but this bond has been paid for primarily by water users, not general fund tax dollars.

FIGURE 2
Recent water bonds have supported a wide range of services



SOURCE: Authors' calculations, using bond act authorization language. See Appendix C.

NOTES: The figure summarizes the allocations of $19.6 billion in bonds approved from 2000 to 2006, based on information specified in the bond acts. Appendix C provides information on spending patterns to date by type of service and region.

Enough GO bond funds remain unspent to maintain state spending at around $1 billion per year for another two or three years.[7] Even if a new bond passes in 2014, the water sector should not anticipate much more than this annual level of support from state bonds going forward and would be wise to prepare for less. Meanwhile, the debt service on water bonds is approaching the level of recent bond spending, at around $700 million per year (Table 1).[8] The rising debt service for these and other bonds passed in the 2000s (in transportation, education, housing, and other areas) could limit the state's ability to take on significantly more GO bond debt.[9]

Looking ahead, we also see little potential for significant increases in federal spending on California water. If anything, California should expect less. Federal spending was lower in 2011 than in the preceding years, reflecting the diminishing dollars from the one-time economic stimulus funds allocated during the recent recession. Budget cuts are also leading to smaller programs in some core areas of federal support, such as flood control. To meet future water funding challenges, Californians will need to find the money here at home and rely on sources other than state bonds.

1

Why it's hard to fund public goods

Goods like flood protection, stormwater management, and ecosystem restoration are what economists refer to as public or collective goods.The term "public good" can be understood by looking at its two key characteristics: (1) the consumption of a public good is "non-rival," (its consumption by one person does not limit its consumption by another); and (2) the consumption of a public good is "nonexclusive" (there is no straightforward or cost-effective way to exclude someone from consuming it). Take the example of a levee. The protection received by a house behind the levee in no way diminishes the protection received by its neighboring house. (Thus, the use of the levee by the two houses is non-rival.) Moreover, once the levee is built, it becomes difficult or impossible to limit the protection it provides to only certain houses situated behind it. (Thus, use of the levee is nonexclusive.) In such situations, the market's normal pricing mechanisms for recovering the costs of providing a particular good break down. Free-riding occurs because individuals have incentives to pay less than their fair share, and it can be hard to rally the financial resources to provide the collectively desired amount of the good. Typically, decisions about how much of a public good to produce are made through the political process, and taxes or fees are used to cover some or all of the costs. It may not be possible to fulfill the collective demand for the public good, depending on the vagaries of the political process and, as we discuss in the next section, the laws governing the imposition of taxes and fees.

"Externality" is another term used by economists when discussing the difficulties of raising public funds. Externalities are the unintended consequences (either positive or negative) of economic activity. They arise when a market does not exist for a product or byproduct. Environmental pollution is a classic example of a negative externality. Water-related externalities can arise in numerous ways, e.g., as a consequence of groundwater extraction, surface water diversions, discharge of effluent, and application of water for irrigation or other purposes. In some instances, negative externalities can be resolved through the assignment of enforceable property rights. (An example is water marketing; if the sale or leasing of water rights would adversely affect downstream water rights holders, the latter must be made whole under California law.) However, in many important situations, the informational costs of establishing and enforcing these property rights make resolution through private negotiation prohibitively expensive (Coase 1960). In such situations, other public policy approaches, including regulation (and the establishment of regulatory fees) may be better suited to the task.

[7] As of June 30, 2013, roughly $4.5 billion of the $19.6 billion had not yet been spent; this includes $1.375 billion that had not yet been appropriated to specific activities as of mid-October 2013 (see Appendix C).
[8] By 2014, the debt service on water bonds is anticipated to surpass $1 billion per year (Appendix C, Figure C8).
[9] California has relatively high levels of state debt, whether compared with the state budget or personal incomes (State Treasurer's Office 2013).

Money Rules: A Legal Primer

Despite their many names and variants, there are really only three basic sources of state and local funds to support water services: fees, taxes, and fines. Many people would add bonds as a fourth source, but bonds come with an important caveat: they do not create new money; they just enable borrowing against one or more of these three other sources. Each of these sources has rules, which have evolved in ways that affect California's options for water system management.

Fees, Taxes, Fines … and Bonds

Before delving into the legal issues, here are some brief definitions and illustrations of how these four sources are currently used for water in California.[10]

Fees (including service fees and assessments)

The fee category includes various charges levied in exchange for a specific service, and it is the primary funding source for many water-related activities: [11]

- Water and wastewater bills (including both fixed and volumetric service fees) cover the vast majority of expenses that local water and wastewater utilities incur; local water rates of contracting agencies also cover most costs of the SWP and most operating costs of the CVP.[12]
- Property assessments or fees (a surcharge on a property tax bill linked directly to a service received by the property) support some flood works and a handful of stormwater programs (see Box 2).[13]
- Developer fees or "connection fees" are one-time charges on new construction, a common means of funding various types of water infrastructure.
- Permitting fees, such as fees for pollution discharge permits, support the regulatory operations of some state and local agencies.[14]

Taxes

The tax category includes both charges destined for general governmental purposes ("general taxes") and charges earmarked for specific purposes ("special taxes").

- State general taxes (mainly income, sales, and corporate taxes) fund some state water agency functions and service debt on most general obligation bonds.
- Local general taxes (on property, sales, and other activities) are important for flood protection and stormwater management.
- Some local governments also levy special taxes—such as parcel taxes and sales tax add-ons—to pay for flood protection, stormwater management, and watershed protection.[15]

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[10] For a breakdown of revenue sources for different types of local public agencies, see Appendix B, Table B3.
[11] "Charge" has a specific legal meaning under Proposition 218, described below. We use it here in the generic sense, without regard to its legal status as a fee, tax, or fine.
[12] Monthly bills and other service fees (including developer fees) brought in more than 80 percent of water and wastewater utility revenues from 2008 to 2011 (Appendix B, Table B3).
[13] Eight percent of local flood agency revenues came from property assessments and special taxes from 2008 to 2011 (Appendix B, Table B3).
[14] Fees for entrance to or use of a public agency's property generate unrestricted revenues, but this is not a common source of revenue in the water sector.
[15] For some recent examples, see Appendix E and the accompanying online data set on local ballot measures.

- The state uses special taxes, such as a tax on gasoline, to fund the transportation sector, but there are currently no special taxes earmarked for water services, although this idea has been floated in recent years.[16]

2

Finding the water on the property tax bill

Several kinds of taxes and fees appear on property tax bills, all of which are used to support local water projects, like flood protection and stormwater management:

- Property tax. This is a general tax, not tied to a specific service rendered to the property. The local government may use some of these revenues to support flood works or stormwater management, but it is not obligated to do so. Property tax levels have been strictly limited since the passage of Proposition 13 in 1978. Special districts (including water, wastewater, and flood control districts) still receive small legacy shares of this money.
- Property assessment or fee. These are charges linked directly to a service received by the property. New assessments (which must be proportional to the benefits received by the property) must be approved by a simple majority of property owners, weighted in proportion to the charges each property would pay. New fees (which must be proportional to the cost of service to the property) must be approved by an unweighted simple majority of property owners on whom the fee is levied or two-thirds of all local voters.
- Parcel tax. Like assessments and fees, these taxes are usually earmarked for specific purposes. But unlike assessments and fees, they are not tied to a specific service to the property. Thus, property owners not benefiting from flood works would contribute to a parcel tax fund earmarked for this purpose, whereas only direct beneficiaries would contribute to a property assessment or fee. New parcel taxes must be approved by two-thirds of all local voters.
- Property tax surcharge. Local voters can also approve adding a surcharge to the property tax to pay off local general obligation bonds, which are usually earmarked for specific purposes. This requires a two-thirds majority for all sectors except education (which requires 55% since a reform passed in 2000). It is not common for water-related services.

Fines (including penalties)

The fine category comprises charges imposed by a government agency or the courts as a result of a violation of the law. Although various water-related regulations authorize fines, they are rarely imposed, and they bring in only limited (and unpredictable) revenues. Fines are exempt from the substantive limitations on, and voting requirements applicable to, fees and taxes.

- Fines are sometimes levied for violations of pollution discharge limits or wetlands permitting requirements.
- In some places, fines are imposed for excessive pumping of groundwater, and they can also be used when customers do not adhere to rationing restrictions during drought emergencies.[17]

[16] In 2004, the administration proposed a fee on water users to fund a variety of water-related purposes. This idea was further developed in Senate Bill 34 (Simitian) in the 2011–12 legislative session (see Box 6, below).

Bonds

Bonds are a means of borrowing to undertake long-term investments, with repayments typically stretching over 30 or 40 years (see Box 3). State and local governments can issue many kinds of bonds. For our purposes, two major categories are important: general obligation (GO) bonds and revenue bonds. GO bonds—backed by the full faith and credit of the issuing government—are typically repaid with taxes. Revenue bonds are funded and guaranteed by the revenues from the specific project being financed.

- As noted above, the state GO bonds are an important component of current state support to the water sector; they are repaid from the state general fund.
- In contrast, a GO bond issued to pay for the initial phase of the SWP is being repaid by water sales to local agencies using the water. Subsequent expansions of the SWP have been funded with fee-backed revenue bonds.
- Many local utilities issue revenue bonds, repaid by an assortment of fee income, including water and wastewater service fees, and developer fees, plus occasionally special taxes.
- Local water and wastewater utilities can also borrow money at below-market interest rates from two State Revolving Funds that are capitalized by federal grants.
- Local GO bonds for water are rare. Exceptions include a $500 million bond to pay for stormwater projects approved by voters in the City of Los Angeles in 2004, a $200 million bond to pay for watershed health and parks approved by Oakland voters in 2002, and a $30 million bond to pay for wastewater system upgrades by residents of Benicia in 1997.[18] Such bonds are typically repaid through a property tax surcharge.

[17] As an example of groundwater pumping fines, the Mojave basin adjudication authorizes a penalty for excess pumping above the free production allowance (Superior Court of Riverside County 1996).
[18] Since 1995, we identified five other communities that approved GO bonds including some water-related purposes, alongside other functions (e.g., stormwater management plus road system improvements). See Appendix E and the accompanying online data set.

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Two common misperceptions about bonds

People often incorrectly assume that bonds *must* be used for capital or infrastructure projects. They also often assume that bonds are more expensive than "pay-as-you-go" (or "pay-go") financing because of the added cost of paying interest.

Bonds are, indeed, especially suitable for capital projects. Such investments typically last for many years, and bonds can be repaid over a comparatively long period. Stretching out these payments makes sense from the perspective of intergenerational equity, since the population repaying the bonds in the future also benefits from the investments. California law codifies this idea by requiring that state GO bonds be used for "construction or acquisition of capital assets," meaning tangible physical assets lasting 15 years or more (Gov't. Code § 16727(a)). This statute allows for a portion of the bond proceeds to be used for assets with a shorter life, for major maintenance and equipment, and ancillary costs associated with investments (design and planning work, environmental assessment and mitigation, and land acquisition). Although it is usually followed, this statute can be overridden by the new law approved to authorize any subsequent bond issuance. A prominent example was California's Economic Recovery Bond Act (2004), which authorized the state to issue up to $15 billion in GO bonds to fund the state's budget deficit (i.e., almost entirely for operational or noncapital purposes). Portions of the recent water bonds have also been used to fund operations of state agencies and other noncapital activities like research (see text discussion and Appendix C).

On face value, bonds are, indeed, more expensive than pay-as-you-go financing. However, when repayment is stretched out over long periods, it is important to consider the cost of borrowing in present-value terms. This calculation nets out the rate of return that the bond issuers (in this case, the public) could be making on the money they don't need to spend today on the project because they can borrow the funds. In present-value terms, bond financing is usually roughly equivalent in costs to pay-go financing. If inflation on construction costs is higher than the overall inflation rate reflected in market interest rates (as is often the case), it may actually be cheaper to finance infrastructure projects through borrowing.

Constitutional Complications

State constitutional requirements dictate the rules under which revenue can be raised from these funding sources, making some easier to use than others. The rules for state and local bonds are long-standing, and they favor state GO bonds. Whereas local GO bonds generally require a two-thirds majority of local voters,[19] state GO bonds require approval by just a simple majority of the state's voters.[20] In the wake of three constitutional reforms approved by voters since the late 1970s, state GO bonds have also become an easier source of funding to approve than many taxes and fees for water services. Here we summarize key provisions of these constitutional reforms and then describe their implications for the water sector.[21]

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[19] This two-thirds requirement was included in the constitution California adopted in 1879 and reflected concerns over local indebtedness from large infrastructure projects such as railroads (Beebe, Hodgman, and Sutherland 1967-68). An exception, agreed to by voters in 2000, is education bonds, which now require a 55 percent majority.

[20] State GO bonds can be put on the ballot by a two-thirds vote of the legislature or by initiative; five of the six recent water bonds used the initiative process. Revenue bonds generally do not require voter approval because they are backed by a project-specific income stream.

[21] For a more detailed analysis of the legal implications of these changes, see Appendix A.

Proposition 13 (1978)

California's famous Proposition 13 arose as a protest against the rapid increases in property taxes that accompanied California's booming real estate markets in the 1960s and 1970s. It limited the property tax levied by local governments to one percent of each parcel's estimated value, and restricted the rate at which the parcel's taxable value could be increased.[22] Previously, cities, counties, and many special districts levied their own property taxes, and the combined property tax percentage was usually considerably higher than one percent. Following Proposition 13, revenue from the one percent levy was divided up among these agencies, more or less in proportion to their pre-Proposition 13 share of revenues.

Proposition 13 also changed the approval process for other taxes. It required that all increases in state taxes be approved by a two-thirds vote of the legislature, and it introduced a new requirement that local special taxes be approved by two-thirds of local voters.

Proposition 218 (1996)

Many local governments responded to Proposition 13's reduction in property tax revenues by increasing their use of various fees, including for water services. Some special districts levied general taxes (which Proposition 13 did not address) after approval by a majority of their local voters. The drafters of Proposition 218 proposed this new constitutional amendment to restrain many of these practices. Proposition 218 stated that special districts could not levy general taxes, but only special taxes, and it clarified that local general taxes *always* required simple majority voter approval and that local special taxes *always* required two-thirds voter approval.[23] Proposition 218 also introduced new substantive restrictions and requirements for voter approval for many "property-related" fees and special assessments, including those charged for most water-related services.[24]

These new substantive requirements served to tighten the connection—or nexus—between new property-related fees and the services they fund. Total revenues collected by fees must not exceed the costs of providing the service, and these revenues must not be used for purposes other than those for which they were imposed. Fees also may not exceed the proportional cost of service attributable to each parcel, and they must be levied for services actually available to the parcel. Finally, fees may not be used to provide general governmental services available to the public at large in the same manner as they are to property owners.

The new voter approval requirements generally involve a two-step process that takes some authority away from local governing boards. First, property-related fee increases must be subject to a public hearing. If a majority of the affected parcel owners protests, the agency must abandon its plans. Second, local voters must approve the increase for some fees. To meet this requirement, agencies can either seek approval from a simple majority of the property owners subject to the fee, or from two-thirds of all registered voters.[25] Water,

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[22] Proposition 46 (1986) authorized voter-approved property tax rate increases above the one percent rate to repay local infrastructure bond debt.
[23] These latter provisions were ambiguous in Proposition 13 and in related court decisions.
[24] See Appendix A for an analysis of the relevant judicial decisions. Key exceptions are charges by wholesale water supply agencies and developer fees. Although this has not been tested in court, water wholesalers have generally operated under the assumption that they are not subject to the requirements of Proposition 218 because they do not deliver water to retail customers. Separate court rulings require developer fees to have a reasonable nexus with, and be roughly proportional to, the impacts of the development. Privately owned water utilities, which deliver water to about 20 percent of the state's residents, are also exempt from Proposition 218. Their pricing is regulated by the California Public Utilities Commission, with input from the Division of Ratepayer Advocates, which defends the interests of ratepayers in the service areas.
[25] For property assessments, property-owner votes are weighted by the amount each owner would have to pay. For property-related fees, agencies may obtain a simple majority of property-owner votes or a two-thirds majority of general electorate votes; this latter provision is not applicable for assessments, which must be levied in proportion to the *benefit* they provide to each property. (Fees, in contrast, must be levied in proportion to the *costs of service* to the property.) Ironically, the weighted vote approach has drawn opposition in some places on the grounds that

wastewater, and refuse collection service fees are exempt from this second step, but it applies to other services, including flood protection and stormwater management.

Proposition 26 (2010)

Proposition 26 redefined many additional governmental fees as taxes, and it applies to both state and local agencies. It is especially relevant for a class of fees levied for regulatory purposes, such as to control land or water use, to pay for a permit review, or to fund an environmental mitigation program. Agencies can still levy a fee as long as it does not exceed the reasonable cost of providing the service and is allocated in a way that bears a fair and reasonable relation to the "payor's burdens on, or benefits from, the governmental activity." Legitimate state regulatory fees continue to be subject to a simple majority vote by the legislature, and local governing boards can approve similar local fees. But charges for programs that provide general public benefits, or that exceed the costs of providing the service, are now special taxes, requiring approval by two-thirds of the state legislature or a two-thirds popular vote at the local level. Like Proposition 218, Proposition 26 "grandfathers in" fees that were in place prior to its passage, but any increases or other changes in fees are subject to the new law.

There is considerable uncertainty about how the courts will interpret which actions constitute a "governmental activity" that can be covered by a regulatory fee, rather than a tax. One view is that Proposition 26 prohibits the adoption of all fees designed to mitigate adverse external effects of resource use (i.e., negative externalities—see Box 1). As explained in detail in Appendix A, however, we believe the substantive provisions of Proposition 26 continue to authorize regulatory fees to cover the costs of mitigating the harmful effects of future land and water use.

The effects of these propositions on the fiscal health of the water sector

Because the water sector has historically relied heavily on locally generated revenues, the constitutional changes described here have profoundly altered the landscape of funding options (Table 2). Property tax revenues, which were traditionally a mainstay of local infrastructure budgets, are now in scarce supply.[26] Moreover, there is still considerable uncertainty about which types of charges may be adopted as fees and which must be enacted as taxes (Appendix A). Direct voter approval—often at the high bar of a two-thirds supermajority—is required for any charge that now qualifies as a tax, and voters must also directly approve many fees. The reforms have also limited the state's ability to raise funds for water services.

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it is "undemocratic" (see Appendix A). Despite requiring only a simple majority vote, property-owner ballot measures have not been more successful than special tax and GO bond measures that require a two-thirds majority of all voters (see Appendix E).

[26] From 2008 to 2011, property taxes accounted for 5 percent of water district revenues, 8 percent of wastewater district revenues, and 36 percent of flood control district revenues (Appendix B, Table B3). Comparable information for city and county water departments is not available.

TABLE 2
The effects of Propositions 13, 218, and 26 on state and local revenue rules

		Pre-1978	Proposition 13 (1978)	Proposition 218 (1996)	Proposition 26 (2010)
State	**Taxes**	50% of legislature	**Two-thirds of legislature**	→	→
	Regulatory fees	50% of legislature	50% of legislature	50% of legislature	**Stricter requirements (more likely to be a tax)**
	GO bonds	50% of state voters	50% of state voters	50% of state voters	50% of state voters
Local	**General taxes**	Flexible	Flexible	**Simple majority for cities and counties, not available to special districts**	→
	GO bonds[a]	Two-thirds of local voters	Two-thirds of local voters	Two-thirds of local voters	Two-thirds of local voters
	Special taxes	Undefined	**Two-thirds of local voters**	→	→
	Property taxes	Flexible	**1% of purchase price +2% annual increases**[b]	→	→
	Property-related fees and assessments	Flexible	Flexible	**1) All water-related services: Strict cost-of-service requirements 2) All water-related services: Property-owner protest hearing 3) Floods and stormwater: 50% of property owners or two-thirds popular vote**[d]	→
	Non-property-related fees	Flexible	Flexible	Flexible	**Stricter requirements (more likely to be a tax)**
	Wholesale fees	Flexible	Flexible	Flexible[c]	**Stricter cost-of-service requirements**[c]

NOTES: Bolded text shows the changes resulting from each constitutional reform. The arrows indicate that the rules from the earlier proposition remain in place. "Flexible" typically means that rate decisions could be made by governing boards. Before Proposition 218, there was variation in voting requirements for different types of general taxes.

[a] In 2000, voters passed Proposition 39, which lowered the voter threshold to 55 percent for school bonds.

[b] Property taxes may be increased to repay GO bonds with two-thirds local voter approval (or 55 percent for schools).

[c] As described in the text, water wholesale agencies have assumed that they are exempt from Proposition 218 because they do not deliver services directly to properties, but this issue has not been decided by the courts. Proposition 26 may require public wholesale water agencies to adhere to stricter, proportional allocation of costs.

[d] The popular vote option is only available for fees, not assessments.

Although some of these changes are undoubtedly salutary, pushing management agencies to be more transparent and accountable to the public, the reforms also significantly increased the burdens of funding services in ways that may not always serve the public interest. To date, the financial effects of these reforms—and particularly of Proposition 218—have varied across management areas:

- Water supply and wastewater utilities have been the least affected, in large part owing to their exemption from having to gain direct voter approval of rate increases. Successful protests at rate hearings have been rare and confined to small, rural communities where it is easier to mobilize

a majority of ratepayers to formally contest the proposed rate changes.[27] However, water utilities are coming under greater legal scrutiny over whether their rate structures comply with Proposition 218's cost-based fee requirements, particularly regarding modern management tools like conservation-oriented pricing and the use of nontraditional resources like recycled wastewater. The fee proportionality rule may also restrict agencies' ability to introduce lower "lifeline" water rates for low-income customers.

