C V F P P

2017 UPDATE

TECHNICAL SERIES

## DRAFT Technical Memorandum

# Central Valley Flood Protection Plan Investment Strategy

## March 2017

STATE OF CALIFORNIA
THE NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

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# 1.0 Introduction and Context

## Section 1 Highlights

- Section Outline:
  - 2012 CVFPP Funding Recommendations
  - Developing the Draft CVFPP Investment Strategy
  - CVFPP Funding Plan Overview
  - Historical Context
- Key Section Takeaways:
  - CVFPP Investment Strategy supports the refinement of the 2012 CVFPP SSIA and builds upon 2012 CVFPP funding recommendations
  - The recommended funding plan is contained within the CVFPP Investment Strategy
  - Investments in flood management have been sporadic and reactionary, not sustained and proactive

Over the last century, land development has continued in the Central Valley to meet the needs of a growing population. A complex water supply and flood risk management system supports and protects a vibrant agricultural economy, urban areas, and numerous small communities. The State Plan of Flood Control (SPFC) protects a population of over 1.3 million people, major freeways, railroads, airports, water supply systems, utilities, and other infrastructure of statewide importance, including $80 billion in assets (including structural and content value and estimated annual crop production values). Many of the more than 500 species of native plants and wildlife found in the Central Valley rely to some extent on habitat existing within areas protected by the SPFC.

In 2006, Department of Water Resources (DWR) launched FloodSAFE California, a multifaceted program to improve public safety through integrated flood management. FloodSAFE California was funded by almost $5 billion provided through Proposition 1E and Proposition 84 bond measures. Preparation of the Central Valley Flood Protection Plan (CVFPP) and the Statewide Flood Management Program (SFMP) are two important components of the FloodSAFE initiative. DWR prepared the CVFPP in compliance with Senate Bill (SB) 5, which includes the Central Valley Flood Protection Act of 2008. The Central Valley Flood Protection Board (CVFPB) adopted the CVFPP on June 29, 2012. The CVFPP provides a plan for integrated, sustainable flood management investments that will reduce flood risks for areas protected by SPFC facilities. As conceived by the legislature, the CVFPP is updated every 5 years, beginning in 2017. The 2017 CVFPP Update includes recommendations on investments and policies to support comprehensive flood risk management actions locally, regionally, and systemwide, rather than promoting specific projects.

The update's primary focus is to refine the State Systemwide Investment Approach (SSIA) formulated in 2012 to achieve the CVFPP goals. The SSIA provided a road map for Central Valley flood risk management and is now being refined based on new information, physical changes to the flood system, and policy updates over the past 5 years. The 2017 CVFPP Update describes implementation progress and recommends refinements to programmatic investments needed to implement the CVFPP over the next 30 years. The update also identifies the need to address eight main policy issues that impede full implementation of the CVFPP. This Draft CVFPP Investment Strategy Technical Memorandum (Investment Strategy TM) provides the technical support and analysis for the refinements made to the SSIA since 2012. The Investment Strategy TM is one of fifteen supporting documents of the 2017 CVFPP Update that provide greater detail supporting the broader programmatic plan. For more information on the 2017 CVFPP Update and all of its supporting documents, appendixes, and attachments, see the Draft 2017 CVFPP Update (DWR, 2016).

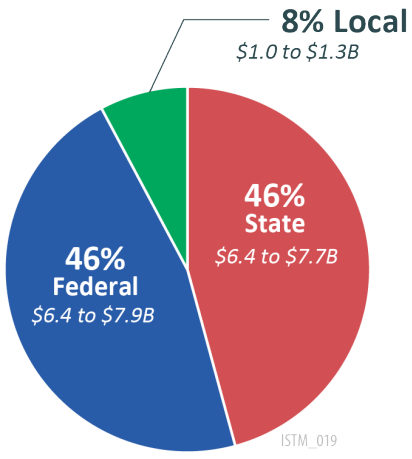
## 1.1 2012 CVFPP Funding Recommendations

The 2012 CVFPP (DWR, 2012) recommended a mix of federal, State of California (State), and local funds to implement the SSIA. Funding sources would vary according to the type of project or program, beneficiaries, availability of funds, urgency, and other factors. Cost-sharing among State, federal, and local agencies would change depending on specific project objectives and agency interests. A legislative requirement for Proposition 1E funds is to maximize, to the extent feasible, federal and local cost-sharing in flood management projects. Cost-sharing rules are governed by federal and State laws, regulations, and policies, which continue to evolve over time.