- Flood management agencies face greater challenges because they must now obtain direct voter approval for any increases in local revenues earmarked for flood protection. The weighted simple-majority property-owner elections for assessments allowed under Proposition 218 require more precision in defining the benefits individual parcels will receive from the flood works, based on factors such as depth of flooding. An alternative is to seek a two-thirds popular vote on a special tax to support flood works.[28] Although there have been some successes, many flood management agencies continue to rely on legacy assessments set before Proposition 218, plus an assortment of other local, state, and federal support.[29]
- For stormwater agencies, it is arguably even harder to establish the necessary relationship between costs and benefits for property-related aspects of stormwater management, such as the role of impervious surfaces in sending runoff into the streets. With only few successes at the ballot box, stormwater agencies have had to rely on their limited legacy resources, local general fund contributions, and state grants to do a job that has gotten much bigger since Proposition 218 was passed.

Proposition 26, though relatively new and untested, is likely to create additional challenges for several other types of water activities. The law may require public wholesale water agencies—generally considered exempt from Proposition 218 because they do not deliver water to properties—to explain and justify changes in water rates and rate structures. In addition, it could make it more difficult to establish fees for non-property-related sources of polluted runoff, such as road use. Finally, Proposition 26 will likely limit the options available for funding ecosystem management activities, including habitat restoration programs and environmental clean-up. Regulatory fees on activities that cause environmental harm are a natural way to fund environmental mitigation (and indeed, already fund activities such as oil recycling and the disposal of electronic waste in California). Proposition 26 requires that charges to support environmental clean-up and restoration caused by past activities be enacted as taxes; it may also define all environmental mitigation charges—including those that require resource users to pay for programs to address the environmental harm caused by new actions—as taxes that require majority voter approval if enacted at the state level and two-thirds voter approval if adopted by local governments.[30]

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[27] We are not aware of any successful protests where more than half of property owners objected, but in several cases in small rural communities, boards have not gone forward with the increases following a large share of property owner protests. For examples in Amador County and Tuolumne County, see Appendix E, note 2.
[28] Agencies also have the option of pursuing a two-thirds popular vote for a property-related fee, but they have no reason to do so because, unlike fees, special taxes are not subject to Proposition 218's other requirements, such as setting the fee proportional to the costs of service to the parcel.
[29] See Appendix E and the accompanying online data set for information on flood- and stormwater-related ballot measures since 1995.
[30] The legislature can also pass such taxes with a two-thirds majority. As noted above, our interpretation of Proposition 26 is that it does not apply to "prospective" regulatory fees that address harm caused by new actions (see Appendix A), but this question will ultimately have to be resolved by the courts.

What's Broken, and What's Not?

This overview of legal constraints paints a sobering picture of the funding options for water services in California. By some accounts, California's water system is already in a deep crisis, with failing marks for essential infrastructure and with vast unmet spending needs.[31] Yet this system is both large and multifaceted, and it is important to take a closer look to identify where the real problems lie. We do this by examining how well California is meeting various water management goals and identifying areas where lack of money is a key obstacle to success. This closer examination reveals a more nuanced picture of fiscal health for California's water system, with several areas needing urgent policy attention.

The Tricky Business of Estimating Funding Gaps

Before delving into the details, a few words are in order regarding our methods for evaluating potential shortfalls in funding for the state's water system. We rely principally on what is known as a gap analysis. This approach compares estimates of spending needs with an assessment of the likely ability of water agencies to meet these needs, based on their recent expenditures and ease of access to funding mechanisms. Critical gaps occur where the needs significantly exceed funding ability. This exercise, while useful, is subject to some important caveats.

The first caveat concerns the notion of "needs." Estimates of spending needs reflect the professional judgment of analysts about the costs of meeting specific management objectives, including societal goals of safe and reliable water supply, flood protection, pollution prevention, and healthy ecosystems. Yet these numbers are often too high. For example, conventional estimates of infrastructure needs often fail to acknowledge that pricing and other incentives can reduce per capita demand (and correspondingly reduce the need to expand facilities). More generally, these estimates do not always reflect the most economically efficient way to meet the given management objectives. Nor do they always consider whether the benefits from identified projects will exceed the costs—a litmus test for whether the investment is worth paying for. On the other hand, estimates of spending needs can be too low if they do not adequately anticipate the replacement costs of aging infrastructure, risk mitigation (such as seismic upgrades), or future conditions that will increase costs, such as new regulatory requirements or worsening hydrologic conditions owing to climate change. Our discussion highlights how these upward and downward biases may affect the estimates.

The second caveat concerns general data limitations. Needs estimates are more complete in some areas than others; where necessary, we have made back-of-the-envelope calculations to gauge the magnitude of the problem. The same is true for information on expenditures (summarized in Table 1, above); we were only able to provide rough estimates of budgets for stormwater runoff management, as these budgets are embedded in broader municipal budgets for public works.

Finally, the data on both expenditures and needs allow us to look at most management activities on an individual basis only, reflecting traditional separations or "silos" between agencies managing water supply, wastewater treatment, flood works, and other functions. Such divisions are increasingly artificial as water

[31] The "California Infrastructure Report Card: A Citizen's Guide - 2012" from the American Society of Civil Engineers (ASCE) gives California grades of C+ or less for water supply (C), wastewater (C+), levees and flood control (D), and urban runoff (D+) (American Society of Civil Engineers 2013). The American Water Works Association (2011) investigated the needs of buried drinking water infrastructure and found a nationwide cost of more than $1 trillion for the next 25 years, with western states accounting for the largest share.

management in California becomes more integrated across these silos. For instance, many water supply and wastewater agencies now collaborate to convert highly treated wastewater into new supplies, and similar partnerships have begun between water supply and stormwater agencies to capture and reuse urban runoff. Many modern water infrastructure investments incorporate features to better protect aquatic ecosystems, and some agencies are investing in broader watershed protection alongside their traditional functions. More integrated approaches offer the prospect of more cost-effective, environmentally sustainable water system management, and the state has encouraged this approach by earmarking some bond funds to regional groups pursuing such goals (Figure 2, above).

We begin our gap analysis by examining the two areas that are doing relatively well: water supply and wastewater systems. We then turn to the five areas that are in more serious trouble. California is failing outright in four of these: providing safe drinking water for small, rural communities; ensuring adequate flood protection; managing polluted stormwater; and protecting aquatic ecosystems and the species that depend on them. We are also on the brink of failure in a fifth area—more integrated water management—where bond funding does not appear to have fulfilled expectations. For more details on the needs and gap estimates presented here, see Appendix B.

Passing Grades (Mostly) for Water Supply and Wastewater

Water supply and wastewater are the two biggest ticket items in California's water system, together accounting for more than 85 percent of recent spending (Table 1, above). Both areas continue to be reasonably successful, achieving their core management objectives of providing safe and reliable water supplies and collecting and treating sewage before releasing it into rivers or coastal waters. Likewise, for the most part, California's drinking water and wastewater utilities have been meeting the safety standards assigned to them: public health violations are relatively rare and are mostly confined to smaller, rural systems that face special challenges, an issue we return to below.[32] Ensuring water supply reliability is difficult in California because the state has limited and highly variable supplies. Yet the system has proven itself capable of adapting to periodic droughts and overall supply constraints by using a variety of modern management approaches, including conservation, water trading, underground storage, off-stream surface storage, and reuse of treated wastewater. This "portfolio approach" to water supply management has accommodated the sustained growth of the state's population and economy despite relatively flat overall human water use since the early 1980s. To wit, both total population and real gross domestic product (GDP) per capita have doubled since the late 1960s, and the economic productivity of water (measured by GDP per unit of water used) has increased by a factor of four (Hanak et al. 2012). To be sure, managers cannot rest on their laurels; they will face renewed challenges to match this performance in the years to come, with the added complications from climate change and other pressures. Recent trends nevertheless mark an important shift from the traditional approach to water planning, which assumed that supplies would need to continue increasing to accommodate growth.

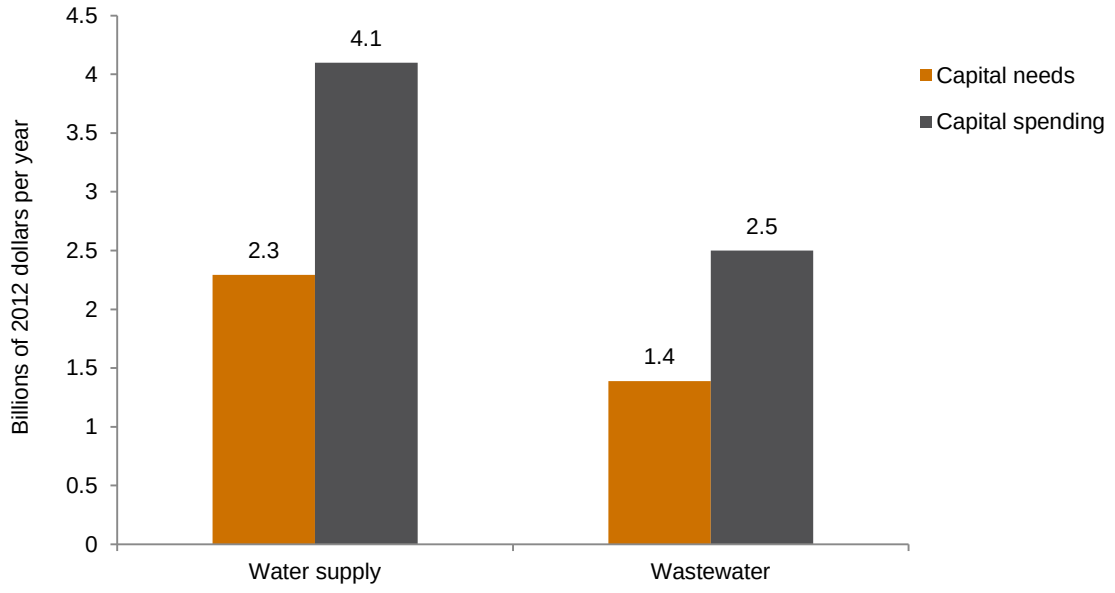
[32] According to the California Department of Public Health (DPH), 98 percent of the population is served by large community water systems (those serving at least 3,300 people), and a small minority of these systems (5%) have drinking water standard violations in any given year. The violation rate is higher (8%) in smaller systems (www.cdph.ca.gov/certlic/drinkingwater/Pages/Smallwatersystems.aspx). Not all violations result in public health problems. Since regulation of wastewater systems began in the 1970s, the amount of suspended solids and organic matter discharges from publicly owned treatment works has dropped 80 to 90 percent, despite more than a doubling of wastewater discharges (State Water Resources Control Board 2013a). Data are not available on the number of wastewater facilities discharging at the required treatment standards.

A healthy fiscal check-up

The water sector also appears to be in fairly good financial health. One way to assess this is by comparing capital expenditures with estimates of long-term investment needs to meet the requirements of the Safe Drinking Water Act (which applies to all water utilities that supply drinking water to at least 15 homes or businesses) and the Clean Water Act (which regulates utilities that treat wastewater). Every four years, the U.S. Environmental Protection Agency (USEPA) conducts systematic assessments of these capital needs for the next 20 years, using information supplied by local utilities about their capital improvement plans for a range of activities, such as upgrading or expanding treatment plants, storage facilities, and underground pipes. The drinking water utility survey understates capital needs somewhat, because it excludes system expansions whose explicit purpose is to accommodate population growth (e.g., facilities to serve new subdivisions).[33]

The USEPA reports typically generate a lot of media attention, and they are used as evidence of the nation's water infrastructure crisis; California-focused stories tend to suggest that we face the greatest challenges because our numbers are the largest.[34] Of course, California is also the most populous state in the nation, and the reports say nothing about the ability to meet these capital needs, only that they are large. The latest estimates for California post a 20-year price tag of $45.8 billion for drinking water systems and $27.8 billion for wastewater utilities.[35] However, local capital spending comfortably exceeds the annual share of these needs, which suggests the industry is on sound financial footing, even allowing for the additional costs of expanding water supply systems to accommodate population growth (Figure 3).

FIGURE 3
California's drinking water and wastewater utilities seem on track to meet investment needs



SOURCE: U.S. Environmental Protection Agency (2008) and (2013) (needs) and author estimates (spending). See Appendix B.

NOTE: The chart compares annual capital needs from recent USEPA surveys with local capital expenditures by wastewater utilities and urban water utilities. Both measures exclude interest payments for borrowing.

[33] This survey also excludes activities related to source protection, likely to be a relatively small share of most agencies' expenditures (Appendix B).
[34] After the release of the most recent survey, headlines in California and in the nation highlighted California's position at the top of the list (Cart 2013, Zhe 2013).
[35] U.S. Environmental Protection Agency 2008 (wastewater) and 2013 (drinking water). Both numbers are in 2012 dollars. See Appendix B.

Because this conclusion contradicts the conventional wisdom about the condition of California's water infrastructure, we asked urban utility managers from around the state for their reactions in our regional workshop discussions. Although many agreed with our assessment, some speculated that the needs estimates do not adequately reflect the capital replacements many aging systems should be undertaking. We were also told that some local boards and managers are reluctant to publish capital plans that seem too pricey, to avoid scaring the rate-paying public. However, the USEPA estimates adjust for system replacement needs that appear too low, and when we looked at capital spending by individual agencies, we found that the vast majority were reinvesting more than 1 percent of their fixed assets every year—a benchmark some managers suggested as a minimum for healthy asset replacement.[36]

If local water supply and wastewater utilities appear to be generally on track, this is thanks in no small part to the fact that they are the agencies the least hamstrung by the constitutional restrictions on water finance described above. These utilities rely primarily on fee income from their ratepayers, and they have generally been able to raise water and sewer bills to cover their operational costs and invest at a healthy pace.

Looming cost challenges

Our discussions with utility managers also considered some looming challenges that are likely to increase costs and make it harder to pay the bills in the future. One issue is increasing treatment costs for drinking water and wastewater, a result of the rising safety standards and the deteriorating quality of source water.[37] The condition of water quality in some groundwater basins is of particular concern, and many groundwater-dependent communities are having to replace wells or install costly wellhead treatments to remove harmful chemicals that are either naturally occurring (such as arsenic) or caused by farming or industrial activity (such as nitrate and perchlorate). The nitrate problem—a result of decades of chemical fertilizer use and the spreading of manure from livestock operations—will get worse before it gets better, because the accumulated chemicals in the soil are slowly moving through the state's aquifers (Harter et al. 2012; State Water Resources Control Board 2013c). Proposed higher drinking water standards for chromium-6 (which has both natural and industrial origins) are causing new cost concerns in some regions.[38]

Another looming issue for many of the state's water supply agencies is the future of water exports from the Sacramento–San Joaquin Delta, a network of manmade channels and islands south of Sacramento that serves as the hub for moving SWP and CVP water from its sources in the northern and eastern mountains to water users to the south and the west. Delta exports constitute roughly 30 percent of supplies for urban communities in the San Francisco Bay Area and Southern California, and a similar share of irrigation water in the southern half of the Central Valley. The current conveyance system faces reliability challenges for a variety of reasons (notably, unhealthy conditions for many native fish species and seismically vulnerable levees). Water agencies are considering investing in the Bay Delta Conservation Plan (BDCP)—a 50-year habitat conservation plan—to improve ecosystem conditions and water supply reliability. The proposal includes two tunnels to divert some exports underneath the Delta instead of through it, along with extensive habitat restoration and other ecosystem improvements. The tunnels, currently slated at about $15 billion in

[36] This estimate was only possible for special districts. Of the 253 combined water and wastewater districts in the data, only 16 percent invested less than 1 percent of their fixed assets in 2008–11. The corresponding figures for the 239 wastewater-only and 489 water-only districts (including some purely agricultural districts) were 19 percent and 36 percent, respectively. Larger districts generally had higher investment ratios.
[37] See Hanak et al. (2011), chapters 3 and 6, for a discussion of rising standards, often linked to improved detection technology as well as a better understanding of human and environmental health risks.
[38] The Association of California Water Agencies (2013) estimates the annualized costs of compliance for the new standards to be $616 million, nearly five times higher than the estimates by the California Department of Public Health ($156 million/year).

new investments plus some operational cost increases, would be paid for by water users. (The general public would cover most of the multibillion dollar ecosystem improvements; more on this below.)

There has been much public discussion and debate about the affordability of the tunnels. BDCP puts the implicit additional water supply cost of new conveyance, based on current cost estimates, at $302 to $408 per acre-foot at the Delta.[39] Additional costs would accrue for transmission, treatment (for urban users), and distribution, which could add as much as several hundred dollars to the price paid by urban water users. Others that have examined BDCP put the likely cost much higher, with estimates ranging from $500 to $1,000 per acre-foot.[40] Still, for most urban water users, Delta exports in this price range would remain competitive with most other new sources of supplies.[41] In contrast, this price increase could be prohibitive for many agricultural activities.[42] Among the many open questions is whether water users could agree to a cost-sharing formula with lower payments by agriculture, potentially in exchange for lower reliability, or to a smaller project (lowering both future exports and costs, and using the savings to develop more local supplies in urban areas).

Agricultural water users south of the Delta also face other looming challenges, including soil salinization in some areas (Medellín-Azuara et al. 2008) and unsustainable groundwater pumping in places like the Tulare Basin (Faunt 2009, Famiglietti et al. 2011). Because of these problems, we expect a continued decline in agricultural water use and irrigated acreage and a rise in the share of higher-income farming activities that can support higher water costs—both trends have been under way since the 1980s (Hanak et al. 2011; Medellín-Azuara et al. 2012; Howitt et al. 2012).[43] When considering these trends, it is important to keep in mind that California's agricultural economy can continue to grow in value while shrinking its water and land footprint. Indeed, analyses show that this is even possible under dry forms of climate change, with significant declines in farm water use.[44] It also bears noting that California's economy is less vulnerable to reductions in agricultural output than it once was. Agriculture today is a small share of the state's economy (currently just 1–2% of GDP)[45] but it uses a large share of the state's water resources (nearly 80% of all farm, nonfarm business, and residential water use combined).

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[39] See California Resources Agency (2013), available at http://baydeltaconservationplan.com/Libraries/Dynamic_Document_Library/July_Public_Meeting_Presentation_Final.sflb.ashx.

[40] See, for example, http://hydrowonk.com/blog/2013/09/16/what-would-be-californias-water-supply-situation-without-the-bdcp-and-what-it-means-for-tunnels/. These estimates were developed by Dr. Rodney Smith of Stratecon, Inc.

[41] Costs vary significantly by type of supply. For recycled water, costs can range from the low hundreds to over $2,000 per acre-foot. A review of 26 Bay Area recycled water projects found an average cost of about $1,100 per acre-foot (M.Cubed 2007). Costs for desalination tend to be even higher. BDCP cites five proposed desalination projects in Southern California that have estimated costs ranging from $1,191 to $2,340 per acre-foot (see previous footnote for source). Costs of demand management typically range between $500 and $1,000 per acre-foot (based on author's review of 27 urban conservation master plans developed for various California water utilities between 2009 and 2012).

[42] As an indication, 2005 irrigation water prices in different subregions within the San Joaquin River hydrologic region averaged from a low of $10 to a high of $53 per acre-foot, and the range in the Tulare Lake Basin hydrologic region was $12 to $87. With a 25 percent reduction in water availability, farmers in some parts of the Tulare Lake Basin would be willing to pay between $250 and $500 per acre-foot (2008 $), but many agricultural activities south of the Delta would not support such prices (calculations from the Statewide Agricultural Production Model, as reported in Hanak et al. 2011, ch. 2). Agriculture in coastal areas generates much higher values per unit of water used and has a correspondingly greater ability to pay for water. See Medellín-Azuara et al. (2012).

[43] This shift to higher-value crops comes with a danger of decreased flexibility for southern Central Valley growers, many of whom are shifting from field crops to orchard crops, which cannot be fallowed during droughts without large investment losses. Statewide, orchard crops increased from 17 to 25 percent of crop acreage between the early 1980s and the mid-2000s. In this later period, orchard crops constituted 32 percent of crop acreage in the San Joaquin River and Tulare Lake regions (Hanak et al. 2011, ch. 3).

[44] Medellín-Azuara et al. (2012) show that with a warm-dry form of climate change and a 29 percent drop in farm water use by 2050, real farm revenues can still increase by 26 percent compared to conditions in 2005. See also Hanak et al. (2012), Figure 7.

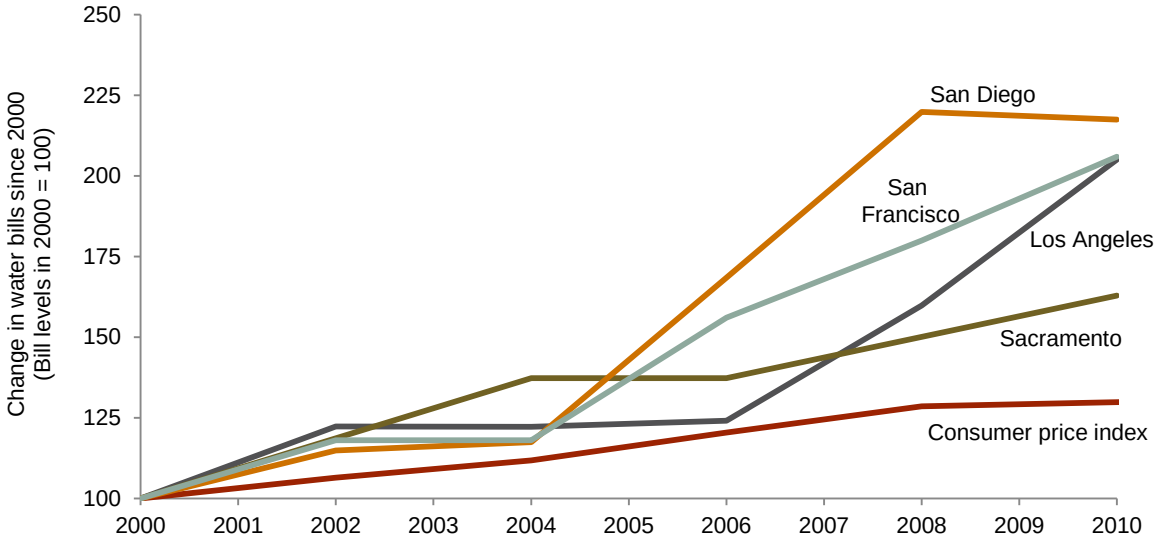
[45] The higher end of this range includes all food processing industries as well as primary crop and livestock production (Hanak et al. 2012, using data from the U.S. Bureau of Economic Analysis). Agriculture's share in employment is higher (2–4%, depending on the source and whether agriculture-related manufacturing is included). With economic multipliers, the share of employment and labor income is higher (see, e.g., UC Agricultural Issues Center 2013), but one must be cautious in using multipliers to gauge the role of a sector in the economy, because they imply

Looming legal challenges

Some observers have also raised concerns that the combination of rising costs and new legal constraints on funding—particularly related to Proposition 218—will compromise the ability of utilities (now on solid financial footing) to pay their way in the future.

Monthly water bills have indeed been going up faster than inflation to recoup the costs of new investments (Figure 4).[46] During the late 2000s, many utilities also experienced fiscal challenges from declining water (and sewer) use—a combined result of drought, reduced economic activity, and continued progress in water use efficiency. Because most of the costs for local water systems are fixed (i.e., not varying with the volume of water sold or wastewater treated), declining water use can reduce total revenues faster than total costs, requiring utilities to increase the per volume charge for services.

FIGURE 4
In California's urban areas, monthly water bills have been growing two to three times faster than inflation



SOURCE: Author calculations using information from the American Water Works Association (2010) and water agency financial reports.

NOTES: For Sacramento, 2002 and 2008 values are interpolated. The CPI is the consumer price index for California. The figure reports changes in typical water bills (including fixed service charges and volumetric charges).

Many utilities have found themselves in the unenviable position of having to make unpopular rate increases while the rate-paying public is still feeling the effects of the recession. Although successful protests of rate increases under the rules of Proposition 218 have been rare, managers in several regions indicated that local governing boards can get "cold feet" from even a few vocal opponents of higher rates. Too much timidity can result in lower spending on system upkeep and improvements needed to maintain quality of service over the longer term. Indeed, some utilities have recently reduced their capital spending to cope with declining revenues.[47]

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that there is no capacity for other sectors to adjust in response to changes in the given sector. All sectors have multiplier effects; aggregating them all would significantly overstate the size of the economy.

[46] The Metropolitan Water District of Southern California's *2010 Long Range Finance Plan* foreshadows this trend continuing, at least for the South Coast. It projects rates for Tier 1 and Tier 2 water will increase by 4.5 percent to 6.7 percent annually between 2010 and 2020.

[47] In 2011, capital spending by local public water and wastewater utilities was about 10 percent and 15 percent lower, respectively, than for the 2008–2011 average reported in Figure 3.

Perhaps a bigger question, however, is whether recent court challenges to rate structures and billing practices will prevent local water managers from continuing to pursue the modern, portfolio-based approaches that have been so essential to allowing the state's population and economy to grow and prosper despite growing water scarcity. The issue at hand is not whether broad numbers of ratepayers are willing to pay for important services but rather the vulnerability of the entire funding system to legal challenges by a handful of individuals. Four issues are of particular concern: conservation-oriented pricing, the incorporation of nontraditional sources of supply, the sustainable management of groundwater resources, and affordability for low-income households. [48]

The future of tiered water rates

The challenge to conservation-oriented pricing concerns the legality of using tiered water rates, in which customers are billed according to two or more price tiers, with a higher price per gallon for the upper tiers. The theory of tiered-rate pricing is that people have more flexibility to reduce their use in the upper tiers (e.g., by reducing less essential activities like outdoor watering) and that the higher price provides added encouragement to do so. By the mid-2000s, over half of the state's urban water utilities used tiered rates, and the practice has been growing as more utilities aim to reduce per capita urban water use, still high in California relative to comparable economies with similar climates, such as Australia, Spain, and Israel.[49] The legal issue is whether these rate structures are consistent with Proposition 218's requirement that fees be proportional to the cost of service. This accounting requirement turns out to be more complex than voters may have anticipated when they approved this constitutional reform (see Box 4).

The courts have ruled that agencies cannot set different price tiers for different customer categories unless the rate differentials are based on differences in costs of service among categories. This ruling is beneficial insofar as it discourages the artificial subsidization of water use.[50] However, there is also a risk that courts will interpret the cost proportionality requirement too rigidly to allow tiered pricing to be used more generally as a tool to promote conservation. Under Proposition 218, higher price tiers can be justified to the extent that new water sources cost more than existing supplies, which is usually the case. Although agencies can show that these rates do encourage conservation—thereby allowing both utilities and users to avoid these additional costs—it is difficult to establish a precise link between the amount of water saved and the higher volumetric prices.

There have been particular concerns for the consistency of budget-based (or allocation-based) tiered rate structures with Proposition 218's proportionality requirements. These rate structures adjust individual customer tiers by drawing on efficiency-based usage norms for indoor and outdoor use, and by taking into account both the number of residents (important for indoor use) and the landscaped area and climatic zone (important for outdoor use). Rate structures based on water budgets, which are increasingly popular in Southern California, enable utilities to send salient messages to ratepayers about efficient levels of water use: the monthly bills inform customers when they exceed their allotment, and customers face higher prices for any excess water use. Budget-based structures also help utilities to manage the inherent challenge of fiscal instability in a sector that faces high fixed costs. (Utilities use the more reliable revenues from the lower tiers to cover their fixed costs, and they use the more variable revenues from top tiers to fund conservation

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[48] See Appendix A for a more detailed discussion of these issues.
[49] See Hanak et al. (2011), ch. 2, and Cahill and Lund (2013).
[50] Lower prices for irrigation water, for instance, would still be justified if the water delivered is untreated or if the supplies are subject to interruption in the event of shortages.

programs, which augment effective supply.) Such rate structures are consistent with the long-standing constitutional requirement of reasonable use (Article X, section 2, adopted by the state's voters in 1928), and they are helping urban water utilities meet new legal requirements to reduce per capita water use by 20 percent by 2020 (Baerenklau, Schwabe, and Dinar 2013).

4

Water rate structures and the fallacies of molecular-level accounting

Proposition 218 calls for water and wastewater utilities to base their charges and rate structures on property service. In the extreme, this implies that each property should only be charged for the costs of delivering particular water molecules to the property.

However, accounting for the costs of collective services like water in this way has inherent pitfalls. Most water utility costs in urban areas are fixed costs that serve the entire community jointly, such as the costs for water treatment and distribution pipe capacity. Given the water system's existence, the additional costs of serving a single existing house are small. The community service capacity increases the value of each property served regardless of the volume of its water use, as connected homeowners avoid the largely fixed cost of having their own wells. Property owners also benefit from this system for fire protection (and reduced fire insurance rates), irrespective of the volume of water they use for other purposes. Any effort to determine the equitable shares of collective water service leads to a number of baffling questions. Should the cost of the large, fixed system and its treatment and pipe capacity be allocated to customers by connection, by quantity of water used, by property value increase due to the water service availability, or by some combination of these methods? Allocation by connection implies a parcel fee, allocation by water use implies a volumetric rate per gallon used, and allocation by the increase in property value implies a property value assessment. Because the same fixed cost serves a variety of purposes for a diverse set of customers, no single method of cost allocation will simultaneously be economically efficient and equitable in terms of all services to all parties, while raising sufficient revenues to cover (but not exceed) costs (Giglio and Wrightington 1972).

Water utilities have traditionally dealt with this problem by billing customers both a fixed service fee and a volumetric fee, in various combinations. As water conservation has become a policy priority in California, reflecting both the overall condition of water scarcity and the societal goal of reducing damage to aquatic ecosystems caused by water diversions, many utilities have adopted tiered rate structures, which charge higher prices for higher (presumably less essential) blocks of water use. Some utilities adjust these tiers for individual water users based on a "water budget" that considers household size, lot size, and climatic zone.

Proposition 218 could upend these pricing practices, depending on how the courts interpret the required property-based accounting of service costs. If the courts allow rates to cover only the additional (marginal) cost required to supply water to a particular property, this would bankrupt most utilities, as they would be unable to support fixed system costs. Other interpretations could bias the allocation of fixed costs in seemingly arbitrary ways, potentially interfering with utilities' ability to effectively balance system pricing objectives. Ultimately, there is no escaping the problem of allocating fixed system costs across a range of services provided to diverse property owners, and no one way to allocate costs fairly to individual properties.

Rate setting is a complex task, and agencies must use their best professional judgment on how to structure rates that enable them to recover their costs while encouraging conservation and efficient use. Water agencies should be required to establish a transparent and understandable record of decisions, but not held to unreasonable standards of precision regarding the allocation of costs to individual parcels (Box 4).

The future of portfolio-based supply management

Conservation is one of several nontraditional tools that water managers are using to meet the water demands of California's economy. Although new water sources are generally more expensive than existing supplies, sources such as recycled water, captured stormwater, and desalinated ocean water not only help accommodate growth but often improve system reliability for existing customers as well. This is especially important for communities reliant on variable Delta exports. More generally, new water sources can act as a hedge against the increasing variability anticipated with climate change. The search for water sources is also consistent with state policy, which encourages water utilities to develop local supplies.[51]

If applied without an understanding of the realities of contemporary water management, Proposition 218's requirement that water rates reflect the costs of water service to each parcel could undermine the ability of water agencies to develop and use alternative supplies as needed as part of their overall water service portfolios. A case in point is a recent trial court ruling in Southern California, *Capistrano Taxpayers Association v. City of San Juan Capistrano* (2013), in which the court interpreted Proposition 218 to prohibit agencies from charging customers for any component of water service (in this case, recycled water) that does not make the component water physically available to them.

This fragmented interpretation of water service costs threatens to undermine one of the hallmarks of contemporary water management, which recognizes that water service is an integrated endeavor. Because the various components of a water system—including the management of native surface water and groundwater supplies, the acquisition of imported water, recycled water programs, stormwater capture, conjunctive ground and surface water management, and demand reduction strategies—cannot be segregated from one another, it is lawful to charge individual property owners and water users a share of all of the system costs. For example, providing recycled water to one part of the service area improves water service for all, so it is lawful to spread the cost of recycled supply among all parts of the service area, including those that do not physically receive that supply.

The future of sustainable management of groundwater basins

Many of California's groundwater basins are at risk, suffering from the effects of long-term pumping that has exceeded the natural rates of recharge. One promising way to stabilize groundwater basins is by charging all pumpers a volumetric fee to limit pumping to sustainable levels and to cover the costs of recharging the basin with imported surface water, local recycled wastewater, or stormwater. This practice has been used successfully for some decades by the Orange County Water District, the Water Replenishment District of Southern California, the Pajaro Valley Water Management Agency, and the Santa Clara Valley

[51] For instance, several state policies encourage the expansion of recycled water use. The recently signed Senate Bill (SB) 322 (October 2013) charges the DPH and the State Water Resources Control Board (SWRCB) to develop a uniform water recycling criteria. The SWRCB Recycled Water Policy aims to increase recycled water from municipal wastewater sources and strongly supports recycled water as a safe alternative to potable water. The state's objective to achieve a 20 percent reduction in per capita water use by 2020 counts recycled water as a way to offset urban use and reach goals (California Department of Water Resources 2010). And the Delta Reform Act (2009) made it state policy to reduce the reliance on water from the Delta, highlighting recycled water as a way to achieve more local self-reliance.

Water District—districts with special legislative authority to manage groundwater supplies on behalf of their communities (Blomquist 1992).

Groundwater overdraft does not affect all pumpers in the same way. For instance, those located closer to the ocean experience saltwater intrusion faster, and so bear greater costs from overdraft than those located further inland within the same basin. Yet the inland pumpers contribute to the problem. A hydrologically accurate cost-of-service analysis would need to account for the external costs of pumping to all users of the basin, not just the costs to the individual property owner. Even if the specific effects of individual pumping vary in time and space, everyone pumping from the basin contributes to the problem, and everyone overlying the basin benefits from more sustainable management in the longer term. Landowners and groundwater users in several districts have challenged groundwater extraction charges under Proposition 218, alleging that they may not be charged a uniform volumetric fee unless they receive the same benefits from the agency's groundwater management program as other users.

In a step forward for sustainable groundwater management, the California Court of Appeal recently rejected claims that Proposition 218 prohibited the local groundwater management agency from imposing a fee on all groundwater extraction as part of its program to prevent overdraft and saltwater intrusion and to augment native groundwater supplies by blending them with recycled water (*Griffith v. Pajaro Valley Water Management Agency* 2013). The court noted that the agency "was created to manage the resources 'for the common benefit of all water users,'" and held that the augmentation charge pays for "'the activities required to prepare or implement any groundwater management program'" (*Id.* quoting Pajaro Valley Water Agency Act). The agency "is not using money from the augmentation charge for 'general governmental service," the court reasoned. "Rather, it is using the money to pay for the water service provided" (*Id.*).

This important decision recognizes that water service is a multifaceted and integrated endeavor and that pricing for such services as recycled water and groundwater replenishment need not be based on where the water molecules are actually delivered. The court also concluded that agencies must have some flexibility in the way they apportion fees: "Proposition 218 prescribes no particular method for apportioning a fee or charge other than the amount shall not exceed the proportional cost of the service attributable to the parcel . . . . [The law] does not require a more finely calibrated apportion" (*Id.*).

Although the *Griffith* decision reflects an informed judicial understanding of the realities of modern water administration, the development of rate structures nonetheless remains an area fraught with legal uncertainties for water managers, who need to think comprehensively about their portfolio of water sources to provide reliable service over the long term. If Proposition 218 is interpreted by the courts as requiring molecular-level accounting of the costs and location of each drop of water, it will undermine the ability to manage California's increasingly sophisticated and interconnected water system so as to provide reliable service despite increasing water scarcity. Balancing costs among users in water systems is an inherent governmental function, not subject to simple accounting solutions (Box 4).

Affordability for low-income households

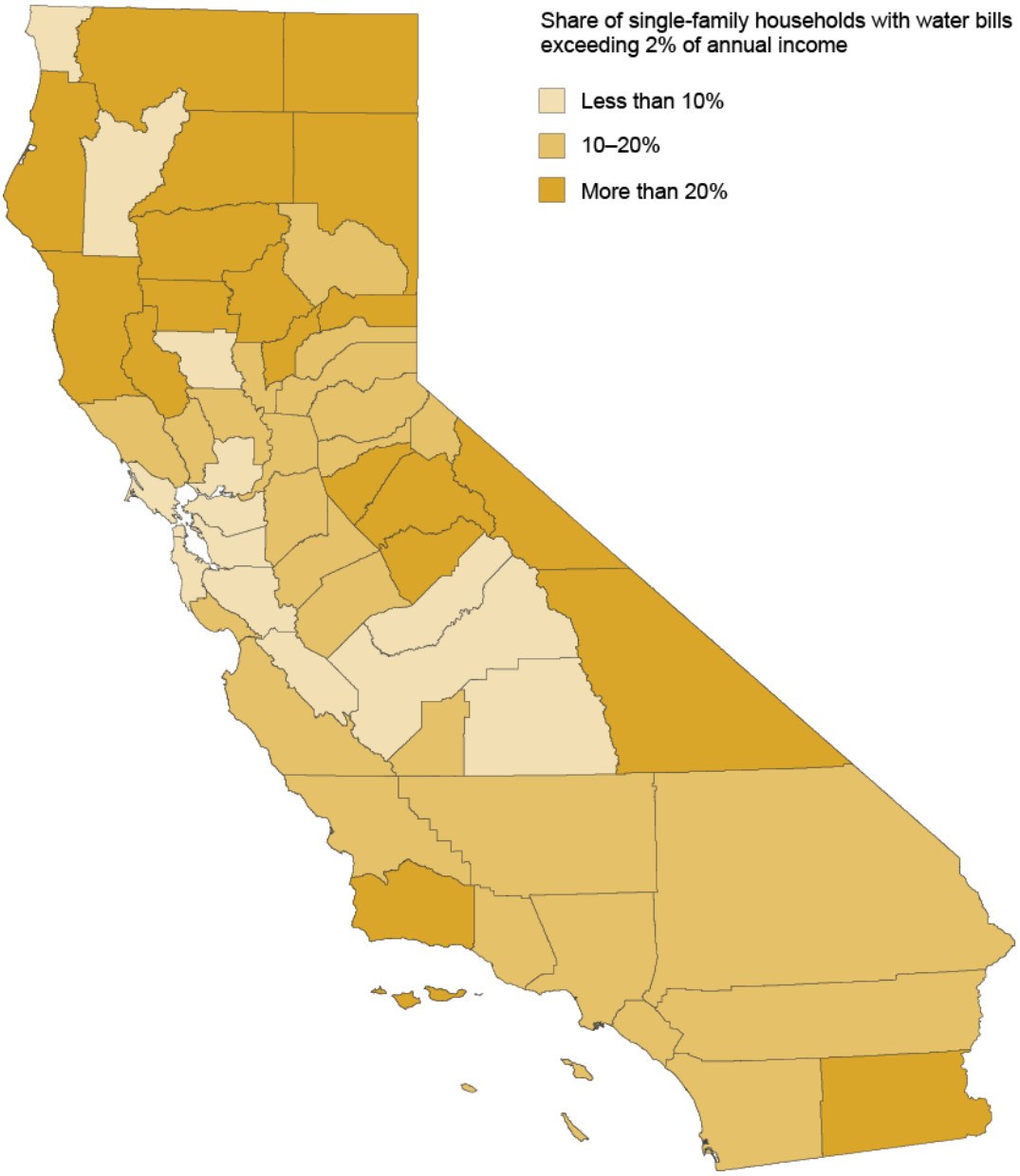
Proposition 218's proportionality requirement may also make it difficult for utilities to offer affordable "lifeline" rates to low-income households. The state's Public Utilities Commission authorizes private energy and water utilities to cross-subsidize low-income customers with rate revenues, and lifeline rates funded in this way are common in both sectors. In contrast, public agencies that did not already have such rates in place prior to Proposition 218 must either use available income from sources other than rates (e.g., revenues from property taxes) or seek voter approval of new tax revenues for this purpose. Tiered rate structures can

help manage this problem, giving low-income consumers (and everyone else) some basic supplies at a lower price. Conversely, high fixed service charges disproportionately affect lower-income households, and many utilities seem to be moving in this direction in an effort to stabilize revenues in the wake of the recent declines in water sales. As the real costs of water and wastewater services continue to rise, Californians may need to reconsider whether Proposition 218's restrictions against cross-subsidies for low-income households are a desirable policy.

Indeed, the state recently adopted legislation affirming that all Californians have the right to "safe, clean, affordable, and accessible water adequate for human consumption" (Assembly Bill [AB] 685, 2012). Companion legislation (AB 2334) that sought to define affordability thresholds and required the Department of Water Resources to develop strategies to make water more affordable in "high-cost communities" did not pass. The guidelines introduced in that bill—flagging water bills exceeding 2 percent of household income as potentially unaffordable—are nevertheless instructive.

Our county-level estimates show the share of single-family households that may already face water bills exceeding 2 percent of their annual incomes (Figure 5). Statewide, the share is nearly 13 percent. The lowest-income households (with annual incomes at or below $25,000) are potentially affected in most counties, and lower-middle-income households (with annual incomes between $25,000 and $50,000) are also affected in counties where water rates are especially high, like Santa Barbara. Although the appropriateness of AB 2334's affordability guidelines for California remains an open question, the state will clearly need to consider affordability for lower-income households as water bills continue to rise. Some of the households exceeding the 2 percent threshold live in areas with small, rural systems with special affordability problems (discussed below), but most are served by larger water systems that could address affordability through local lifeline rate programs. Water is still highly affordable for the vast majority of California's households and businesses, and lifeline rates are a straightforward approach for helping those who are less fortunate receive an essential service.

FIGURE 5
Lower-income households across California may face growing affordability challenges as water bills climb



SOURCE: Author calculations using information from the water fee model (Appendix D).

NOTES: The figure depicts the share of single-family households with water bills likely to exceed 2 percent of household income. The calculations are for entire income groups, based on estimated water use and water bills by group. In most counties, the lowest income group ($25,000/year or less) has average bills exceeding the 2 percent threshold. In some, the lower-middle-income group ($25,000–$50,000/year) exceeds this threshold. In more-rural counties, the data on household water use and water bills may be less reliable.

To recap, the state's water and wastewater systems can remain fiscally robust despite looming cost challenges as long as utilities do not face unreasonable legal impediments to raising the funds they need from the local ratepayers who rely on their services. Later we suggest some constitutional reforms to remedy problems in the laws as now written, as well as steps that the courts, the California legislature, and water managers can take to help the water system navigate this evolving terrain.

Four Areas Where California Is Failing, and One on the Brink

In contrast to this picture of relative fiscal health for water and wastewater utilities, four areas of water management already face structural funding gaps that make them unable to deliver the level of services California residents expect. California is failing in these four areas: small, rural water systems in low-income communities; flood protection; stormwater management; and aquatic ecosystem management. The reasons for failure include high costs and inadequate community resources (for small water systems and for many communities facing a high risk of flooding), outdated cost-sharing arrangements with the federal government (an added problem for flood management), and lack of a clear "fiscal home"—either unclear lines of responsibility for addressing the problem (in the case of ecosystems) or funding rules at odds with assigned responsibility (in the case of stormwater). Finally, despite its promise for addressing water management in more cost-effective and environmentally effective ways, integrated water management is on the brink of financial failure for similar reasons.

Safe drinking water in small, disadvantaged communities

Several recent studies indicate that a lack of access to safe drinking water in poor, rural communities is a serious problem.[52] Small water systems generally rely on groundwater supplies. They have little ratepayer capacity and high unit costs for supplying safe piped drinking water to households, and they are often in areas where groundwater is highly contaminated. For example, the Tulare Lake Basin and the Salinas Valley have significant and sustained nitrate contamination of groundwater, primarily from fertilizer and animal manure on agricultural lands (Harter et al. 2012; Honeycutt et al. 2012). Arsenic (a naturally occurring contaminant) is another prevalent problem, and small-scale treatment for newly designated contaminants, such as chromium-6, is technically and financially difficult.