The intent of the CVFPP is to support equitable distribution of project costs among beneficiaries, encourage projects that provide broad public benefits, and help achieve added flexibility in the SPFC. The State proposes to place a priority on funding and providing a greater State cost share for flood management improvement projects that provide multiple benefits.

Figure 1-1 illustrates the allocation of SSIA costs to State, federal, and local interests described in the CVFPP. Federal cost-sharing for capital improvements was assumed to be based on results of feasibility studies, with cost-sharing amounts varying depending on the mix of purposes included in a project. For example, the federal cost share for ecosystem restoration projects could be as high as 50 to 65% for urban flood risk reduction projects. Costs not qualifying for federal cost-sharing include the property acquisition in fee or easement, relocations, operations and maintenance, and other

Figure 1-1. 2012 State Systemwide Investment Approach Cost-Shares




2012 CVFPP Total
$13.9 to $16.9B

Note:
2012 CVFPP Totals are from Table 4.3 in the 2012 CVFPP.

costs that must be paid by nonfederal project sponsors. Water supply, recreation, or other benefits included in flood risk reduction projects could further modify federal cost-sharing. State cost-sharing of the nonfederal costs also depended on the mix of project purposes. The 2012 CVFPP indicated that adequate funding from local agencies may require creation of new assessment districts to implement capital improvements or to support effective, efficient, and improved system operations and maintenance.

The 2012 CVFPP concluded the State would have to rely more heavily on State bond funding to finance flood risk reduction projects until more federal funding became available. It was expected that local agencies would use assessments to provide their share of the cost.

## 1.2 Developing the Draft CVFPP Investment Strategy

The CVFPP Investment Strategy expands on the 2012 CVFPP efforts in several ways. Beyond incorporating the findings in the 2012 CVFPP and providing the funding recommendation in the 2017 CVFPP Update, the CVFPP investment strategy integrates findings from the 2013 California's Flood Future: Recommendations for Managing the State's Flood Risk (DWR, 2013) and the California Water Plan Update 2013 (DWR, 2014). In turn, this CVFPP investment strategy will inform the California Water Plan Update 2018 (DWR, 2017; under development), which will be implementing an outcome-driven management approach. The 2017 CVFPP Update and this investment strategy have anticipated and used this outcome-driven approach to better align with the California Water Plan Update 2018.

The 2017 CVFPP Update incorporates information from major supporting efforts, including the Draft CVFPP Conservation Strategy (DWR, 2016), six Regional Flood Management Plans (RFMPs)[1], and the Draft Sacramento River and San Joaquin River Basin-Wide Feasibility Studies (BWFSs) (DWR 2016c and 2016d). Furthermore, the RFMPs included financing or funding plans that have helped inform the investment strategy, including the regions' ability and willingness to pay for improvements. These financing plans are critical to CVFPP implementation, given the uncertainty in State, federal, and local agency budgets and cost-sharing capabilities.

This Investment Strategy TM documents how the CVFPP investment strategy was developed to identify a recommended approach to fund the 2017 refined SSIA portfolio as described in the 2017 CVFPP Update. Various funding scenarios were developed and assessed to arrive at the recommended approach. The development of the investment strategy included assembling the costs from the supporting planning studies and analyses, developing priorities of expenditures, and investigating several scenarios for funding implementation of the CVFPP. These scenarios investigated a wide range of funding priorities and amounts—from partial to full funding—and this Investment Strategy TM documents these details.