Getting an overall handle on the scale of this problem and the potential costs is challenging. Some 2,300 small water systems regulated under the Safe Drinking Water Act (systems with 15 to 999 connections) serve about 1 percent of California's population, or around 380,000 people. Recent studies have found that 185 of these systems (8% of the total, serving 58,000 people), have recently failed to meet the standard for one or more health-based maximum contaminant levels (MCLs). A slightly larger number of water systems (215, serving 95,000 people) relies on at least one contaminated groundwater well and failed to meet the standard for at least one MCL between 2002 and 2010.[53] Figure 6 shows the locations of these 215 small systems; although they are more concentrated in the Tulare Lake and Salinas basins, they are present throughout California. An added complication is that state agencies have no estimates of exposure rates for the roughly 1 percent of Californians served by even smaller water systems or domestic wells. A detailed study of nitrate in the Tulare and Salinas groundwater suggests that these populations are at least as susceptible as those served by the small systems regulated by the Safe Drinking Water Act (Honeycutt et al. 2012). Taken together, perhaps 80,000 to 160,000 Californians (0.2 to 0.4% of the state's population) live in small, disadvantaged communities that have difficulties providing safe drinking water.[54]

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[52] See Harter et al. (2012), Honeycutt et al.(2012), State Water Resources Control Board (2013b and 2013c), and California Department of Public Health (2013).
[53] The first numbers are from the California Department of Public Health (2013) and the second are from the State Water Resources Control Board (2013b).
[54] Not all small systems have low-income customers; small mutual water companies in some more affluent, urbanized areas also have water quality problems. This estimate assumes that about 80 percent of small systems have economically disadvantaged populations, based on results from Honeycutt et al. (2012) for Tulare and Salinas. State law defines disadvantaged communities as those with median household incomes at 80 percent or less than the statewide median income, which may be an overly broad definition (e.g., it includes communities with many college students, as well as some retirement communities in which residents may have significant assets but below-average annual incomes). Larger numbers of Californians served by larger water systems are also potentially at risk from groundwater contamination, but these systems can more readily benefit from scale economies to cover the costs of solutions, such as blending sources and wellhead treatment.

FIGURE 6
Small water systems with contaminated groundwater are located across the state

SOURCE: State Water Resources Control Board 2013b.

NOTE: The figure shows 215 small water systems (with 15 to 999 connections or serving approximately 50 to 3,300 individuals) that had at least one contaminated groundwater well and at least one MCL violation between 2002 and 2010.

Statewide, providing safe drinking water to these communities cost-effectively would likely require additional expenditures between $30 million and $160 million per year. Solutions include physically consolidating small systems into larger neighboring systems (where practical), blending water sources, drilling new or deeper wells, or using point-of-use and point-of-entry treatment. In the longer term, as nitrate contamination migrates deeper into aquifers, digging new wells will be a less viable option, but technological advances, such as remote monitoring systems now in pilot development, may make point-of-use treatment more attractive (Cohen and Rahardianto 2013).[55] Administrative consolidation of

[55] Public health officials have been reluctant to consider supporting point-of-use treatment as a long-term solution because of safety concerns if these home-based systems are not regularly maintained and monitored.

utilities—with combined management and technical oversight—may also help reduce costs and improve performance where physical consolidation is impractical, but this process can also face obstacles.[56]

Substantial sums have been available to support safe drinking water delivery under numerous state and federal programs, but this funding is often difficult for small systems to access because of their limited organizational capacity. Moreover, most funds, including those specially earmarked for small systems, have been restricted to capital improvements rather than the ongoing operations and maintenance support that these systems often need. The smallest systems (those not regulated by the Safe Drinking Water Act) are ineligible for many funding programs. Some of these gaps could be addressed through better organization of existing funding programs. Legislation signed in 2013 moves in this direction by augmenting targeted support for small systems (AB 21 and AB 30) and helping government agencies to apply for funds on behalf of disadvantaged communities (AB 115).

Creating a single application for the numerous funding programs would also help, as would facilitating physical and administrative consolidation by indemnifying utilities that agree to annex small systems from potential liabilities for pre-existing problems. The responsibility for overseeing improvements in small systems could be assigned to a local body—e.g., county departments of public health or public works. These entities could help communities address problems with water supply as well as problems with sewer, septic, and drainage systems. In addition, the state should focus attention on understanding the needs in the communities that are currently falling through the cracks because their water systems are too small to be regulated under the Safe Drinking Water Act. One relatively low-cost first step would be to create a single statewide repository for data on systems serving 5 to 14 connections, information that is currently collected by counties.

Flood Protection

California's hydrology and physical features make many areas highly prone to flooding, and managing flood risk has been an important objective since before statehood. Local, state, and federal authorities have long shared these responsibilities. Local agencies generally manage and maintain local infrastructure, such as levees and seawalls. The U.S. Army Corps of Engineers oversees the flood management functions of the state's large reservoirs. The Federal Emergency Management Agency (FEMA) oversees the floodplain mapping that deems which properties lie within the most flood-prone areas (the so-called 100-year floodplains), and it sells flood insurance to individuals and businesses with rate differentials that reflect this mapping.[57] The state Department of Water Resources (DWR) works in partnership with the Army Corps of Engineers to manage flood protection infrastructure during flood emergencies and to conduct large-scale flood management planning. Both agencies supplement local funding, especially for capital investments. Within the Sacramento and San Joaquin River hydrologic regions, the state also has primary responsibility for a large federally authorized flood control project that includes 1,600 miles of levees and thousands of acres of bypasses that periodically divert floodwaters away from urban areas. A 2003 court ruling (the *Paterno* decision) found the state liable for flood damages behind these levees even when they were built

[56] The Legislative Analyst's Office (2011) highlights some of these challenges in a recent review of small special district performance issues in several counties. The process itself, which occurs under the auspices of the Local Agency Formation Commission (LAFCO), can be costly, since it typically requires updated municipal service reviews, sphere of influence updates, or special feasibility studies. LAFCO-imposed terms of consolidation can result in higher-cost personnel agreements. Agencies absorbing another district through consolidation can also face significant up-front costs as they repair aging infrastructure, purchase required equipment, or begin to build a reserve for emergencies or future upgrades. LAFCOs tend not to push consolidation if there is opposition on the part of district management.

[57] A 100-year flood refers to a flood large enough that it has a 1 percent chance of occurring in any given year.

(and subsequently maintained) by local agencies, potentially exposing taxpayers to billions of dollars in liabilities from future floods (California Department of Water Resources 2005).

This lawsuit and the devastating flooding that Hurricane Katrina brought to New Orleans—a city that was believed to have a significantly higher level of protection than metropolitan Sacramento—prompted a concerted effort by state officials to increase attention to managing flood risk in California.[58] In theory, federal policy provides for federal cost shares of up to 65 percent of capital investments for local projects, but the slow pace of this funding caused severe investment backlogs, as locals waited in line for the funds. In 2006, the Schwarzenegger administration allocated half a billion dollars in general fund support to capital projects in lieu of the federal government. Two bonds passed by voters in November 2006 made another $5 billion in state funds available for this purpose, with much of the focus on the Sacramento and San Joaquin River regions where the state is now liable. A 2007 legislative package also aimed to tighten the rules for local building decisions: instead of following the federal guidelines that restrict new construction only within the 100-year floodplain, urbanized areas within the Central Valley would be required to provide protection against a 200-year flood if they wanted to authorize more growth.[59]

Recent planning efforts by DWR and the Army Corps of Engineers have determined that roughly 25 percent of the state's population is living in a floodplain: 4 percent in the least protected areas, and another 21 percent in areas rated as having protection from a 100-year flood but still susceptible to larger and less frequent floods (the so-called 500-year floodplain).[60] Many of these lands are protected by levees subject to rupture or overtopping. The estimated replacement value of buildings in these floodplains exceeds $430 billion. In addition to buildings, many other exposed assets carry significant value, including building contents and crops, as well as public infrastructure (major airports, roads, rail lines, and hospitals). Economic losses from flooding depend on the depth and duration of the flood, and the degree of disruption for businesses; in some places, flooding also poses risks to human life. The severity of flooding could increase with climate change, as warmer winters (with more rain and less snow) raise the prospect of higher winter and early spring flood flows, and as an accelerated rise in sea level causes higher and more frequent storm surges in coastal areas.

The new study by DWR and the Army Corps of Engineers also provides estimates of new capital investments needed to shore up the system and, in some cases, to improve its functionality from an environmental perspective. For instance, "setback" levees, which are set back some distance from the river's edge, can ensure better flood protection while improving riparian habitat. The lower bound estimate, including only those projects with existing cost estimates, is $34 billion.[61] If these projects were implemented over the next 25 years, this would require annual investments of nearly $1.4 billion—more than double the current capital spending in this sector.

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[58] In 1995, the Sacramento Area Flood Control Agency (SAFCA) developed a widely used comparison chart showing that much of Sacramento only had protection against a 70-year flood, whereas New Orleans' flood protection infrastructure at that time was rated to protect the city against a 300-year flood.

[59] Senate Bill 5 (2007) included this requirement, which took effect in 2012, following the adoption of the Central Valley Flood Protection Plan.

[60] See California Department of Water Resources and U.S. Army Corps of Engineers (2013). These estimates used 2000 census tract files to estimate population shares, but with 2012 floodplain maps.

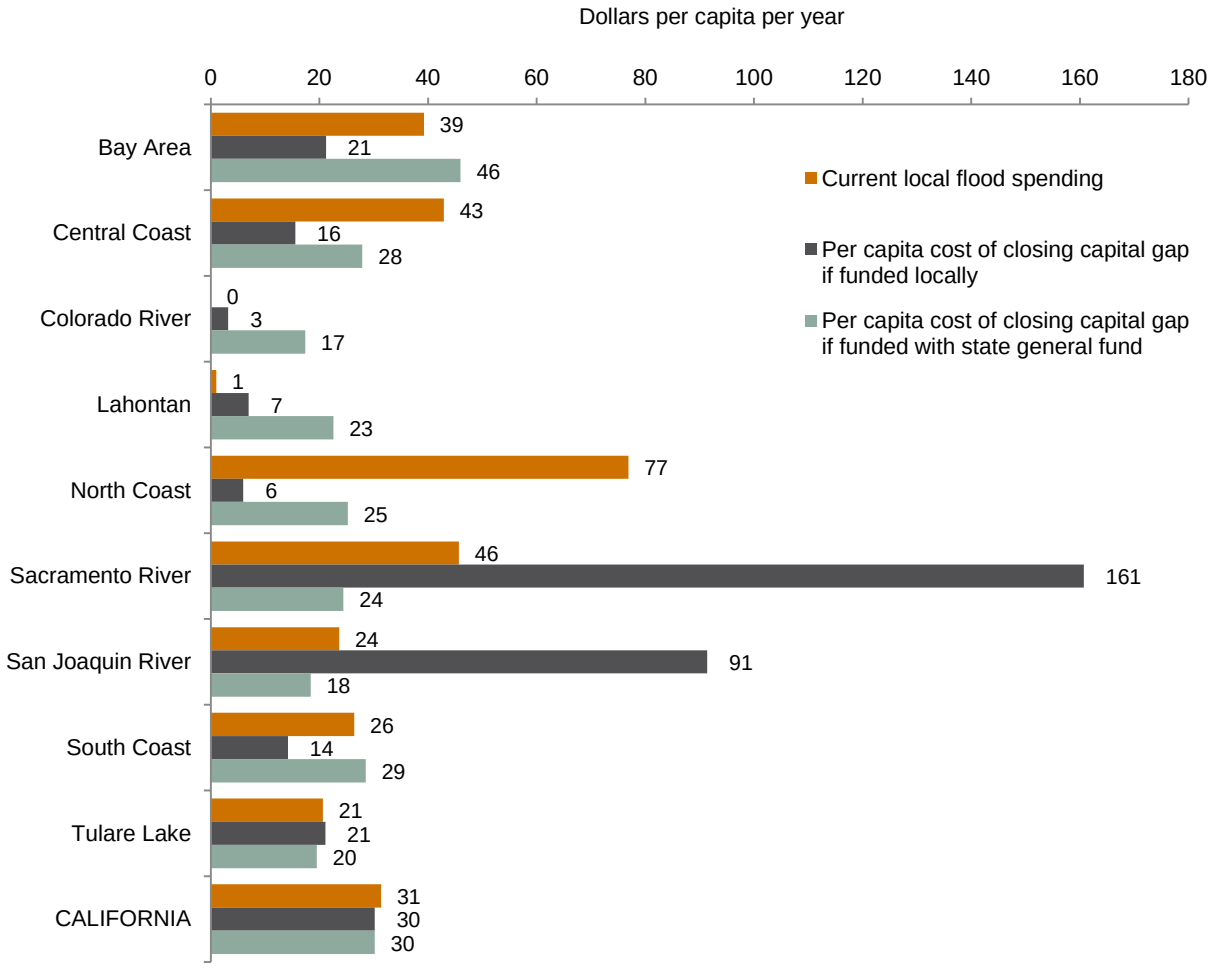
[61] We replaced the study's estimates for Delta levees that are not part of the federally authorized project (and covered as part of the Central Valley Flood Protection Plan) with estimates from the Delta Protection Commission (2012), and we included the U.S. Army Corps of Engineer's preferred strategy for Los Angeles River restoration ($456 million), which became available after the draft report from DWR and the U.S. Army Corps of Engineers was issued.

The new funding needs are potentially even larger, because current expenditures include substantial state spending from GO bonds that are nearly exhausted. Under the optimistic assumption that this is the only additional gap that needs filling, California could be facing a shortfall in flood funding of roughly $1 billion annually.[62] It would take at least 75 years to undertake these investments at current rates of local and federal spending.

Statewide, filling this gap would mean doubling the sums currently spent by local residents on flood management. This may not seem large, on average. In 2011, Californians spent $31 per person, and it would cost another $30 per person per year to fill this gap. But the estimated needs vary greatly by region, such that some regions would end up carrying much larger burdens than others if the funds had to be raised locally. This discrepancy can be seen in Figure 7 by comparing the middle bars (which show the added costs to regional residents if the gap is funded with local taxes and fees) with the bottom bars (which show added costs to regional residents if the gap is instead paid for by state general fund taxes). With local funding, added per capita costs would be especially high in the Sacramento River region ($161/year) and San Joaquin River region ($91/year); together these regions account for half of the total estimated needs. To anticipate the discussion on funding options below, residents in coastal areas, and especially the San Francisco Bay Area, would pay a much higher share of costs if these added costs were paid for by general fund taxes, because the state's general fund relies heavily on progressive income taxes, and incomes are higher in these regions.

[62] This assumes that federal spending and the operations and maintenance costs for the system remain at current levels.

FIGURE 7
Filling the flood investment gap: Costs to residents vary widely if funded locally or statewide



SOURCE: Authors' calculations using SCO local government data files, California Department of Water Resources and U.S. Army Corps of Engineers (2013), California Department of Water Resources (2012), and Delta Protection Commission (2012) and the water fee model. See Appendix B and Appendix D.

NOTES: Current local spending and the estimated capital gap are both around $1.1 billion annually. Population figures are for 2005 and local spending is for 2011. Regional definitions approximate hydrologic regions (see map at the beginning of this report). Colorado River region estimates are for Imperial County, for which no local flood expenditures were recorded in SCO data files for 2011.

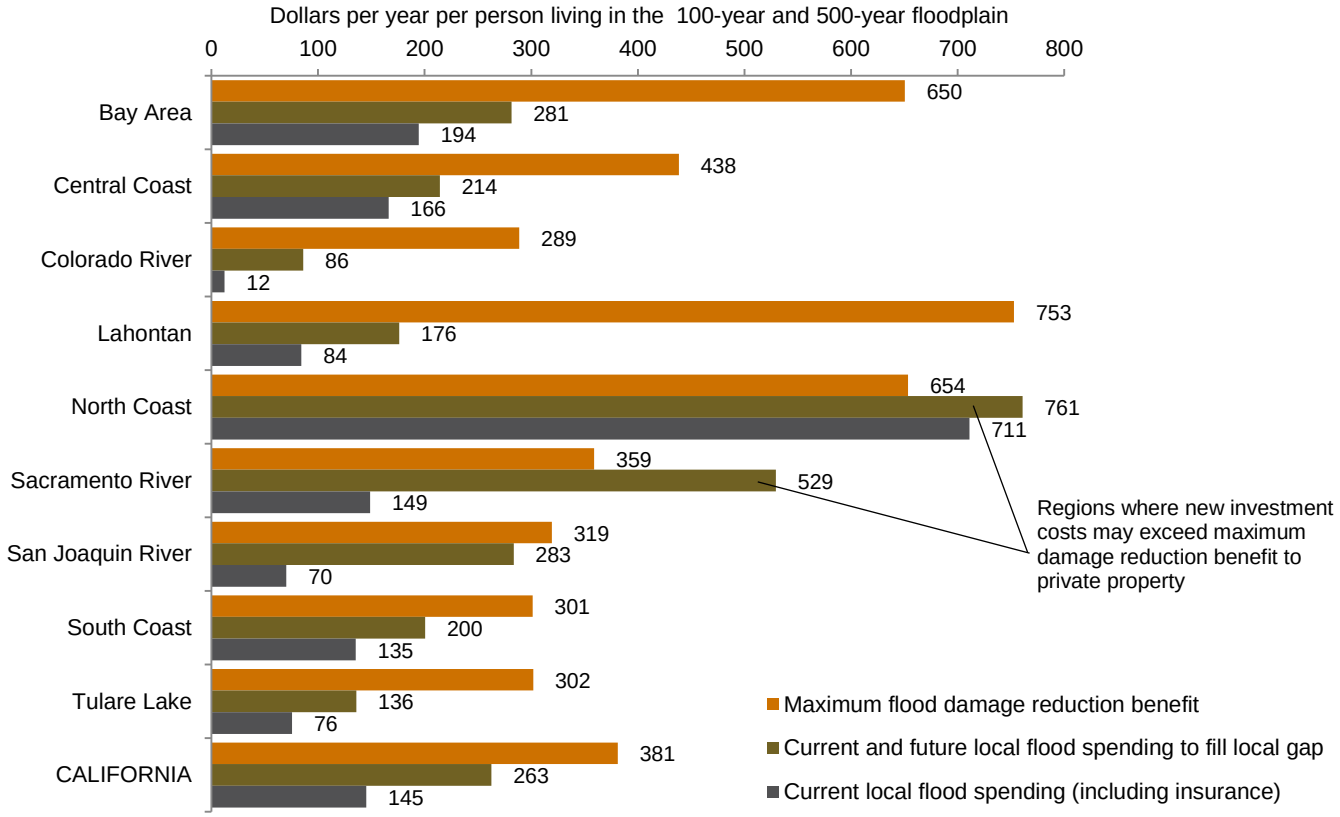
Raising these revenues locally in the places facing large new investment costs is likely to be challenging, especially given the voter approval hurdles in place since Proposition 218. There is also a question of whether some of this spending is worth it to local residents (or to the state). Will it cost more than the value of the protection it would provide? Only a quarter of the total $34 billion investment price tag has already been determined to have benefits that exceed the costs; for the rest (including most spending indicated for the Sacramento and San Joaquin River regions), this assessment still needs to be done.[63]

[63] Only the projects that have already been vetted by the Army Corps of Engineers ($7.5 billion) have systematically passed a cost-benefit test. Some local projects may also have undergone such analysis. The $13.5 billion in Central Valley Flood Protection Plan investments have yet to be analyzed in this way.

To get a rough idea of how things stack up, we estimated the expected benefits of new investments in terms of reduced risk of private losses of buildings and contents.[64] Figure 8 summarizes the results of this analysis in terms of value of the investments (the top bars) and their costs per person living within the 100-year and 500-year floodplains. Current costs are shown in the middle bars, and future costs, including the added investments, are shown in the bottom bars. This analysis—while somewhat preliminary—raises doubts about whether all the anticipated investments are justified, at least in terms of these material flood damages. Statewide, the higher level of annual spending required to cover current and new investments appears worth the cost, albeit marginally: $263 per exposed resident, compared with $381 in expected losses for buildings and contents. In the North Coast, current spending (at $761 per exposed resident) already exceeds the value of flood protection spending for private property ($654). In the Sacramento River region, the costs of filling the investment gap ($529 per exposed resident) will exceed the value of protection ($359). The potential gap is even wider in some of the more rural counties within this region (Appendix B).

[64] See Appendix B for details. For buildings, we took the estimated replacement values from the *Flood Futures* study by DWR and the Army Corps of Engineers (California Department of Water Resources and U.S. Army Corps of Engineers 2013). As discussed in Appendix B, these estimates have some limitations, but on average they appear reasonable relative to building costs in different regions of the state. For contents, the estimates from the study seemed too high, so we used an estimate of 20 percent of the value of buildings, a ratio similar to that used in multi-hazard insurance. (Content coverage in flood insurance contracts in California is slightly lower, at 16%).

FIGURE 8
Not all investments may be worth the costs to floodplain residents



SOURCE: Authors' calculations using SCO local government data files, California Department of Water Resources and U.S. Army Corps of Engineers (2013), California Department of Water Resources (2012), and Delta Protection Commission (2012). See Appendix B.

NOTES: Current local spending includes flood management ($1.1 billion) and premiums paid for flood insurance ($212 million). Current and future local spending also includes 1/25 of the total estimated investment need. Values are calculated per person living in the floodplain (25% of statewide population, share varies by region). Benefit of investments is estimated in terms of the reduced probability of loss of buildings and contents, assuming that current annual risk of serious flooding is 1 in 70 in the 100-year floodplain and 1 in 200 in the 101-year to 500-year floodplain. The calculations may overstate the value of investments because they assume that flooding would cause a total loss of the assets and that the investments eliminate all flood risk. Local projects within each region could be more or less worthwhile than the regional average. Appendix B provides county-level results.