[1] Feather River Partners, 2014; FloodProtect, 2014; Mid and Upper Sacramento River Regional Flood Management Plan Partners, 2014; Reclamation District 2092, 2014; San Joaquin Area Flood Control Agency, 2014; San Joaquin River Flood Control Project Agency, 2014

Many tools were created to aid the decision-making process for the CVFPP investment strategy. The two primary decision-support tools were an Excel management action prioritization database and an Excel-based financial model.

The management action prioritization database collected all of the potential actions, and then categorized and prioritized these actions based on the State's priorities (see Sections 2 and 3 for additional details). This database organized and prepared the inputs for the financial model that helps assess funding scenarios.

Financial modeling is the task of building an abstract representation of a real-world financial situation. The financial model supports scenario preparation for strategic planning, which is accomplished first by creating the model based on known parameters and then testing the model with different inputs. Next, the inputs are used to create a set of outputs that determine the effect of changing one variable or another. Inputs and assumptions used to develop this investment strategy are documented in this TM, but are primarily discussed in Sections 6 and 7.

It is important to keep in mind that with the use of decision-support tools the results must be interpreted and checked for viability against outside influencing factors that are beyond the quantification provided by mathematical tools. In many cases, professional judgment was used to navigate some of these influencing factors to provide reasonable results and make valid recommendations. Taken together, this information provides the basis for a funding plan with the potential to support long-term implementation of the CVFPP. For more description on influencing factors, please see Section 4.

## 1.3 CVFPP Funding Plan Overview

A funding plan is one component of the CVFPP investment strategy (Figure 1-2). After the desired outcomes have been determined, the investments needed to achieve those outcomes and their priorities are developed. At that point, a funding plan can be formulated. The purpose of the funding plan is to describe the cash needs necessary for the prioritized investments, and to identify potential revenue sources to pay for the prioritized investments. The funding plan is one part of an overall strategic plan that involves forecasting combined with scenario development and analysis to produce the CVFPP investment strategy.

Figure 1-2. Nesting of Recommended Funding Plan


A long-term funding plan typically includes the following elements:

1. **Time Horizon.** This element is also known as the financial planning period. In the case of the CVFPP, the current time horizon extends for thirty years from 2017 to 2047.

2. **Scope.** The scope of the funding plan refers to the trade-off between the amount of the funds required to achieve the desired outcomes and the sources of funds that can be used or appropriated to meet the service needs.

3. **Frequency.** This element indicates how often the funding plan is updated in order to provide input to the State budget process. In the case of the CVFPP, updates to the funding plan would be made every 5 years in sync with the updates to the CVFPP.

4. **Content.** A long term funding plan includes analyses of most if not all of the following:
   - Financial environment
   - Revenue and expenditure forecasts
   - Debt position and affordability analysis
   - Strategies for achieving and maintaining financial balance

Although many reports and studies use the terms "funding" and "financing" interchangeably, each has a specific meaning, and the investment strategy strives to distinguish between the two terms. "Funding" refers to a revenue stream, whereas "financing" refers to using that revenue stream to support debt or other financing mechanisms.

### The Difference between Funding and Financing

The word "funding" refers to the generation of revenue to pay for costs or investment. For example, a basin-wide assessment is a source of funding, not a source of financing.

The word "financing" refers to the use of debt or leverage to meet the cash flow demands of project delivery. For example, State-issued general obligation bonds can be used to finance identified SPFC projects. In this example, the State's general fund would be a funding source.

This distinction in terminology is critically important because, as a matter of sound financial management practices and sustainable practice, governmental entities should not use debt (such as general obligation bonds) to finance ongoing operational activities.

## 1.4 Historical Context

In order to better understand the need for a detailed CVFPP Investment Strategy, the historical context of past Central Valley flood investments should be reviewed. To date, investments in Central Valley flood management have been largely sporadic and reactionary based on triggering events over the past 160 years. Moving forward, the CVFPP Investment Strategy proposes methodical strategic investments that could course correct the historical trend to a more proactive investment approach.