In other words, in some regions, the avoided costs of private property damage are enough to justify the added expenditures on flood protection, but in others—notably, the Sacramento River, the North Coast, and possibly also the San Joaquin River regions—other benefits will likely be needed to justify these new investments. Of course, there are many other reasons why flood investments are valuable, including the protection of public safety, the prevention of losses due to business interruption, the safeguarding of public infrastructure, and, in some cases, the added ecological and recreational benefits.[65] Some more eco-friendly projects might also provide the system with more flexible capacity, enabling systems to cope with the increased hydrologic variability anticipated with climate change. However, these findings underscore the importance of doing a detailed risk-based analysis of proposed investments at local and regional scales,

[65] Some state flood managers would also argue that costlier up-front investments may be more resilient over the long run (i.e., that a levee can break, while a bypass system is more robust). To the extent that some types of investments (such as bypasses and setback levees) improve ecological function, they may reduce future mitigation needs for the water system as a whole (in particular, potentially making it easier to continue diverting water supplies to cities and farms).

especially given the size of the potential funding gap facing the state. The results are also consistent with what we heard from water managers regarding the special problems of rural counties, where the combination of new standards for levees, low population densities, and low land values make it virtually impossible to attain the 100-year levels of protection needed to qualify for lower insurance rates and new building permits. These challenges mirror problems some rural communities face in their efforts to meet drinking water and wastewater standards.

Stormwater and other polluted runoff

Stormwater management used to be the younger sibling of flood management—a somewhat mundane job of draining streets from rainfall and excess landscape water. As such, stormwater runoff was mainly handled by municipal public works departments as part of street design and maintenance. This began to change in the early 1990s, when the USEPA started to focus on the "second generation" of problems targeted under the Clean Water Act, including pollutants from "nonpoint" sources such as stormwater runoff. (The "first-generation" efforts concentrated on wastewater treatment and reducing other "point" sources of pollution, like industrial discharges.) Initially, only the largest urban areas (with populations above 100,000) were required to get pollution management permits for urban stormwater. Since the 2000s, smaller municipalities and counties (with populations above 50,000) have also come under the law, which has separate permitting requirements for some high-impact sectors and activities, such as transportation and general construction. Agricultural runoff has also increasingly come under the law's purview, though not through a formal permitting process (Gray et al. 2013).

Urban stormwater permits are reissued every five years, and the requirements have become increasingly stringent. In coastal areas, requirements now typically include high levels of on-site retention of storm runoff for new and redeveloped properties; for water bodies receiving runoff, there are a variety of water quality targets relating to trash, bacteria levels, and various chemical pollutants. Although there is little doubt that the costs of these requirements have also been rising, by just how much is a matter of some dispute. In general, preventing pollution at the source costs much less than capturing and treating polluted runoff before it enters the affected water body, but this can require changing business practices and behaviors of thousands of individuals.[66] Incorporating on-site retention features in new development often can be achieved with little added expense, but it can be very costly to retrofit existing communities.[67] The costs of management also skyrocket when the regulatory target is zero pollution, rather than something less absolute and more affordable.[68] Although few fines have been issued for stormwater permit failures, the regulatory trend appears headed in the direction of stricter limits and lower tolerance.

What is clear is that stormwater agencies face extreme challenges to pay for their new obligations, most of which have come in the years since Proposition 218 was passed. Property-related fees are an appropriate funding source for local stormwater programs, because the impervious surfaces on properties are an important source of stormwater runoff. Landowners are charged fees in order to help solve the problems that they have created or exacerbated—in economic terms, they pay fees to internalize the external costs of

[66] See Appendix B for some examples of recent work in source control, including successes with regards to copper brake pads and pyrethroid pesticide use, both achieved through state regulation.
[67] See Kalman et al. (2000) and Center for Watershed Protection (2013).
[68] For an example, see the discussion in Appendix B of estimates for meeting the trash requirements in Los Angeles. One study estimated that full compliance with Los Angeles County's "zero trash" limit could cost as much as $284 billion in capital investments, assuming the installation of advanced treatment facilities in 65 locations, with a capacity to capture and treat 97 percent of the runoff from historic storms. Although costs could be much lower with some alternative control mechanisms, this example shows how very strict regulations combined with downstream, management, rather than source control, can induce very high costs.

their contributions to stormwater production. Proposition 218 requires elections in which property owners willingly impose these fees on themselves, even though the benefits accrue principally to others, including any downstream residents and the broader environment. Not surprisingly, this is proving to be a hard sell.[69] Since Proposition 218, elections by property owners to establish or raise fees on impervious surfaces have been attempted in only a handful of places and have succeeded in even fewer.[70]

Proposition 218 does not apply to non-property-related sources of polluted runoff, such as vehicle use, toxic chemicals, and litter, but local agencies have had limited success raising funds from these sources. Although the law still allows such non-property-related sources of pollution to be subject to regulatory fees (e.g., a surcharge on gasoline, chemicals, or cigarettes—a common source of stormwater trash), local agencies are concerned that Proposition 26 could make it more difficult to establish these types of fees.[71]

The alternative to regulatory fees or to having property owners pass property-related fees is a two-thirds majority approval of local bonds or special taxes to support stormwater management. This is not inconceivable. Los Angeles voters approved a $500 million bond in 2004, and several smaller coastal cities approved special taxes for this purpose.[72] But this is a high electoral bar for something that is not very visible to voters, especially outside of coastal communities whose economies are closely tied with the condition of local beaches. As one manager lamented, comparing the plight of raising funds for stormwater services to that of raising funds for the upkeep of sewers, "It's too bad that stormwater doesn't smell." Sewer managers are also able to meet their regulatory obligations under the Clean Water Act without having to get voter approval for every rate increase, thanks to their exemption from Proposition 218's vote requirement.

As a very rough indication of the funding gap, we estimate that the total annual costs of meeting urban stormwater permit requirements are in the range of $1 billion to $1.5 billion. Agencies have stable funding for no more than half that amount, leaving a gap of $500 million to $800 million per year, or roughly $40 to $60 per household (Appendix B). Although raising this level of funding will be challenging in the fiscal environment facing stormwater agencies, the gap could grow even larger unless regulatory and management approaches are employed to help contain costs. As the discussion above suggests, it will be essential to examine alternatives to simply capturing and treating all stormwater before it is discharged into water bodies. Some of the most cost-effective approaches for stormwater pollution prevention involve source control and hence may require action at the state level rather than at the level of the municipal authorities

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[69] See Box 1, above, on the general difficulties of funding programs to address externalities.

[70] It appears that only 12 cities or counties attempted property-owner ballot measures for stormwater fees since Proposition 218. Measures passed in only seven of these: San Clemente (2002, 2007, 2013), Palo Alto (2005, after a failed attempt in 2003), Rancho Palos Verdes (2005, then recalled and reduced in 2007), Ross Valley (2007, overturned by lawsuit), Solana Beach (2007), Burlingame (2009), and Santa Clarita (2009). Communities where elections have failed include: Carmel (2003), Encinitas (2005), Woodland (2007), Stockton (2009), and Contra Costa County (2012). (See Appendix E and the accompanying online data set.) In 2012, Los Angeles County supervisors decided not to proceed with an election following protests at the rate hearing. (The hearing is the first part of the two-part election process under Proposition 218. See text above and Appendix A for more on the process.)

[71] Although Proposition 26 does not have the same cost proportionality standards as Proposition 218, it requires that the fee "bear a fair or reasonable relationship to the payor's burdens on…the governmental activity" (Cal. Const., Art. XIIIA, § 3(d) and Art. XIIIC, § 1(e)). Industries or groups not wishing to pay such fees are likely to seek to challenge what constitutes a "fair or reasonable" relationship, especially in an area like polluted runoff, which has multiple, diffuse causes. More generally, there is a concern that some courts may interpret the definition of "governmental activity" in very narrow terms, excluding the costs of mitigation.

[72] Communities that have passed special taxes focused on stormwater include Ferndale and Corte Madera (1997), Santa Monica (2006), and Santa Cruz (2008). Nine communities have passed special taxes or GO bonds for stormwater management along with local road improvements. Some communities have also enacted new general taxes that include stormwater among many other functions. San Mateo County voters approved transportation-related charges in 2005 to support stormwater programs by simple majority vote under special authorization from the legislature. See Appendix E and the accompanying online data set.

who currently carry the permitted responsibility—in effect, responsibility for actions over which they do not have control, at a point in the system where problems are most costly to address.

Aquatic ecosystems

California's historical land and water management practices have altered the state's varied ecosystems, which are now less able to support native species and functions. More than 80 percent of the state's 122 remaining native freshwater fish species are in decline, with a quarter (31 species) listed as threatened or endangered under the federal and state Endangered Species Acts (Moyle et al. 2011). Many other species that depend on aquatic, riparian, and wetland habitat are also under threat. Modern regulations, reflecting society's goals to improve the health of aquatic ecosystems and the species that depend on them, call for new investments, both to mitigate the impacts of past actions and to prevent damage from new actions.

There is no one place to go to find a price tag for such efforts, or to figure out how much is already being spent to address the problem. Our estimates of aquatic ecosystem spending of about $700 million per year (see Table 1, above) cover the activities of state and federal regulatory agencies that oversee species management, some other resource-management oriented agencies (e.g., conservancies that acquire and manage habitat), and some research and experimentation. Some additional costs of ecosystem protection are embedded in the budgets of other parts of the water system. For example, wastewater system upgrades reduce harmful discharges, and environmental mitigation is a standard component of maintenance and new investment activities across the board, typically 3 to 10 percent of a project's costs.[73] In addition to these on-budget expenses, some environmental mitigation activities are costly because they reduce economic activity—for instance regulatory cutbacks in pumping and diversions often reduce agricultural production.

To get a sense of the potential financial costs of new investments to improve aquatic ecosystem function in California, we gathered information from several sources:[74]

- **Recovery plans for listed species.** Recovery plans, prepared by federal wildlife agencies, identify a suite of actions to promote species recovery. They do not necessarily reflect the most cost-effective ways to achieve these goals, and they do not come with detailed funding or implementation plans. They suggest annual costs of about $450 million to $480 million to support many (but not all) of California's endangered native fish species (especially salmon and steelhead trout) plus some other species dependent on tidal marshes.
- **State and federal habitat conservation plans.** These plans, called "Natural Community Conservation Plans" (NCCPs) under California law, promote species recovery in conjunction with the permitting of an economic activity that otherwise compromises endangered species. Unlike the recovery plans, these plans are designed with the objective of full implementation. Seven major plans approved to date have been conceived in conjunction with the authorization of new development; they have focused on land acquisition and terrestrial species, but with some benefits to aquatic or wetland habitat. Developer fees and other local resources provide most of the funding, and annual costs are about $65 million. Another 14 such plans, covering over 30 million acres, are in development, and most do not yet include cost information. One major exception is the Bay Delta

[73] For instance, environmental mitigation for the San Diego County Water Authority's new emergency storage project accounted for about 3 percent of the total project costs of $1.5 billion, and mitigation for the Carlsbad desalination plan accounted for 5 percent of the project costs of $540 million. Mitigation costs accounted for about 9 percent of the $400 million Natomas Levee Improvement Project implemented by the Sacramento Area Flood Control Agency. We also estimate that nearly 10 percent of the Department of Water Resources staff works on ecosystem-related issues.(See Appendix B.)

[74] The annual costs assume that the total costs are spread out evenly over the lifetime of the projects—often as long as 50 years. Costs would be higher if the investments were front-loaded. For details, see Appendix B.

Conservation Plan (described above), which foresees $6.9 billion in ecosystem expenses over a 50-year time frame, and which focuses on many listed aquatic species and some terrestrial species. Project planners are assuming that most of this tab will be paid for by the general public, but this funding is not yet secured. If costs are spread evenly over the full 50-year time frame, annual expenditures would be about $140 million a year, and as much as 50 percent higher with the accelerated investment time frame envisaged by project planners.

- **Other restoration projects.** Other regulatory programs include dam removal on the Klamath River to improve fish passage, part of a hydropower relicensing effort that will cost the state $10 million per year for its share. Some nonregulatory programs with benefits to aquatic species include the Southern California wetlands recovery project and the Central Valley Joint Venture for migratory birds, together costing about $20 million to $30 million per year. Some of the program activities for migratory birds have begun with grant support, but neither program has stable funding.

Taken together, these plans entail $490 million to $670 million annually for aquatic ecosystem investments that currently lack a funding source, depending on the degree of overlap among plans that address the Delta watershed. About half this cost is for work in the Delta and the greater Sacramento–San Joaquin watershed, and about half is for coastal and estuarine ecosystems.

These cost estimates may be on the high side, given the overlap between projected flood investments (e.g., for floodplain habitat in the Central Valley and restoration of the Los Angeles River), and given the potential to reduce the costs of these efforts without losing their core effectiveness. For instance, there are questions about whether the vast habitat expansions planned as part of the BDCP—a large component of total costs—will have enough environmental payoff to warrant the expense (Mount et al. 2013); similar questions are being posed about the ecological value of removing some upstream dams as part of the Central Valley salmonid recovery plan.[75] On the other hand, these cost estimates are also missing key elements that are likely to be important in some regions, such as a recovery plan for the endangered Santa Ana sucker (a fish native to Southern California), addressing environmental problems of the Salton Sea,[76] and upper watershed management in the Northern Sierras, where actions such as forest clearing for fire management can generate both species and water quality benefits. Additionally, many of the plans included in these estimates rely heavily on habitat restoration, without much attention to the mitigation of other environmental stressors, such as poor water quality and invasive species, which could further increase costs, particularly under a changing climate (Moyle et al. 2013).

When not required as part of permitting or mitigation programs, these types of ecosystem-related investments lack a natural local funding base. Nonetheless, as we discuss below, some communities have approved fees or taxes to support their local watersheds. As seen in Figure 2 (above), a substantial share of the recent state GO bonds were earmarked for ecosystem improvements. Figure 9 shows how roughly $2.3 billion of these funds have been allocated across different types of activities since 2003. Slightly more than half (54%) went to land preservation activities around the state, including some projects without any

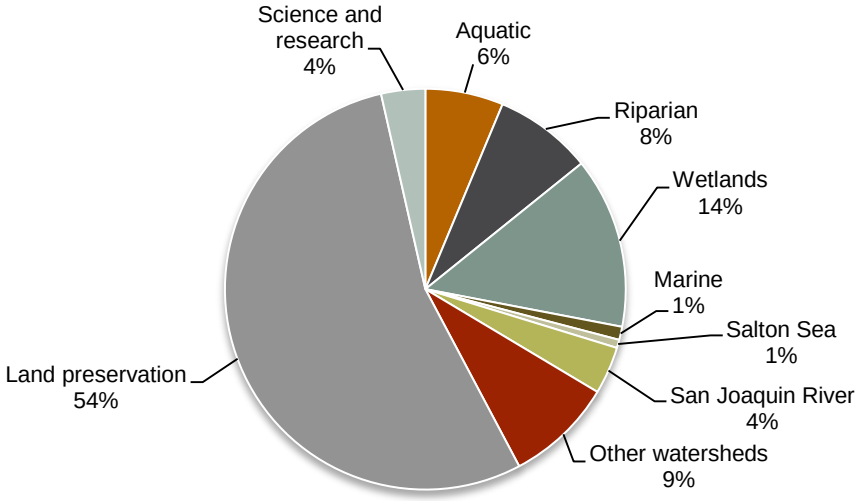
[75] Englebright Dam, for example, has been considered for removal, but the benefit to the status of existing salmonid populations is not clear owing to the already high concentrations of fine sediment in the Yuba River and the large volume of mercury-tainted sediment that would be released upon removal. The benefit could be greatly increased if a viable method is found to deal with the mercury-laden sediment stored in its reservoir prior to dam removal and if releases from upstream dams could be adjusted to benefit the restored salmonid populations (personal communication with Rebecca Quiñones, UC Davis Center for Watershed Sciences, October 2013).

[76] The Salton Sea is a terminal saline lake that relies primarily on agricultural drainage water for replenishment. The state's most recent plan for the Salton Sea (California Resources Agency 2007) projects restoration efforts to reach costs as high as $9 billion to address the combined effects of higher salinity (which will make the Salton Sea unable to support aquatic life and the migratory birds that depend on it) and reduced area (which will cause significant air quality problems in the region). It might be more cost-effective and environmentally beneficial to address the first issue by rewatering parts of the Colorado River delta.

particular relationship to water management.[77] A small share (3%) went to science and research, and the remainder was devoted to various aquatic, riparian, and wetlands restoration, as well as watershed improvements (e.g., erosion control and fire prevention).

Although this funding has undoubtedly helped to support California's compromised aquatic ecosystems, the allocation process does not always appear to have prioritized actions that will deliver the greatest benefits. To be more effective, future bonds will need to focus more systematically on a holistic set of ecosystem goals and components, including building connectivity among various habitats, improving physical and biological processes that support aquatic species, and strengthening natural food webs. To support this prioritization effort, it will be necessary to develop clearer objectives and ways to measure the effectiveness of various actions. This will require a larger, more focused science and experimentation program. Bonds—typically used to fund long-term investments—may not be the best funding source for this ongoing scientific work (see Box 3, above). California must nevertheless find a way to fund the scientific work and the evaluation effort needed to make sure our ecosystem spending truly supports the goals of more effective water system management for the benefit of the economy and the environment.

FIGURE 9
Over half of ecosystem spending from GO water bonds has gone to land preservation



SOURCE: Authors' calculations using bond project data provided by the California Natural Resources Agency and the California Department of Water Resources. See Appendix C (Figure C5).

NOTES: This figure shows the breakdown of awarded bond funds from Propositions 40, 50, 1E, and 84, totaling $2.3 billion. This spending made up 24 percent of the $9.5 billion in awarded funds for which detailed spending information was available as of October 2013. Appendix C describes the categories.

Implementing integrated water management

Integrated water management approaches are essential for improving cost-effectiveness and achieving multiple benefits with scarce water dollars. Here we describe what integration entails, the progress to date, and the challenges of mobilizing the dollars needed to make these approaches more widespread and systematic.

[77] This includes outright land purchases and the purchase of conservation easements, under which landowners retain title but agree not to develop the land. Based on project descriptions, only about a third of these funds (31%) are purposefully directed toward work relating to aquatic ecosystems (i.e., mentioning one or more of the following terms: water, river, wetland, riparian, lake, marsh, stream, or creek). See Appendix C.

In decentralized management systems like California's, integration can occur along both geographic and functional lines. Geographic integration occurs when smaller management entities aggregate or combine forces to implement larger projects. A classic example of this is wholesale water supply networks, which allow retail water suppliers and their customers to benefit from scale economies in water supply investments and to draw on a more diversified set of sources, enhancing reliability. The Metropolitan Water District of Southern California, with a service area covering roughly half of the state's population, is the largest of such networks, and there are about three dozen smaller wholesalers in various parts of the state, often at the county scale. Federal support for wastewater investments in the 1970s and 1980s encouraged the regional consolidation of many wastewater systems. Regionalization has also begun for some flood management and stormwater management programs. For flood management, a good example is the Sacramento Area Flood Control Agency (SAFCA), a joint powers authority (JPA) with seven member agencies spanning Sacramento and Sutter Counties. For stormwater and runoff management, the issuance of regional permits, coordinated by county agencies, has begun to supplant individual municipal-level permits in San Diego, San Mateo, and some other Bay Area counties. Joint powers authorities—comprised of an ad hoc assortment of cities, counties, and special districts—are often a favored institutional arrangement for new regional associations.

"Functional integration" refers to the coordinated management of multiple water system functions at once: water supply, water quality, flood protection, and ecosystem management. Because most local water agencies were formed for a single purpose, this type of integration usually involves interagency partnerships. For instance, the first successful project to use highly treated wastewater to recharge groundwater supplies was implemented by a partnership between the Orange County Water District (which manages the county's groundwater) and the Orange County Sanitation District (which treats the county's wastewater). In some cases, individual agencies have accumulated mandates for multiple functions. This is most common for water supply and wastewater management; about 40 percent of the state's major urban agencies share these functions (Hanak 2005). Less common, but especially useful, are cases where other types of functions are combined. For instance, the Yuba County Water Agency is responsible for both flood management and the delivery of irrigation water within the county; it also produces and sells wholesale hydropower. The Santa Clara Valley Water District manages the county's groundwater basin, delivers imported surface water to retail agencies, oversees flood works, and most recently added watershed protection responsibilities. The Irvine Ranch Water District in Orange County recently changed its charter to incorporate stormwater clean-up responsibilities; the district now captures and treats polluted runoff from landscape overwatering within its service area to help protect the local bay. Another innovative integrated framework is the San Mateo City/County Association of Governments (CCAG), a JPA with countywide responsibilities for congestion management (i.e., local transportation planning). CCAG implements a countywide water pollution prevention program to help its member agencies meet regional stormwater mandates.

To reap the greatest benefits from integration, these functional approaches should be combined at the scale of larger watersheds—the drainage basins that are relevant for many water quality, flood management, groundwater, and ecosystem-related issues. In California, one of the earliest models for this type of integration was the Santa Ana Watershed Project Authority (SAWPA), a JPA established in 1974 to deal with salinity problems within the Santa Ana River watershed.[78] SAWPA members work jointly and with other agencies to manage a range of water-related activities within the watershed, from groundwater recharge, to

[78] See Hanak et al. (2011), ch. 6.

wetlands treatment of polluted runoff, to optimization of reservoir use, to protection of source water quality and water supplies in the forested upper watershed.

Inspired by some early successes of this type, the state has been promoting regional integrated management as a central component of its water policy since the early 2000s.[79] Roughly $1.5 billion was earmarked for integrated regional water management (IRWM) programs in two of the most recent water bonds (Figure 2, above), making $100 million to $200 million available annually since 2003 for these programs.[80] To qualify for these funds, nearly 50 IRWM programs have been formed, covering the most populated areas of the state. Although a few (including SAWPA) correspond to the regional boundaries of the state's major watersheds, most reflect ad hoc groupings based on pre-existing political affinities (e.g., counties) or boundaries for particular aspects of water management (e.g., members of a wholesale water supply network). These ad hoc boundaries often do not line up well with broader water management functions that require a watershed approach to be most effective, such as pollution prevention, species protection, flood management, and groundwater basin management.

From the perspective of water finance, there are two big policy questions: How well are integrated management programs working? And does the state need to continue funding these efforts to keep them going? In our regional workshops with water managers, we sought feedback on how well integration efforts in general—and the state-supported IRWM programs in particular—were succeeding. We found strong support for the idea of bringing about geographic and functional integration, as well as for implementing coordinated approaches and partnerships. Some managers also suggested the need to extend individual agency mandates to facilitate more integrated management across functional areas.

Among the advantages: integrated agencies can make smart plans for water finance. Many of the agencies highlighted above serve as examples. The Yuba County Water Agency uses revenues from dry-year sales of water to help fund local flood works. Irvine Ranch uses revenues from the top tiers of its water rate structure to capture and treat the runoff from overwatering (also known as "urban slobber"). The Santa Clara Valley Water District was able to pass two multipurpose parcel tax measures with two-thirds majorities. (In both cases, the programs contained a diverse range of salient water management actions that appealed to different groups around the county.) And lastly, San Mateo's CCAG was able to raise funds from a surcharge on vehicle registration fees to jointly fund transportation improvements and manage polluted stormwater from the county's roadways.[81]

We also heard of considerable frustration with the state's current approach toward IRWM funding. Thus far, the bulk of the bond dollars have been reserved for cost-sharing grants for larger projects, with more limited funds going toward initial planning efforts. Managers were critical of the frequent rule changes, the cumbersome procedures for approval and reimbursement,[82] and the difficulties in directing funds toward areas with serious funding gaps, like stormwater management.[83] In many cases, bonds are funding activities

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[79] California Department of Water Resources (2005, 2009, 2013). (See *California Water Plan Updates* and *Water 360*, available at www.water.ca.gov/publibrary/reports/water360highlights.pdf.)

[80] In addition, Proposition 1E (passed in 2006) includes $300 million in stormwater-focused funding that is also targeted toward integrated regional water management. In Figure 2, this funding appears under "pollution prevention (stormwater)."

[81] See Appendix A, Box 2.

[82] As some observers noted, recipients essentially have to be able to front the money to get one of these grants, making it especially hard for the most cash-strapped (and by extension, perhaps also most needy) programs to gain access.

[83] As one example, local agencies in San Mateo County were unable to pursue a state-bond-funded grant for low-impact development "green streets" investments that were integrated with its broader "complete streets" transportation improvements, because the required local cost share (coming from CCAG's congestion management budget) was considered to be state-funded. (Congestion management agencies, like other

that larger agencies would likely have undertaken on their own, and thus represent a questionable use of scarce state resources. Rather than reflecting a lack of oversight, this reflects the policy decision that projects should rise to the top if they are "shovel ready" and have identified funding in place—i.e., they have already run through the environmental review process that occurs when agencies are already intending to make the investment.

Although outside funds are ultimately always welcome to local managers, these critiques suggest the need to rethink the premises of bond funding for IRWM programs. Managers readily agreed that some valuable projects requiring integrated management are hard to fund through existing local resources. Regional incentive funds to encourage and support integrated management activities may be especially helpful to jump-start collaborations across agency boundaries, an effort that can require high start-up costs. Outside support can also facilitate the pooling of resources to implement projects when some of the participating agencies lack their own funds, as is often the case for stormwater agencies. Although there are no good estimates of how much seed money is needed to support more integration among local agencies, it seems reasonable to expect that California would benefit from the levels available in recent bonds—$100 million to $200 million per year—in regional incentive funds. As we discuss further below, there are other options besides state bonds to provide this seed money, including regional surcharges on water use, or parcel or sales tax increments, though few of these options are easy to achieve in the current legal environment.

Our regional workshop participants also described the obstacles hampering effective integration at the state and federal levels, resulting in costlier, less effective programs. In their critiques, they mentioned duplicative permitting and approval processes; the promotion of actions that are at cross-purposes with requirements of other agencies (e.g., different policies on levee vegetation by the Army Corps of Engineers and wildlife agencies); mismatched regional boundaries and jurisdictions for purposes that should be managed jointly; and the promotion of actions that are more costly but easier to regulate (e.g., new requirements for on-site retention of stormwater even in places where the system is set up to capture and treat it downstream for water supply). More generally, managers expressed the need for regulatory agencies to be willing and able to collectively consider realistic, analytically sound goals for a region, given the potential costs and unclear payoff of some new mandates, including those related to water quality protection and endangered species management.[84]

In this context, it is also important to consider the capacity of state agencies to contribute to the planning and analysis needed for effective integration. Funding is not the only challenge, but it is one part: several state agencies have come to rely on an infusion of GO bond funds to support their core work.[85] California must find ongoing funding for the transparent, integrated scientific and technical effort required to effectively manage systems regionally, statewide, and *across* management functions. For example, the new Delta Science Plan aims to bring together numerous modeling, monitoring, and analytical efforts to improve understanding of ecosystem management approaches that work best within this large and important

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regional transportation agencies, receive most of the transportation funds collected at the state level through taxes on gasoline.) Local jurisdictions were unable to come up with other funds for this match, because it is so difficult to raise dedicated funds for stormwater. As a result, the county could not receive a grant to support the very integration that will be needed to prevent water pollution.

[84] Many of these critiques reflect the complexities and challenges of adapting regulatory oversight for individual environmental laws—now on the books for several decades—to the realities of 21st century water management. For more discussions on this theme, see Hanak et al. (2011), chapters 5, 7, and 9, and Hanak et al. (2013).

[85] For instance, the Delta Stewardship Council has been largely funded by bonds, as have DWR's statewide water-planning activities. On average, over $181 million per year of state operational budgets for water management agencies came from bonds in 2008–2012 (Appendix C, Table C14).

watershed (Delta Stewardship Council 2013a). But it is currently an ambitious plan with no funds attached to do the work.

Again, there are no good estimates of the funding gap for the scientific and technical work necessary to support integrated management for state agencies. As a rough, lower bound estimate, $100 million per year in additional, stable funding seems necessary for this purpose. Adding this to the estimated gap for regional incentive funds, California needs to find $200 million to $300 million a year to support integrated water management.

Summing Up: The Funding Gap Scorecard

Table 3 summarizes the results of our review of funding for California's water system. Water supply and wastewater systems are doing a decent job of maintaining needed investment levels, though legal challenges related to Proposition 218 could threaten this passing grade. Four areas (safe drinking water in small, rural communities; flood protection; stormwater management; and aquatic ecosystem management) are failing outright (in part owing to the voter approval requirements of Propositions 218 and 26). One area—integrated management—needs a better funding system to become more successful. We next examine options for improving this scorecard.

TABLE 3
Funding gap scorecard for California's water system

	Overall grade	Annual gap ($ millions)	Key funding challenges
Water supply	Passing (mostly)	—	Rising costs; Proposition 218 threatens legality of modern management techniques and lifeline pricing.
Wastewater	Passing (mostly)	—	Rising costs; Proposition 218 threatens legality of modern management techniques and lifeline pricing.
Safe drinking water (small rural systems)	Failing	$30–$160	High per capita costs; low-income ratepayers; limited management capacity and funding access.
Flood protection	Failing	$800–$1,000	Unfulfilled expectation of large federal cost shares; Proposition 218 requires local property owner/voter approval of new local funds; inadequate incentives for locals to approve funding; high per capita costs in some rural areas.
Stormwater management	Failing	$500–$800	Proposition 218 requires property-owner approval; Proposition 26 may increase difficulties of imposing non-property-related regulatory fees without a two-thirds popular vote; state action needed for many low-cost approaches.
Aquatic ecosystem management	Failing	$400–$700	No obvious local funding source for actions not required as mitigation.
Integrated management	On the brink	$200–$300	Reliance on unstable, and not always well-allocated, state bonds for regional seed funds and for scientific and technical work at state level.

NOTE: For flood and ecosystem management, the lower bounds reflect the possibility that some projects included in the cost estimates discussed in the text are not cost-effective.

Filling the Gaps

Our review of California's water funding gaps suggests the need to find another two to three billion dollars annually to enable the state to pursue five societal objectives for water management: (1) delivering safe drinking water in small, disadvantaged communities; (2) ensuring adequate flood protection; (3) preventing contamination of the state's waterways and beaches from stormwater and other polluted runoff; (4) restoring health to the state's aquatic ecosystems; and (5) providing information and incentives for more integrated, cost-effective approaches to water management. These sums are not large relative to the size of California's economy (more than $1.9 trillion), or even to total annual spending in this sector (more than $30 billion). Moreover, the benefits to the state's residents from such spending would likely be much larger. The gaps occur in areas that lack clear lines of management responsibility or funding authority, or where local populations are too resource-constrained to cover the costs.

California will need to find these resources here at home, because federal support will at best continue at current levels (and quite possibly decline). Many state and local sources are potentially available; each comes with tradeoffs, and some are more suitable than others for specific activities. We assess the pros and cons of different options from a variety of perspectives, and we propose a mix of sources most appropriate for filling the gaps.

What Are the Options?

California will need to continue to use a combination of local and state fees and taxes to pay for water services and should consider some additional sources as well. We suggest a range of options (Table 4). This list includes some broad revenue sources, such as general fund taxes and special sales or parcel taxes, all of which do not have a tight connection (or "nexus") to the activity being funded. These will always qualify as taxes under California law. Surcharges on water use, chemical use (e.g., fertilizers and pesticides), and road use (e.g., fuels and vehicle license fees) do have a close connection to many of the areas with critical gaps, though not necessarily enough of a connection to qualify legally as regulatory fees rather than taxes. Other sources, including property assessments and developer fees, must have a tight nexus to be lawful. Although the surcharges listed in the second group could fill any funding gap, we only consider sources of funding that have some connection with the management area. The shaded cells in Table 4 denote the areas we exclude because they lack such a nexus.

Table 4 further indicates whether the source is currently in use for funding a particular activity; "possible" indicates cases where this is not yet happening but might be worth considering. Bonds are not listed as a separate funding source because they are simply a means of borrowing against a revenue stream (see Box 3, above). Any of the sources listed here could be used to repay bond borrowing. Most of the specific revenue sources could be levied at the state, regional, or local levels.

TABLE 4
Potential funding sources to fill critical gaps

	Safe drinking water[a]	Floods	Stormwater	Ecosystems	Integrated management
No close connection to the activity being funded (always a tax)					
State general fund	Common	Common	Common	Common	Common
Broad special taxes (state)	Possible	Possible	Possible	Possible	Possible
Local general fund	Possible	Common	Common	Possible	Possible
Broad special taxes (local)	Sometimes	Sometimes	Sometimes	Sometimes	Possible
Some connection to the activity being funded (fee or tax, depending on specifics)					
Water use surcharge	Possible		Sometimes	Sometimes	Sometimes
Chemicals surcharge (e.g., fertilizers, pesticides)	Possible		Possible	Possible	
Road use surcharge (e.g., fuels, vehicle licenses)			Sometimes	Possible	
Hydropower surcharge				Possible	
A close linkage to the activity being funded (always a fee)					
Property assessment		Sometimes	Sometimes	Possible	
Developer fee		Common	Sometimes	Common	

NOTES: "Common" means already commonly used for this purpose, and "sometimes" means sometimes used. "Possible" means the source could be appropriate, but it is not yet used for this purpose in California. Shaded cells denote a lack of nexus between the funding source and the management area. Were the funding source tapped for this purpose, it would automatically be a tax. One exception is the use of a surcharge on water use for safe drinking water programs. Even though this would be a tax, we consider it as a potentially relevant funding source for this activity, for reasons described in the text.

[a] As discussed in the text, the gap estimate is for small systems with low-income populations. Larger systems are better able to pay their own way because they benefit from scale economies.

Many, but not all, of these sources are already in use.

- **State general fund:** State support primarily comes from the recent GO bonds, which have provided funding for all five areas, among other services (see Figure 2, above). These bonds are all being repaid with general fund revenues, as would several bonds under consideration for the November 2014 ballot.
- **Local general fund:** Many communities tap these resources for flood and stormwater programs.[86]
- **Broad special taxes (state and local):** Broad taxes that are or could be used to fund water system gaps include sales tax increments, parcel taxes, and property tax surcharges (Box 5).
- **Water use surcharges:** Introduction of a statewide surcharge has been under discussion since the mid-2000s. Although it is not commonly recognized, such surcharges are already in use at the local and regional levels (Box 6).
- **Chemical surcharge:** A small surcharge on chemical sales supports the operations of the state's regulatory oversight programs, but surcharges are not currently being used to help fund programs to mitigate the harmful impacts of agricultural pesticides and other chemicals on public health or ecosystems.
- **Road use surcharge:** Road use is a major source of stormwater pollution, and Caltrans now supports its stormwater mitigation programs out of its general budget, largely funded by taxes on motor fuels. San Mateo County's surcharge on vehicle registration fees helps fund the countywide stormwater program.
- **Hydropower generation surcharge:** A small surcharge on the generation of hydroelectric power might be worth considering, particularly to fund ecosystem recovery.
- **Property assessments:** In addition to numerous pre-Proposition 218 legacy assessments for both flood and stormwater programs, new assessments have successfully been raised for flood works by several Sacramento Valley flood management districts and for stormwater by several coastal communities (see note 69).
- **Developer fees:** These fees, imposed to require new developments to compensate for the burdens they add to public services and the environment, sometimes help fund flood protection investments. They have also been the main source of funds to support habitat preservation under NCCPs as mitigation for building on lands that provide habitat.[87]

[86] Local funds include new allocations of general fund revenues for these purposes by the city council or county board of supervisors. Flood districts also receive their share of property tax revenues based on the proportional allocation among local agencies calculated after the passage of Proposition 13 (See Appendix B for recent revenues from this source).

[87] Developers and local agencies often also create financing districts known as Mello Roos Community Facilities Districts that levy a parcel tax on properties within the district to pay for infrastructure needed to support new development. They are authorized to pay for flood and storm protection services, including storm drainage (Cal. Gov't Code §53313(e)). Most of these districts are created before they are inhabited, which allows a landowner vote (one acre, one vote). (If the area of the district is inhabited by 12 or more voters, a regular popular vote must be held.)

5

Broad special taxes: Locals use them, so could the state

Sales tax increments: Cities and counties may seek voter approval for supplemental sales tax increments of up to 1.5 percent for general or specific purposes. Most of the state's urbanized counties have a supplemental sales tax to support transportation funding, and San Diego County has been considering asking voters to augment the current transportation-focused tax by an additional half cent to support habitat restoration for the county's NCCP and possibly also its stormwater programs. Marin County voters recently approved a quarter-cent sales tax to support parks and open space, with many activities directly supporting local watershed health (Marin County Parks 2013).* In California, the state sometimes uses sales tax earmarks to support other sectors (such as transportation and education) but not water. In 2008, Minnesota voters approved a three-eighths-cent sales tax increment to fund water resources and environmental restoration projects under the Clean Water, Land and Legacy Amendment. In 2010, Iowa voters established a Water and Land Legacy Fund and authorized the allocation of a three-eighths-cent sales tax for clean water and flood control projects to begin the next time the state legislature approves a sales tax increase.

Parcel taxes and property tax surcharges: Unlike property assessments, which must be tied directly to the benefits that property owners receive, these broader taxes can fund a wider range of programs. The Santa Clara Valley Water District's multipurpose water management parcel taxes (passed in 2000 and 2012) support a diverse range of activities (flood protection, seismic safety of water infrastructure, safe drinking water for residents drawing on compromised groundwater wells, and watershed improvements). The City of Los Angeles's GO bond to fund stormwater investments is being repaid with a property tax surcharge. These measures, approved by two-thirds supermajorities of voters, cost roughly $35 per household annually in Los Angeles and $55 per household in Santa Clara County. The state does not levy parcel taxes, but it could.

* See Appendix E and the accompanying online data set for other examples of local special taxes supporting the water system.

6

Water bill surcharges: More common than one might think

Water supply utilities have lobbied hard against a statewide surcharge on the water bill, but such surcharges already help fill critical gaps in some places:

Ecosystems. Water users routinely fund some ecosystem protection efforts through their water bills. Some money from these bills goes toward mitigation for the direct impacts of investment projects as well as installation of more environmentally protective facilities (e.g., fish screens on diversions, and most recently dam removal on the Carmel River). The costs are often folded into the basic water bill, along with the utility's other costs of doing business. But explicit eco-surcharges also exist. The Sonoma County Water Agency adds a surcharge (currently $81/acre-foot [af]) to water sold to retail agencies to fund the costs of ecosystem enhancement on the Russian River for coho salmon, with the aim of protecting supply reliability. Since the passage of the Central Valley Project Improvement Act in late 1992, the CVP also collects a smaller volumetric surcharge (currently about $9/af for agricultural customers and $18/af for urban and hydropower customers) to support restoration activities, including water purchases for wildlife refuges and a variety of programs to support salmon. San Francisco's water system also charges its retail agency customers (and its own ratepayers) to support environmental resources in the Tuolumne River watershed and within local Bay Area watersheds.

Stormwater. Irvine Ranch Water District uses revenues from the top tiers of its rate structure to capture and clean up the polluted runoff from overwatered landscapes.

Regional integration. To improve system reliability, the Metropolitan Water District of Southern California and the Sonoma County Water Agency—both wholesale water agencies—use a volumetric surcharge on all water sales to fund cost-shares to member agency projects for conservation programs and local supply development (see Appendix A).

Statewide surcharge? Some policymakers have proposed a statewide water surcharge to support these and other types of water-related activities. In 2006, the Schwarzenegger administration proposed a "capacity" charge on all water retailers, levied per retail connection on a slightly graduated scale to support state programs and IRWMs (AB 1839, Laird). In the 2011–2012 legislative session, Senate Bill 34 (Simitian) proposed a volumetric fee on water users for broadly similar purposes. In these proposals, agriculture would have contributed a small share of revenues; in the Simitian bill, the charge would have been imposed per irrigated acre to avoid the problem of accounting for unmetered groundwater use (see Appendix D). Both fee proposals met with stiff resistance from water industry officials.

In addition to the advantages of collecting a surcharge for statewide purposes, there could be practical advantages for having the state implement water surcharges on behalf of regional or local authorities. A state-imposed surcharge on water users would not be subject to the election requirements of Proposition 218, which applies only to local agencies.

A Pros and Cons Checklist

Before examining the desirability of increasing funding from each source for the five areas with funding gaps, it is useful to review a general checklist of points to consider:

- **Is there a connection, or nexus, between the funding source and the activity to be funded?** The connection could be positive (if the money would improve service for those who are paying), or compensatory (if the money would instead reduce harm caused by those who are paying).[88] There are fundamental fairness arguments in favor of nexus-based payments because they are tied to activities that directly benefit from (or are directly responsible for the need for) the program. In addition, economic efficiency considerations often favor this type of funding source. When the form of payment affects prices, it can directly align the incentives of those paying with the goals of the program. For instance, surcharges on the cost of fertilizers and pesticides can encourage more judicious applications. Thus, this surcharge both directly reduces pollution of streams and groundwater basins and contributes to mitigation costs. A volumetric surcharge on water use can reduce demand, thereby improving water system reliability and potentially alleviating pressure on instream flows that support aquatic species. Irvine Ranch Water District's surcharge for excessive outdoor water use saves water and reduces pollution.
- **Are there broader social equity considerations?** The goal of establishing a nexus between funding and a specific activity is sometimes worth overriding for social justice considerations, such as making sure that all California residents have access to affordable and safe drinking water. In such cases, support from other sources, such as general tax dollars, can be preferable. It is also important to consider who pays for general funding sources, some of which are more "progressive" than others (i.e., levied disproportionately on higher-income households). Because California's income tax is progressive and makes up a large share of state general fund revenues, the state's general fund is the most progressive of the funding sources discussed here (Figure 10). Because higher-income households are concentrated in coastal areas—and especially in the San Francisco Bay Area—using state general fund resources to pay for water activities also means that Bay Area residents pay a larger share of these costs relative to their share of the population (Figure 11). Volumetric water use charges, sales taxes, and uniform parcel taxes are much less progressive.[89] The progressive nature of the state general fund makes state GO bonds a relatively fair way to pay for some water activities, unless debt repayment requires cutting other programs that target lower-income households.[90]
- **Are there broader public benefits?** Other broader societal benefits can also justify using general public resources. For instance, flood damage can adversely affect local or even regional economies and not just the people who own properties within the floodplains. Broader communities often benefit from ecosystem enhancements, especially when they also improve recreational opportunities. Many broader benefits are local or regional in nature, making a local or regional funding source more appropriate than state tax dollars. In policy discussions on this topic, this geographical dimension is usually ignored, with the result that even local public benefits are deemed appropriate for state GO bond funding.[91]
- **How hard is it to administer the funding source?** Once approved, it would be relatively straightforward to tap existing funding sources, as collection methods are already well established. In contrast, some new sources would entail enough administrative burden to be impractical. As an

[88] The terms "stressor pays" and "polluter pays" are sometimes used to refer to cases where payments are made to reduce the negative impacts of one's actions (e.g., in the Delta Stewardship Council's *Final Delta Plan*). The term "beneficiary pays," which has often been used in discussions of water finance in California since the mid-1990s, can refer to payments either in exchange for positive benefits or to reduce negative impacts caused by one's actions.