### 1.4.1 Fiscal Impact of Statewide Flooding in Recent History

Statewide direct flood damages since 1955 are approximately $19.3 billion (in 2015 dollars). Annual direct flood damages for all years since 1955 average about $338 million. Table 1-1 shows the direct flood damages from the ten most expensive floods since 1955. All ten floods have impacted the SPFC planning area in the Central Valley, and seven of these included direct damages exceeding $1 billion (in 2015 dollars). The annual direct flood damages for the ten most expensive floods averages $1,621 million per year.

Table 1-1. California's Ten Most Expensive Flood Events

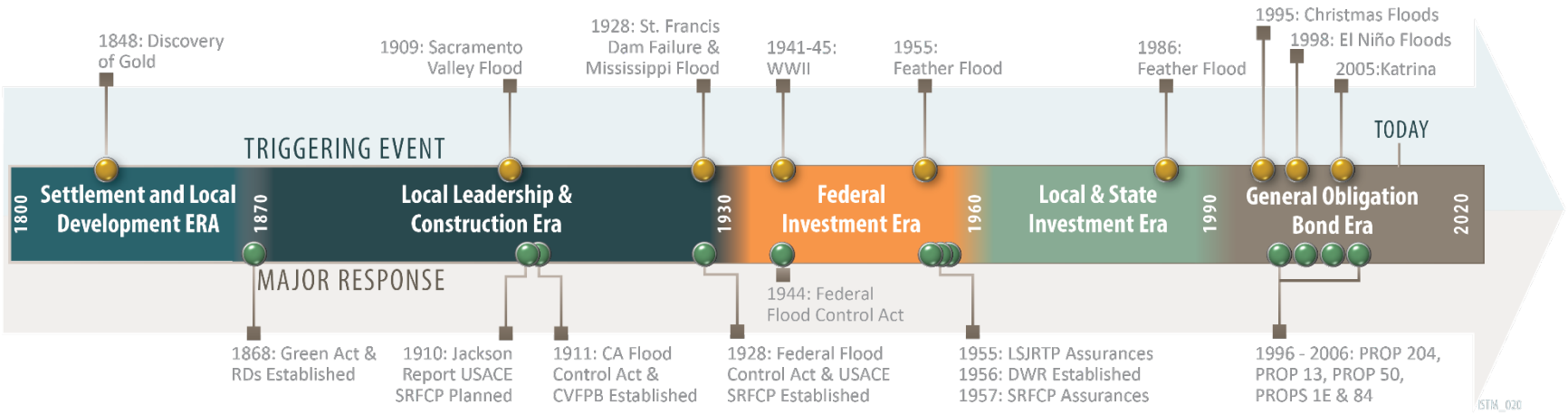
| Year | Event Name | Statewide Fatalities [3] | Direct Flood Damages [1, 2] |
|---|---|---|---|
| 1955 | 1955 Christmas Flood | 74 | $1,280 |
| 1964 | | | $1,500 |
| 1969 | Winter storms | 47 | $2,340 |
| 1980 | | | $1,330 |
| 1982 | Winter storms | | $730 |
| 1983 | | | $1,490 |
| 1986 | St. Valentine's Day storm | 13 | $820 |
| 1995 | 1995 Christmas floods | 28 | $2,350 |
| 1997 | | | $3,160 |
| 1998 | El Niño floods | 17 | $930 |

Notes:
1. 2015 $M
2. DWR, 2016
3. DWR, 2013

### 1.4.2 Historical Investments and Events over the Past 160 Years

California's historical approach to flood management can be grouped into four general eras. Figure 1-3 shows these eras and how they align with significant climatic events (i.e., floods and droughts), development of water management infrastructure, and the establishment of local, State, and federal laws and agencies.