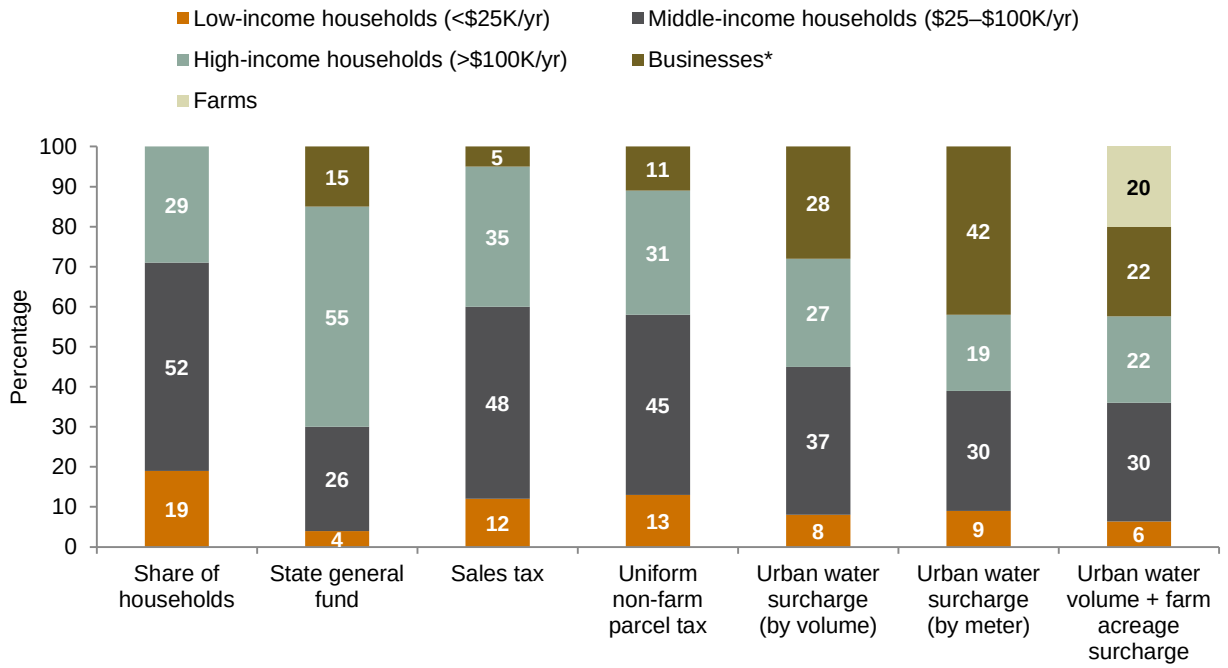
[89] Higher-income households pay more than their share of the population for these revenue sources, because they consume more than lower-income households, but they pay less as a share of their total income.

[90] Payment of GO bond debt service is second in priority after K–14 education funds mandated under Proposition 98.

[91] This is the case, for instance, in the definition of public benefits in the bond act currently slated for the November 2014 ballot (SBX7-1, 2009).

example, a volumetric fee on agricultural water use might be desirable—making a direct connection between users and fees—but it is impractical since groundwater pumping is not metered in most areas. This makes an irrigated acreage fee more administratively attractive, even though it does not affect prices. For similar reasons, it may be most expeditious to charge the general public, rather than those directly responsible, when dealing with legacy pollutants like mining debris and in situations where many parties and activities are responsible for environmental harm, as in the Delta ecosystem.

FIGURE 10
The state general fund is the most progressive revenue source available to the state government



SOURCE: Author calculations using the water fee model. See Fee Model Technical Specification at end of Appendix D for data sources and model specification.

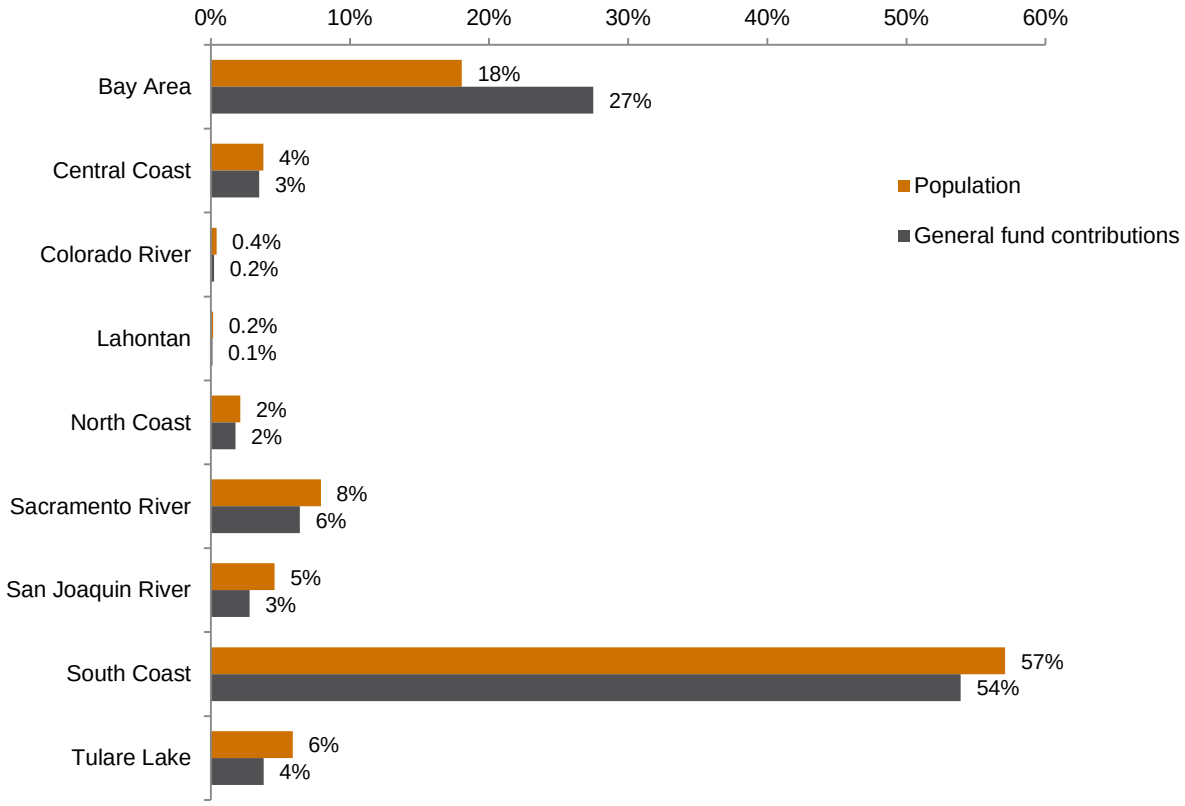
NOTES: The "urban" volumetric water surcharge is set to match the shares of water use by each income group for the entire state (including suburban and rural areas, but not farm water use). The urban water volume plus farm acreage surcharge assumes that 20 percent of the revenues would be paid through a charge on irrigated acreage. The urban water connection surcharge varies in proportion to meter size, and we assume that multifamily, commercial, and industrial connections have single-family meter equivalents of 3, 6, and 12, respectively; other proportions could be considered.

* Although many of the costs paid by businesses would ultimately be borne by California households, there is not adequate information to determine how to allocate these payments across income groups. One exception is the sales tax, which economic research suggests is largely passed through to households directly. For the general fund and the sales tax, businesses include farm businesses; for the other charges, only nonfarm businesses are included.

- **How hard is it to get the funding approved?** Since the passage of Propositions 13, 218, and 26, the overriding consideration is often simply whether it is possible to get the funding approved. In principle, cost-based payments can be considered fees for services to properties, but the tight proportional cost restrictions imposed on the definition of fees have made this difficult for many of the gap areas. Instead, management agencies need to look for local tax-based sources that usually require two-thirds of local voters to sign on. Even flood control and stormwater management charges that still qualify legally as fees require voter approval (at a minimum, by 50% of affected property owners). These changes have enhanced the attractiveness of two sources that have fewer hurdles: state GO bonds (which require a simple majority approval from the state's voters) and developer fees (which require no voter approval, and which have looser nexus standards than the strict requirements regarding cost of service and other substantive standards of Proposition 218).

- **How reliable is the funding source?** These two relatively easy sources have a drawback, however: unreliability. The recent pattern of postponing new GO bond ballots underscores the potential for stop-and-go funding for bond-reliant activities, such as ecosystem management. During the recession, the state was also forced to suspend bond sales (and the activities that depended on them) because of difficult credit market conditions. Developer fee revenues are tied to the vagaries of state and local housing market conditions. They all but vanished during the recession, causing problems for agencies relying on this source to fund capital projects.

FIGURE 11
Because they have higher incomes, San Francisco Bay Area residents contribute disproportionately to the state's general fund



SOURCE: Author calculations using the water fee model. See Fee Model Technical Specification at end of Appendix D for data sources and model specification.

NOTE: The figure shows population and general fund contribution shares for counties within each hydrologic region; counties within more than one region are included in the region where most of their population lives. For a list of counties included in each region, see the map at the beginning of this report.

Matching Funding Sources to Gaps

As this review suggests, there is no magic formula for how to fill the critical gaps. But California should try to follow the general principles outlined above in deciding whether responsible parties and direct beneficiaries, or the broader local, regional, or statewide community should pay for different activities. In practice, some less-than-ideal alternatives might also help in the near term, given that the best options are not always feasible because of legal or political constraints. State GO bonds backed by the general fund have often been used as the stopgap solution, but they cannot do all of the heavy lifting, given the scale of unmet needs and the practical limits on how much the state can tap this source without compromising other important programs. Over the longer term, California will need a funding system better tailored to meet

societal demands for water management. Some of the financial solutions identified here will be difficult to implement without reforms to California's laws, a topic addressed below.

Safe drinking water in small, disadvantaged communities

Roughly $30 million to $160 million is needed annually to bring safe drinking water to small, disadvantaged communities that face special problems of costs and affordability. Many of these communities likely also need support for safer management of wastewater. Tens of millions of dollars are available every year for these communities through existing programs, such as the small system grants administered as part of the Safe Drinking Water Revolving Fund (for drinking water), the Clean Water Revolving Fund (for wastewater), and the U.S. Department of Agriculture's programs for rural water systems—all funded by federal tax dollars (Appendix B). But these funds need to become more accessible and more flexible so that these communities have the resources not just for new capital investments but also for special needs, such as organizing local water systems.

Additional funding could come from a mix of sources. A surcharge on commercial nitrogen fertilizers, which are currently exempt from the state sales tax, is appropriate to help fund solutions for nitrate-impacted communities. As a frame of reference, a 7.5 percent sales tax on fertilizers in the Tulare Lake and Salinas basins would raise close to $30 million annually, potentially addressing most or all of the nitrate-related drinking water problems in those two regions (including larger systems and non-disadvantaged communities) (Harter et al. 2012). A fertilizer surcharge would also strengthen the incentives for farmers to meet longer-term water quality management goals by reducing fertilizer applications.[92] (To address nitrate pollution from the spreading of manure from large livestock operations—about 40 percent of all fertilizer use in these two regions—a charge could be assessed per head of cattle.) A nitrogen fertilizer surcharge dedicated to safe drinking water programs would require the approval of two-thirds of the legislature. If instead the state established a regulatory program to address the harm caused by new fertilizer and livestock pollution, such surcharges could potentially be passed as state regulatory fees with a simple majority legislative vote, rather than needing to meet the two-thirds legislative hurdle for a special tax.

General taxpayer support is more appropriate where water quality problems stem from naturally occurring contaminants. Given social equity considerations, a progressive funding source like the state general fund would be suitable. Alternatively, a statewide water use surcharge might also be appropriate, similar in spirit to using higher rates for most users to subsidize lifeline rates at the local level. Such a surcharge would likely require a two-thirds vote of the legislature. Alternatively, this and any other tax requiring a two-thirds legislative vote could be passed by a majority approval of a ballot initiative by the state's voters.[93] Local taxpayers might also contribute to these programs (particularly in more affluent regions), and local governments (especially counties) can play a valuable oversight role.

Flood management

State leaders often talk about California's flood crisis, and the numbers appear to back them up. California faces a potential gap in this area of $1 billion annually to address an investment backlog and replace the state bonds that have supported recent spending; additional gaps are possible if federal contributions decline in the future. One priority is to determine which investments provide adequate value to the state's residents to

[92] Medellín-Azuara et al. (2013) found that this level of tax would reduce fertilizer use by 1.6 percent, implying an elasticity of demand of -0.21.
[93] Although this surcharge would likely be a tax, rather than a fee, it could be justified on similar grounds to the use of some transportation-oriented taxes on gasoline, serving programs such as paratransit.

justify the costs, analyzing how these investments reduce economic risk and enhance ecosystem outcomes. Another priority is to decide how to apportion funding responsibility among state, regional, and local residents.

A substantial share of flood protection benefits goes directly to those who live and own property in the floodplain. Since Proposition 218, there have been a few modest successes in passing property assessments for floodplain residents in the Sacramento area. Yet the sums raised are small relative to the potential need; in the SAFCA area, the assessments collect roughly $60 to $120 per household per year. The sales pitch used to promote the assessments appealed especially to residents with less than 100-year protection: the new spending was designed to provide them with enough protection so that they could qualify for lower flood insurance premiums. Some recent federal policy changes may provide more impetus for local property owners to pay for flood investments for this same reason. The National Flood Insurance Program (NFIP) has recently undergone a reform that will dramatically raise rates for many properties within the 100-year floodplain,[94] and the NFIPs parent agency, FEMA, is requiring floodplain remapping that will decertify some levees, placing more homes within the 100-year floodplain. However, these changes will not affect the majority of California's floodplain residents, who already have 100-year protection. As Figure 8 shows, even splitting costs across all floodplain residents (most of whom live in areas that already have lower insurance rates) results in very high per capita costs in some regions, making local property-owner funding at best a partial source of new funds.

Broader local taxes are an appropriate source as well, given the benefits to the local economy from protecting public infrastructure and preventing business interruptions. Spreading out the costs in this way makes them more affordable, but it will generally mean convincing two-thirds of the voting public to sign on. In Santa Clara County, where many lower-income residents have low levels of flood protection, the county's multipurpose water district did this successfully in two successive parcel tax measures, combining a package of improvements that had broader appeal to general voters with flood works.

Broader regional approaches to flood funding are not yet used in California, but they are also relevant in some places, like the Sacramento River region, where investments in bypass capacity in more rural areas can increase protection region-wide.[95] A regional approach has also been proposed for the Delta, another highly interdependent area (Delta Stewardship Council 2013b). A state-imposed regional fee would be exempt from the voter approval requirements of Proposition 218 if the state levied it directly on the fee-payers, as Proposition 218 does not apply to the state.[96]

The state must continue to help fund flood works—both to protect critical infrastructure and to achieve the kind of environmental benefits that are possible only with some costlier types of investments, like setback levees. The state's liability exposure in the Central Valley since the *Paterno* ruling is also an important consideration, though our preliminary estimates of the net benefits of flood investments suggest that not all the slated investments in this region are worthwhile from that perspective.

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[94] The Biggerts-Waters Act (2012) aims to restore solvency to the NFIP by making insurance rates actuarially fair in the 100-year floodplain. One key change is removing the grandfathering of subsidized rates for properties built before 1975.
[95] This regional approach is favored in the *Central Valley Flood Protection Plan* (California Department of Water Resources 2012), the source of most of the investment cost information used in our analysis of flood protection needs of the Sacramento and San Joaquin River region.
[96] If the state instead levied the fee on local flood control agencies – which in turn would have to pass along the fee to their customers in the form of a surcharge or higher rates – then the fee would likely be subject to Proposition 218's voter approval and substantive requirements.

Some local governments are also considering tapping into new development, which is a relatively easy funding source to access to help pay for flood protection. Allowing more growth in flood-prone areas increases the economic risks from flooding. Nonetheless, it merits scrutiny as a funding strategy because it can spread the costs and increase total revenues, potentially improving overall levels of protection. (For instance, if this revenue source enables communities to reach the 200-year level of protection now required for urbanized areas within the Central Valley, it may be a good option.) As part of a regional strategy, urbanized areas may have an interest in encouraging some rural areas to remain more flood-prone, to provide a less costly buffer against large floods than some of the more capital-intensive projects under consideration.[97] As part of this strategy, these rural areas would need to receive some support to help with higher insurance costs, and perhaps would need selective permit exemptions for new structures necessary to maintain viable farm business operations, such as warehouses and farm equipment facilities.[98]

Stormwater pollution management

Local agencies are required by law to manage the pollution from stormwater and other urban runoff, and they may face a funding gap of $500 million to $800 million annually to meet this mandate. The substantive and procedural requirements of Propositions 218 and 26 have generally made it necessary to seek a two-thirds vote of the electorate to garner funds needed to comply with regulatory standards that are (at least in principle) the expression of broad societal demand for these services. A variety of activities cause stormwater pollution, so any effort to draw contributions from those who share responsibility will lead to a variety of suitable funding sources, such as surcharges on chemical use, road use, and sources of litter, in addition to fees on impervious surfaces. However, many of the costs of failing to manage stormwater pollution fall on residents within the broader watershed, not local residents, making local voting a poor match for finding the needed funds. Regulatory fees that are assessed without a local popular vote are more suitable, although Proposition 26 has introduced uncertainty about this option.

Geographic integration—or regionalization—of stormwater permitting can help make these programs more cost-effective and fiscally viable. Some help may also be available from integrated management partners who work with water supply: they can share costs when capturing stormwater that benefits the water supply, and they can help reduce "urban slobber" with tiered rate structures that discourage overwatering. Likewise, the tiered rate structures can provide funds for clean-up of the water runoff that still occurs.[99] Ultimately, though, the state will need to play a major role by passing laws to establish statewide regulatory fees on some pollutants (e.g., chemicals and transportation fuels); by establishing regulatory programs that reduce some pollutants at the source—an essential cost-containment measure; and by directly funding local agency programs unless and until the laws governing how these agencies may raise funds for stormwater pollution management are brought into sync with the laws that require this service.

Aquatic ecosystems

Although many water and land management activities now incorporate and fund more environmentally beneficial approaches, at least several hundred million dollars annually of new funds appear needed to

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[97] See Hanak et al. (2011), ch. 6, for a more detailed discussion.
[98] As an example of this approach, SAFCA has purchased conservation easements for some farm properties in adjacent Yolo County, where it is also helping to pay for flood insurance (Hanak et al. 2011, ch. 6). Selective exemptions for building permits might require federal and state authorizations.
[99] For this to happen, the state would need to authorize this more broadly. Currently only two Orange County water suppliers are authorized to run such programs under special legislative authority. See Appendix A, Box 2.)

support a suite of high-profile species recovery efforts. As with stormwater pollution, there are reasons to fund some of these efforts through surcharges on activities that cause ecosystem stress. In addition to surcharges on water use (see Box 6), chemicals, and land development, one new type of surcharge that holds promise is a tax on hydropower generation.[100] Hydroelectric dams have contributed significantly to the decline in California's aquatic ecosystems by restricting access to upstream habitats and altering the quality of habitats below dams.[101] As an illustration, a "mill" tax of 0.1 cent per kilowatt hour would raise roughly $34 million annually.[102] New legislation would be required to impose some of these surcharges (notably, on water use, chemicals, and hydropower), but there would likely be a sufficient nexus between users and fees to allow these to qualify as regulatory fees, rather than taxes (Box 7).

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Regulatory fees can help fill the funding gap

The waters of California and the resources supported by those waters are a public trust of the state. Under Proposition 26, the state is entitled to charge a fee sufficient to cover the "reasonable cost of the state of conferring the benefit or privilege." These costs include the environmental harm done when water is diverted for urban, agricultural, or power generation purposes. As long as the proceeds of a water surcharge are used to mitigate these costs, this type of fee would seem to be permissible under Proposition 26 (i.e., it would not have to be enacted as a special tax). A fee on hydropower could be justified similarly to a fee on water use, since all hydropower generators enjoy the privilege of interfering with the state's public trust in the state's waters. Similarly, use of fertilizers and other chemicals can be understood as a privilege granted to the user to engage in a practice likely to damage the state's public trust resources. Proposition 26 therefore would allow the state to levy a fee to raise funds to pay the costs the state may incur to offset these damages.

Local and regional taxpayers may also have interests in providing some ecosystem support, given their geographic proximity to the benefits. The sales and parcel taxes in Marin and Santa Clara Counties (Box 5) are both good examples. The San Francisco Bay Restoration Authority, a new regional agency charged with raising and allocating local funds for wetland and wildlife restoration, is considering proposing a regional parcel tax to support these efforts, which would also provide recreational benefits, stormwater pollution prevention, and flood protection.[103]

There are also good reasons to use state tax dollars to support some ecosystem recovery work, especially when the sources of stress are diffuse and shared broadly. Public support for the Delta ecosystem can be justified on this basis; there are many sources of ecosystem stress and most Californians benefit in some way from the activities that are responsible (National Research Council 2012; Hanak et al. 2013). A progressive funding source, such as the general fund, might be especially suited for supporting ecosystem recovery, since higher-income residents tend to have a higher level of demand for such efforts (Bergstrom and Goodman 1973; Shaikh and Larson 2003).

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[100] The Supreme Court has held that a state may tax the generation of hydropower from federally licensed facilities that is sold intrastate. See Utah Power & Light Co. v. Pfost 286 U.S. 165 (1932) and also Susquehanna Power Co. v. State Tax Commission 283 U.S. 291 (1931), which says that states may levy property taxes on federally licensed hydroelectric power facilities. South Carolina currently taxes all intrastate electricity sales, including sales from the state's 24 FERC-licensed hydro projects (S.C. Codes § 12-23-10 & 12-23-20).
[101] See Hanak et al. (2011), ch. 5.
[102] Average annual generation from 226 hydropower facilities for 1990–2002 was 33,900 gigawatt-hours (California Energy Commission 2013).
[103] A report prepared for the San Francisco Bay Restoration Authority (EMC Research 2011) suggested strong regional support for an annual charge of $10 to $20 per household.

Integrated management

State involvement in integrated water management has relied on funding from two recent bonds,[104] and this support would continue in bond proposals for the November 2014 ballot. Integrated decision-making is necessary for sustainable water management, but the bond-enabled IRWM funding program leaves much to be desired. Partial alternatives exist in some regions, with wholesaler surcharges to fund local portfolio development within the Metropolitan Water District of Southern California service area and Sonoma County (Box 6). These regional incentive funds currently focus on water supply reliability, and they do not yet tackle some important aspects of functional integration related to flood prevention, ecosystem support, and pollution management unless there are direct water supply benefits.