Figure 1-3. Flood and Water Management Timeline



### *Settlement and Local Development Era (1800 to 1868)*

California's motivations for water management activities and investments during the settlement era largely focused on public safety and providing water for development. Water managers and private landowners experimented with and employed a number of management actions, typically involving construction of infrastructure such as canals, levees, weirs, and dams. Funding for construction and operation of these flood and water management systems came from private sources (such as landowners) or, in the case of communities, from community-pooled resources. In general, investment during this era was characterized by private local investments that fostered economic development but often did not account for the action's impacts on downstream or upstream landowners and communities. Levee construction along the Sacramento River and its tributaries is an example of early private investment in flood management. In the mid-1800s, levee construction began in the Central Valley to protect individual landowners and growing cities such as Sacramento and Marysville. Many of these early levees were low levees constructed of on-site or easily available materials (sand and gravel). Landowners learned by trial and error as levees often failed during flood events. Gradually, the height and stability of levees increased to better contain the rivers, which in turn increased downstream flood risk. However, this system of private levee construction also "led to competition between landowners to continually raise and strengthen levees piecemeal so that any overflow would flood somebody else's land" (DWR, 2016e), highlighting the need for a more integrated approach to flood management.

After the discovery of gold in 1848, private development of other water systems also accelerated and exacerbated the problems caused by the "levee wars" (DWR, 2016e). Miners built diversion structures to aid the use of sluice boxes for faster gold mining. This eventually evolved to hydraulic mining methods. Hydraulic mining resulted in heavy sediment loads (or debris) in rivers and creeks, which reduced flow capacities and exacerbated flooding in the Central Valley. This demonstrated how one action can have systemwide impacts with negative consequences.

### *Local Leadership & Construction Era (1868 to 1930)*

In response to slow reclamation of land, the California Legislature passed two new acts in 1868 that changed how land was developed in California. The first, the Green Act, consolidated existing land laws, made purchase and reclamation of swamplands easier, and allowed landowners to petition their county board of supervisors to permit the construction of levees to protect reclaimed lands. The second act, Assembly Bill (AB) 553 of 1868, permitted the creation of a levee district in Sutter County that protected certain lands in the county from flooding. This act led to the creation of Levee District 1, the oldest continually operating flood control district in California, which could impose taxes for construction of regional flood protection. These two acts accelerated the reclamation of land and construction of levees and resulted in competition among landowners to protect property.

The years between 1900 and 1904 were characterized by high river stages but no significant flooding. However, starting in 1904, the Sacramento River basin experienced a number of significant flood events over several years that further demonstrated the shortcomings of the trial and error approach to constructing levees (DWR, 2016e). In 1910 the California Debris Commission produced the Jackson Report, a comprehensive plan for controlling the floodwaters of the Sacramento River and its tributaries (DWR, 2016e). Following this report, the Sacramento River Flood Control Project (SRFCP) was authorized by the California Legislature in the Flood

Control Act of 1911. The Flood Control Act also established the California Reclamation Board (renamed the Central Valley Flood Protection Board [CVFPB] in 2008), which was empowered to approve plans for the construction of levees along the Sacramento River or its tributaries or within any of the overflow basins. The federal government became involved in the SRFCP project after Congress passed the Flood Control Act of 1917, which authorized $5.6 million to specific components of the SRFCP. The Flood Control Act of 1928 fundamentally changed the way construction of project levees were financed. As adopted, this act recognized that local interests had already contributed more that the required one-third of the total $51 million estimated for SRFCP construction and considered their financial obligation to the project fulfilled. By the end of the 1920s, the USACE established the Sacramento District to oversee work on the SRFCP, with the federal government taking over a much larger role in the administration of both river and bypass levee construction.

### *Federal Investment Era (1930 to 1960)*

The number of large-scale water supply and flood management projects increased in the 1930s as additional federal funding became available in response to the Great Depression, when Congress authorized almost 40 projects, including the Central Valley Project (CVP), to promote infrastructure development and public works job creation. The federal government also constructed a number of large dams to provide water supply and flood protection benefits, such as Friant Dam (construction began in 1937) and Shasta Dam (construction began in 1938).

Although the start of World War II slowed the process, planning and construction continued, with Friant Dam completed in 1942 and Shasta Dam complete by 1945. These projects were primarily funded through federal appropriations, and provided water and power to growing postwar cities and agricultural communities. Contracts written with water and power users (contractors) set the terms for repayment of the costs of facilities and operations allocated to those purposes.

During and after World War II, the federal government continued to plan and build flood control projects. The Flood Control Acts of 1944 and 1946 authorized USACE to construct a number of flood control projects including dams and river projects in the San Joaquin Valley (e.g., Lower San Joaquin Tributaries Project and Pine Flat Dam, both authorized in 1944). Congress also authorized USACE to build Folsom and New Melones dams in 1944, and the operation of these facilities was integrated into the CVP. The Flood Control Act of 1944 also authorized the construction of Oroville dam on the Feather River.

In the 1950s, the federal government worked to reduce flood damages by improving cooperation between local, State, and federal agencies. This was accomplished through the National Flood Insurance Act and through the Watershed Protection and Flood Prevention Act of 1954, which was designed to reduce flood damage by fostering cooperation of agencies at all levels through cost sharing of local and regional projects.

The original project assurances provided to the federal government in the mid-1950s concerning primarily operation and routine maintenance (O&M) of the project make no mention of “repair, rehabilitation, and replacement” (RR&R), a phrase first introduced in the Water Resources Development Act of 1986 (WRDA 1986). Activities are guided, in part, by O&M manuals developed by USACE in the mid 1950s and hydraulic design criteria developed at approximately

the same time. Currently, flood management system O&M and RR&R obligations for SPFC facilities are shared among the State and local maintaining agencies (LMAs) (DWR, 2017b).

### *Local and State Investment Era (1960 to 1990)*

The floods of 1986 caused extensive damage to the flood management system of the Sacramento Valley. The storms caused close to $50 million in public and private property damage, excluding damage to roads and other infrastructure. In the northern Delta, 1,600 people were evacuated, and $20 million in property damage occurred.

While flood infrastructure had the unintended consequence of increasing flood risk on some floodplains (by supporting additional development within the floodplains), it and other forms of water management also generated a different set of unintended environmental consequences. Starting in the 1970s, environmental awareness increased, causing a push for increased environmental regulations and increased funding for environmental protection projects. Following the passage of WRDA 1986, non-federal interests were required to share more of the financial and management burdens (DWR, 2016e). These new requirements, coupled with the more stringent environmental regulations, resulted in further reduction in the federal share of spending for flood and water management projects.

The State responded to the federal requirement for greater State and local cost sharing by passing SB 399 (1973) and the Way Bill (1973), both of which increased State involvement. However, funding for flood and water management projects became more difficult when voters in California passed Proposition 13 in 1978, Proposition 62 in 1986, and Proposition 218 in 1996. Proposition 13 limited ad valorem taxes on California properties. The proposition limited the amount of tax that could be collected based on the assessed value of private property, including real estate, to 1 percent of the assessed value of the property. Proposition 13 also decreased the assessed value of the properties to 1975 values (negating three years of increased value), and limited increases of assessed value to 2 percent per year. Property that is sold or declines in value after an initial purchase may be reassessed. The enactment of Proposition 13 cut local property tax revenue significantly, causing cities and counties to raise user fees and other local taxes. In response, voters approved Proposition 62, the Voter Approval of Taxes Act, in 1986. This proposition required that new general taxes be approved by two-thirds of the local agency's governing body and a majority of voters, and new special taxes be approved by a two-thirds majority of voters. This led local agencies and cash-strapped communities to use assessments and property-related fees (among other fees) to pay for government services. Proposition 218 was passed by voters in 1996, and added requirements and limits on local governments' ability to impose or increase assessments and fees (see Section 4 for more detail).