The wholesaler surcharge approach now simply involves the approval of the wholesale agencies' governing boards. The program run by the Metropolitan Water District of Southern California is facing a legal challenge to this practice from one of its member agencies, on the grounds that the fee does not benefit all water users within the Metropolitan service area equally, as required by Proposition 26's proportionality criterion (Appendix A). Losing this ability to develop flexible, regional programs to make water supply reliable would be unfortunate; in essence, it would be the equivalent of making a large network adhere to the type of "molecular-level accounting" discussed earlier (see Box 4).

Given the many competing claims on state resources, we explored having regions fund their own IRWM programs through a variety of mechanisms at the regional level: (1) a volumetric water surcharge on urban water use (with or without a complementary charge on irrigated agricultural acreage); (2) a connection fee on urban water customers, graduated by meter size; (3) a uniform parcel tax; and (4) a sales tax increment. (For details of this analysis, see Appendix D.) We considered annual statewide funding of $200 million, roughly the amount made available annually by Proposition 84. Currently, IRWM bond funds are allocated by population within each hydrologic region, though with a slight boost to the more rural, inland regions relative to the Bay Area and the South Coast.[105]

Given this rural boost and the disproportionate share of the general fund now paid for by Bay Area residents (Figure 11), any of the regional funding alternatives would cost local residents more in every region except the Bay Area and the South Coast. Yet the incremental costs to locals would be quite small, increasing water rates by a couple of percentage points, or increasing sales taxes by less than 0.05 percent (a sales tax of 8.5% would not need to increase to more than 8.55%). A volumetric fee on water is the most progressive of these regional funding options. At the level considered here, it would lead to a complementary reduction in statewide urban water use of 25,000 to 115,000 acre-feet (see Appendix D).[106]

Although, in principle, regions could implement their own surcharges to establish regional funds supporting integrated management activities, it might be more expeditious to do this at the state level, either with approval by the legislature or with a statewide ballot initiative, perhaps as part of a broader water package that could include a bond and other reforms. This could be done by establishing a common fund, returned to regional entities complying with state requirements (much as federal gas tax revenues are returned to states to fund transportation projects). Integrated management will also require funds for scientific and technical analysis. Both statewide and regional funding contributions, either from broader taxes or from water surcharges, would be appropriate to support this work.

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[104] This includes broad IRWM programs authorized under Propositions 50 and 84. In addition, Proposition 1E authorized $300 million in stormwater programs intended to employ integrated approaches (see Appendix C).
[105] More generally, bond funds have disproportionately supported activities in the more rural and inland regions (see Appendix C).
[106] Because local governments cannot levy income taxes, local funding options tend to be less progressive than the state general fund.

A Road Map for Sustainably Funding California's Water System

This final section summarizes our findings regarding the funding gaps in California's water system and charts a road map for improving the system's fiscal health and ensuring that it will remain healthy far into the future. The road map will require some bold new actions by local agencies, who will remain the central players in both funding and managing water-related services. Even bolder actions will be required by the California legislature, the courts, and California voters to help facilitate a more sustainable funding framework. State and federal agencies must also play their part in helping the system put available funds to best use.

Check-Up Results

Despite rising costs, California's water and wastewater systems are largely on track to meet societal goals for water management. The key financial challenges relate to overly restrictive limitations on what constitutes a fee for service, with laws now potentially requiring a degree of connection that runs counter to the goals of integrated water system management. As the inflation-adjusted costs of water and wastewater services continue to rise, the accounting requirements could also have unintended social consequences, by restricting the ability to extend lifeline rates to lower-income customers through cross-subsidies from other customers within the service area.

Structural gaps exist in several areas where a combination of new environmental mandates, lack of clear funding authority, high voter approval thresholds, and lack of affordability mean the system is failing. In some cases, even pinning down the size of the gap is difficult because managers lack the resources to estimate the costs. Overall, California faces unfunded annual costs of $30 million to $160 million for safe drinking water in small, poor communities, as much as $1 billion for flood protection, perhaps $500 million to $800 million for stormwater, and at least several hundred million dollars for aquatic ecosystem recovery focusing on endangered species. In addition, California needs to mobilize $200 million to $300 million annually to support integrated water management efforts, including $100 million to $200 million per year in regional incentive funds (now funded by state GO bonds) and another $100 million in steady funding to develop the scientific, technical, and regulatory functions to support cost-effective, sustainable water management.

Finding the Cash

State bond funds have helped fill all of these gaps to some extent, but the total gap appears at least twice as high as recent aggregate water-oriented spending from these bonds (less than $1 billion annually). Rather than address these gaps, some bond funds have been used for activities that are better able to pay for themselves, such as furnishing cost shares for water supply projects. New bond funds are likely to be more limited than in the recent past, and they should focus on the areas that either lack natural funding sources or address broader social concerns. Even if new bonds are on the horizon, California will need to draw on a broader mix of revenues. The prospects for success will depend in large part on the state's ability to enact a suite of legal reforms, ranging from passing new state special taxes and regulatory fees to revising some of the most problematic aspects of the state constitution that threaten to impede local funding of these areas (Box 8, page 70).

Table 5 provides our assessment of the best available funding mix in the current legal environment (assuming no new legislative action or voter-approved constitutional changes), and the optimal mix if such reforms are enacted. In constructing these alternatives, we have favored sources with a direct connection to the responsible party (water users, chemical dischargers, and road users), as well as sources with built-in behavioral incentives to manage water more sustainably (through volumetric surcharges that can alter demand for water and for products that cause water pollution). For shared responsibilities or benefits, we have also favored funding that reflects the geographic scope of the community of interest (whether state, regional, or local). In Table 5, a funding source that is marked with more dollar signs is a larger contributor relative to other sources. However, the number of dollar signs does not represent a precise amount or fraction of the gap to be filled. Total funds raised would be higher in the reform alternative than under current conditions.

TABLE 5
Funding sources to fill critical gaps, now and with recommended legal reforms

	Safe drinking water [c]		Floods		Stormwater		Ecosystems		Integrated management	
"Gap" ($ millions/year)	$30–$160		$800–$1,000		$500–$800		$400–$700		$200–$300	
Responsibility	State		State, regional, and local		Regional and local		State and regional		State and regional	
Legal environment	Current	Reforms	Current	Reforms	Current	Reforms	Current	Reforms	Current	Reforms
No close connection to the activity being funded (always a tax)										
State general fund (GO bonds)[a]	$$$	$	$$$	$$	$$$		$$$	$	$$$	$
Local general fund			$		$					
Broad special taxes (state, regional, local)[b]			$	$$	$	$$	$	$$		$$
Some connection to the activity being funded (fee or tax, depending on specifics)										
Water use surcharge[b]		$$			$	$$	$	$$	$	$$
Chemicals surcharge (e.g., fertilizers, pesticides)		$$				$$				
Road use surcharge (e.g. fuels, vehicle licenses)[b]						$$				
Hydropower surcharge								$$		
A close linkage to the activity being funded (always a fee)										
Property assessment			$	$$		$$				
Developer fee			$$	$$	$	$	$$	$$		

NOTES: Dollar signs indicate a minor role ($), moderate role ($$), or a major role ($$$). These symbols do not denote specific values, only the relative importance of each source for addressing the gap. Shaded cells denote revenue sources with poor suitability for the purpose.

[a] In addition to GO bonds, any of the revenue sources listed here could be used to secure near-term funding through revenue bonds.

[b] Broad special taxes and some surcharges could be assessed at the state, regional, or local levels (for examples, see Boxes 5 and 6).

[c] As discussed in the text, the gap estimate is for small systems with low-income populations. Larger systems are better able to pay their own way because they benefit from scale economies.

In the current legal environment, state GO bonds—backed by state general fund dollars—will continue to be the most feasible way to fund these gap areas. Developer fees, also relatively straightforward, can continue to play a moderate role for flood and ecosystem investments. For ecosystem management, the key will be making the best use of mitigation funds set aside to protect habitat. This broad approach, preferable to

piecemeal mitigation, is currently being attempted through habitat mitigation banks that pool the resources of many new projects. There is also a limited possibility for developer fees to contribute to stormwater programs. New construction is often required to provide stormwater mitigation on-site by meeting new low-impact development standards, but in places where this is too costly (e.g., with infill projects), contributions to a collective fund can support the overall program. We also see limited potential for sporadic new successes in water use surcharges and broad special taxes (parcel and sales taxes) to support stormwater pollution management, ecosystem recovery, and regional integration (following the examples in Boxes 5 and 6). New property assessments could be used to support flood programs. New contributions from the local general fund may also help support local stormwater and flood programs as local budgets recover from the fiscal hangover of the recession.

Even at best, though, these combined sources are unlikely to do the job. A more robust funding approach would diversify the funding base, shifting the responsibility away from the state and local general funds toward dedicated fees and taxes at the state, regional, and local levels:

- **For safe drinking water programs** in small, low-income communities, the state would maintain responsibility, but it would do this primarily through the enactment of two surcharges: a regulatory fee on synthetic and natural fertilizers, to address nitrate contamination, and a special tax on statewide water users, to serve as a kind of statewide lifeline program. The federal government can also help by relaxing restrictions on the use of its revolving fund grants, so that they can more flexibly support these small systems.
- **For flood protection**, there would be more broadly shared responsibility across state, regional, and local entities. Broad special taxes (e.g., parcel taxes and sales tax increments) would be increased at the local and regional levels. These measures could more easily pass following the enactment of a constitutional reform that lowers the local voter threshold from two-thirds to a simple majority—comparable to the simple majority required for statewide fiscal ballot measures and local general taxes. Property assessments and fees would be treated like water and sewer services under Proposition 218: still subject to formal public noticing (and protest hearings), but exempt from voter approval requirements. The state and federal governments would use their policy leverage to incentivize floodplain residents to pay for flood works, by setting actuarially fair insurance rates (as now required under a 2012 federal law), and potentially also mandating insurance in areas with less than 200-year protection (under new state legislation). The state would help raise funds in key locations (e.g., the Sacramento and San Joaquin River regions) through the establishment of regional flood maintenance districts with regional fees. The state would also continue to contribute financially, given statewide interests in critical infrastructure, ecosystem enhancements, and liability issues within the Central Valley, through general fund/GO bond dollars and perhaps also through dedicated special tax revenues (e.g., income or sales tax increments).
- **For stormwater**, these and other constitutional reforms would make it possible for local and regional agencies to raise the funds they need to carry out their mandate. Charges to manage stormwater would be exempt from Proposition 218, and subject only to Proposition 26, which guides regulatory fees. (Proposition 26 would, if necessary, be clarified to authorize the costs of environmental mitigation programs through regulatory fees.) Stormwater charges would no longer require voter approval as long as a fair and reasonable relationship is established between the charges and the harm caused by the activity. Regulatory fees would be established on a variety of sources that contribute to the problem (e.g., on chemicals, road use, and prominent sources of litter, such as cigarettes and fast-food restaurants). Broad special taxes (now accessible at a lower simple majority voter threshold) would also be increased as needed, and water suppliers would contribute more actively through the integration of stormwater capture into their water supplies and through water service fees (where excess watering contributes to "urban slobber.") The state would enact some of

these fees statewide (e.g., with surcharge on certain chemicals and motor fuels). The state would also use its regulatory authority to help keep down costs, by implementing source control measures and by setting judicious targets and objectives for local and regional stormwater programs.

- **For aquatic ecosystems,** a similar mix of fees and taxes would enable programs to be funded at the state and regional levels. A new hydropower surcharge—enacted under state law as a regulatory fee or a special tax—would contribute to the mix. State general tax dollars would also continue to support some ecosystem recovery work, especially when the sources of stress are diffuse and shared broadly.
- **Integrated management** activities at the regional level would be supported primarily by regional water use surcharges (with or without complementary charges on irrigated agricultural acreage) and broad special taxes, such as a sales or parcel tax, now easier to pass. The state might enact the water surcharge and pass it through to local agencies, which could ease the local approval process (Box 6). The state would also need to raise some resources to support the integrating functions of state agencies, including scientific and technical analysis and regulatory work. Because stability of these activities is especially important, this would preferably come from a statewide surcharge on water or a dedicated special tax, rather than annual allocations from the state general fund.

This shift away from state general fund tax dollars toward multiple sources of more targeted funds has two potential drawbacks. First, most other sources are less progressive (Figure 10, above). However, an overreliance on bonds, without corresponding increases in general fund revenues, can actually have the opposite effect if it results in cutting back programs that are especially important for low-income households. Second, some observers might consider this multipronged funding approach to be more administratively complex and costly than focusing on one or two broad sources, like a water surcharge or a sales tax increment. However, targeted funding sources, which tap contributions from the individuals and communities that benefit from or share responsibility for the need for this spending, are preferable. Such sources more readily align the incentives of residents and businesses with modern water management goals, and they will often be better spent—with more accountability—if they are both raised and managed at the geographic scale of the community of interest (often regional or local, rather than statewide).

Aligning California's Constitution with the Requirements of Modern Water Management

Ensuring sustainable funding for water service and water resources management will also require revisiting some of the constitutional provisions that govern water charges and ratemaking (Box 8).[107] The strictures of these laws threaten to impede sound, integrated management. Some aspects of the suite of constitutional reforms passed by voters since the late 1970s are salutary. Notably, the requirements for transparency and accountability prevent local agencies from using ratepayer contributions for programs that are unrelated to the services on which these charges are levied. However, Proposition 218's requirements that water charges be set in a way that allocates costs proportionately to the services received by individual parcels oversimplifies the challenges of allocating largely fixed and communal water system costs in a way that is both fair and efficient (see Box 4). Likewise, Proposition 26's potential for disallowing the funding of environmental mitigation programs with regulatory fees risks further degrading the health of California's watersheds. Finally, Proposition 13's requirement that local special taxes be approved by two-thirds of local voters—combined with Proposition 218's requirement that special districts cannot levy general taxes (which still require a simple majority vote)—limits the potential for communities to assess themselves to meet goals

[107] For a more detailed discussion of these legal recommendations, see Appendix A.

and laws approved by the majority. Allowing one-third of local voters to rule over fiscal decisions favors the search for funding through state GO bonds, which are easier to pass, but which hide the costs under the carpet. To bring this point home, *none* of the six state water bonds approved by voters since 2000 would have passed under local supermajority funding rules.[108]

The substantive standards of Propositions 218 and 26 are themselves in tension with one another. Proposition 218 applies most directly to water rates and other fees for water service provided to property (and the customers who reside on that property). Its requirement that these charges not exceed the cost of service to individual parcels is not appropriate for regulatory fees and water management programs designed to protect the environment and the public from the negative effects of land and water use. Yet to date, the courts have failed to distinguish between these two different types of water programs and charges. The cost-of-service requirements under Propositions 218 and 26 are also potentially at odds with the water conservation and reasonable use mandates of Article X, Section 2 of the California Constitution. Likewise, they conflict with state and federal laws requiring agencies to implement conservation measures, to promote nontraditional supply sources, and to prevent polluted runoff from entering rivers and coastal waters. In addition, Proposition 218 could stymie efforts to meet other legitimate policy aims, such as extending lifeline rates to low-income consumers.

[108] See Appendix C, Table C1 for pass rates on all state GO water bonds since 1970. Only six of the 21 bonds passed since 1970 (29%) would have passed with a two-thirds voting requirement, authorizing only 8 percent of the total value approved in today's dollars.

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Constitutional reforms for sustainable water management

Over the past few decades, California voters approved a suite of fiscally oriented constitutional reforms that have important implications for water sector funding: Propositions 13 (1978), 218 (1996), and 26 (2010). These propositions aimed to improve the transparency, efficiency, and fairness of fees and taxes. Unfortunately, some provisions of these measures are now collectively having the unintended consequence of impeding efficient and equitable funding of California's water system. In particular, they are limiting the ability of local public agencies to manage water resources responsibly, while encouraging over reliance on state GO bonds. The latter are easier to pass, but less fiscally transparent and less well-suited than local sources to funding many types of activities.

To manage the state's water resources sustainably for the benefit of the economy, society, and the environment, Californians should adopt a new set of constitutional reforms (Appendix A). These reforms would continue to hold public agencies to high standards of transparency and accountability, but they would give agencies the needed flexibility to manage water in a more sophisticated, integrated way to improve supply reliability, maintain water quality for public and environmental health, protect the state's residents and businesses from harmful flooding, and safeguard our aquatic ecosystems.

Amend Proposition 218 to

- Allow local public water agencies to adopt service fees that benefit their customers by increasing water supplies, reducing demand, or otherwise enhancing the reliability of water service, without needing to demonstrate the precise linkage between these activities and the costs of service or molecules of water delivered to individual parcels.
- Exempt stormwater management and other regulatory fees that require land and water users to pay for the external costs of their activities from Proposition 218.
- Add flood management fees and assessments to the list of charges that are exempt from the voter approval requirements of Proposition 218 (comparable to water and sewer charges).
- Exempt "lifeline" rates from the cost-of-service-based standards of Proposition 218 (comparable to private water and power utilities).

Amend Proposition 26 to clarify that

- State and local governments may enact regulatory fees that require resource users to pay for the external costs of their activities.

Amend Propositions 218 and 26 to

- Provide that the reviewing courts must defer to a public agency's determination of the need for a charge or rate structure and uphold it if there is substantial evidence in the administrative ratemaking record to support the agency's decision.
- Declare that public water agencies and reviewing courts shall interpret the provisions of Propositions 218 and 26 in a manner that is consistent with the water conservation and reasonable use directives of Article X, § 2 of the California Constitution.
- Reaffirm that neither the legislature nor local governments have authority to divert the proceeds of water-related charges to purposes other than water resource management and regulation.

Amend Proposition 13 to

- Allow local special taxes for water-related purposes to pass with a simple majority of voters (comparable to the voter threshold for local general taxes and fiscal measures on statewide ballots).

For all of these reasons, Californians should revisit these laws to make them more consistent with the precepts of modern water management, with a more flexible definition of fees and a lower voter threshold for special taxes.[109] It is doubtful that anyone involved in the sequential enactment of these three initiatives—the drafters, sponsors, or the voters—carefully thought through the consequences of these laws for programs such as tiered water pricing, water recycling, stormwater discharge fees, coordinated management of surface and groundwater, or lifeline rates for low-income households. Because these propositions are part of the California Constitution, these changes would require voter approval of a new constitutional amendment, which could be placed on the ballot by the legislature or through the initiative process and passed by a simple majority of voters.

We recognize that changing the constitution in this way will not be easy, but we believe it is the best way for Californians to ensure that their water system can support a strong economy, society, and environment both now and in the decades to come, when water management will need to become ever more flexible and holistic in order to meet the challenges posed by increasing scarcity, climate change, and continued growth of the population and economy.

Other steps can be taken by water agencies, the legislature, and the courts to avoid some of the worst consequences of the existing laws:

- **Water agencies** need to provide a transparent, well-explained record of their rate decisions (a positive result of Proposition 218). This is important for explaining charges to the courts and to their ratepayers.
- **The legislature** can provide guidance to the courts on how to interpret Propositions 218 and 26 to promote integrated, conservation-oriented water management. Earlier guidance on the pass-through of charges in wholesale water rates is a model in this regard (Appendix A). Additional legislation that would help provide more financial stability for water agencies includes establishing a statute of limitations for challenges to property-related fees and assessments under Proposition 218 (comparable to the 120-day statute of limitations for capacity charges, connection fees, and development impact fees).[110]
- **The courts** need to realize the importance of a whole-system perspective in water management and refrain from molecular-level accounting.

Minding the Gap

Beyond finding the cash, California needs to develop a better understanding of the real spending needs for water service in order to meet water management goals in a cost-effective manner. This includes getting a better sense of the value of some big-ticket items that the public will be asked to pay for, including flood protection, ecosystem recovery, and some types of stormwater management and drinking water investments. Not all of the envisaged programs may be worth the costs. It will be important to improve awareness of the value of projects with multiple benefits, for instance the water supply benefits of stormwater, or the water quality benefits of forest management in the upper watersheds. Such information is necessary to help justify cost-sharing arrangements, especially given the cost-of-service requirements of Proposition 218.

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[109] The reduction from a two-thirds to a 55 percent vote for local school bonds, approved by voters in 2000 (Proposition 39), dramatically improved the funding landscape for school and community college infrastructure across the state (Hanak 2009; McGhee and Weston 2013).
[110] See Cal. Gov't Code §§ 66020, 66022.

More generally, a more integrated, watershed-based approach to water management can help Californians establish a reliable water supply despite increasing water scarcity and changing climatic conditions, thereby getting the most value on the dollar for some of the underfunded areas of water management. Local agencies are proving most successful at managing and funding water programs when they take a broad, integrated approach, using formal partnerships to extend the geographic and functional reach of their operations, and expanding their own mandates to provide more comprehensive water services.

State and federal regulatory agencies also need to support effective integration. More than their grant dollars, local agencies need these higher levels of government to work together so that their regulatory efforts are coherent at a regional level, with consistent, reasonable mandates and geographic approaches. Resource managers at all levels need to develop broad and practical goals for managing California's watersheds in ways that support both the economy and the environment. Sustained, coordinated scientific and technical analysis and ongoing experimentation and innovation will be essential for success.

As daunting as California's water funding challenges may seem, this is an inherently fixable problem. Relative to current spending of over $30 billion per year on this vital sector, Californians need to raise an additional 7 to 10 percent—or $150 to $230 per household annually—to fill critical gaps, and they need to reform the laws to ensure that those parts of the system that are currently in better shape can continue to perform effectively. This effort is essential to meeting a suite of important societal goals: supplying safe, reliable water supplies for households and businesses; protecting residents and property from harmful floods; maintaining clean rivers, lakes, and beaches; and safeguarding the survival of the many species that depend on our watersheds. California's residents will support the needed changes with their votes and their pocketbooks if state and local leaders come together to make the case for reform.

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