### *General Obligation Bond Era (1990 to 2020)*

With the reduction in federal authorizations and the more stringent conditions on State and local financing of flood management projects, the State turned to general obligation (GO) bonds. Between 1990 and 2016, eight water management bond propositions were passed at the State level. These include the Propositions 204 (1996), 13 (2000), 50 (2002), 84 (2006), 1E (2006), and 1 (2014). The size of these bond measures has fairly steadily increased over time, with Proposition 1 in 2014 authorizing the sale of $7.1 billion for water infrastructure. Political and legal limitations on the State's borrowing capacity may restrict future bond measures. State GO bonds are paid back from the State's general fund, so the ultimate funding of projects financed

by GO bonds comes largely from the State's personal income, sales, and corporate taxes. So ultimately, this method of funding of flood management competes directly with education, health care, and all of the other demands on the general fund.

Since 2007, and to facilitate needed flood protection improvements, Proposition 1E (2006) and the Central Valley Flood Protection Act (2007) authorized use of bonds to make improvements to SPFC facilities prior to the adoption of the CVFPP.

Since adoption of the CVFPP in June 2012, flood management planning has progressed at the federal, State, and regional/local levels, and the implementation pace has been steady, enabled by a continued influx of State bond funding for capital projects, approval of new and increased local benefit assessments for capital improvements, and increased levels or operations and maintenance. Implementation has also been aided by recent State general fund allocations targeted at addressing deferred maintenance. The State and local entities have continued investing in projects that are consistent with the SSIA, feasible, and ready to move forward, to the extent funding has been available. Since the passage of Propositions 1E and 84 and the approval of more than a dozen assessments for flood control improvements approved by property owners (e.g., Sacramento Area Flood Control Agency, San Joaquin Area Flood Control Agency, Three Rivers Levee Improvement Authority) and services throughout the Central Valley, progress has been made implementing levee improvements and reducing flood risk, especially in urban areas.

Although significant progress has been made since 2007, much remains to be accomplished, and continued assistance from the federal government is key. The recently signed federal Water Infrastructure Improvements for the Nation Act of 2016 (Title 1 of which is Water Resources Development) provides authorization of feasibility studies and implementation of several flood control projects in California, but total funding is still well below those seen during the federal investment era. Unless bipartisan agreement is found to increase federal infrastructure spending, lower federal participation in flood management appears to be the current trend.

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# 2.0 Intended Outcomes of the 2017 Refined SSIA Portfolio

**Section 2 Highlights**

- Section Outline:
  - The Importance of Demonstrating Value
  - The Why, What, and How of CVFPP investment
  - 2017 Refined SSIA Portfolio Organization and Expected Outcomes
- Key Section Takeaways:
  - The 2012 SSIA has been refined based on an outcome-driven approach.
  - Each water management program—including the CVFPP—has a specific role to play in helping the broader water management system become more sustainable with an improved balance between the highest level societal values.
  - Demonstrating the CVFPP's contribution to supporting these societal values is important for securing increased investment in, and sustainable funding for, SPFC improvements.

Historical trends indicate that the status-quo approach to flood management investment is unsustainable for the future, and there is a need to balance increasing demands with wise investments. Planning and investment must focus on expected outcomes of particular actions and investments. This outcome-driven planning approach has been used to develop the 2017 CVFPP Update and its refined SSIA portfolio. The application of the outcome-driven approach is also grounded within this CVFPP Investment Strategy and is guiding investment priorities.

## 2.1 The Importance of Demonstrating Value

Despite recent progress toward more sustainable flood risk management through implementation of the CVFPP, significant challenges remain. It is critical that the State demonstrate the value of effective flood management in the SPFC to secure greater levels of funding needed to implement the CVFPP over 30 years.

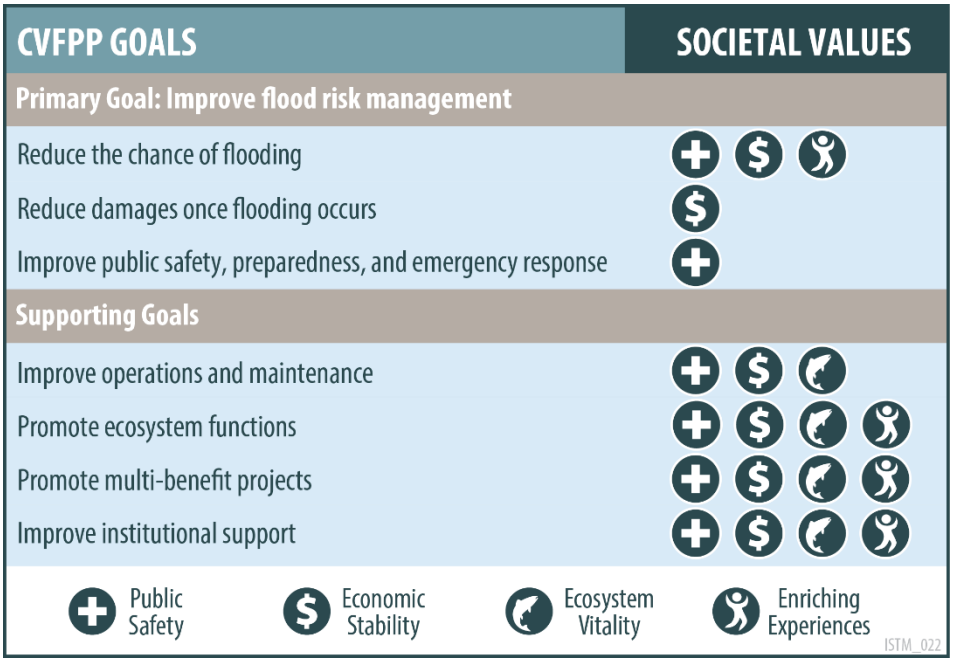
### 2.1.1 Societal Values

To help meet these challenges, flood management in the Central Valley must work toward sustainability, which is defined as a resilient, dynamic balance among the societal values: providing public health and safety, sustaining vital ecosystems, supporting a stable economy, and providing opportunities for enriching experiences (Figure 2-1).

Figure 2-1. Four Societal Values


All DWR water management programs—the CVFPP included—play specific roles in helping the State support these societal values and move toward sustainability. The relationship between the CVFPP's goals and societal values for water management is shown in Figure 2-2. Demonstrating the CVFPP's contribution to supporting these values is important for securing increased investment in, and sustainable funding for, SPFC improvements.

Figure 2-2. Societal Values Supported by the CVFPP Primary and Supporting Goals



### 2.1.2 CVFPP's Contribution to Sustainability

Each water management program—including the CVFPP—has a specific role to play in helping the broader system become more sustainable with an improved balance between the highest level societal values.

Central Valley flood management is primarily intended to contribute to these goals by helping to minimize lives lost from flooding and contribute to the economic stability of local communities, the region, and the State. At the same time, the CVFPP is expected to provide opportunities for ecosystem and other multi-benefits associated with flood system improvements (such as recreation and other enriching experiences). Characterizing management actions' ability to contribute to these outcomes of broader public interest is key to raising State funds for implementation and maximizing all potential funding sources. This makes it essential for CVFPP updates to be able to describe progress not only toward CVFPP goals, but also to show how meeting those goals can contribute to broader societal values.

Historically, planning has focused primarily on identifying individual projects in isolation to achieve short-term goals. The result has been the piecemeal flood management system we have today with inconsistent standards, funding, governance, and performance. The outcome-driven approach applied to the 2017 CVFPP Update shifts the focus from isolated actions to desired results by focusing on intended outcomes that could provide the greatest value for State investment over the long term. This shift in focus can improve flood management in the Central Valley in three important ways:

- **Funding:** Flood management has long been underfunded in California. An improved framework for setting intent, articulating dependencies between management actions and outcomes, and tracking effectiveness provides a way to more clearly demonstrate the value of flood management to California taxpayers, and will likely lead to more proactive and stable funding for flood management.

- **Effectiveness:** Setting clear intent, and then tracking whether or not intended outcomes are achieved over time, improves the ability to course-correct. This ultimately makes the system more effective as assumptions are tested and actions are improved.

- **Local-State Partnership:** When flood system funding is linked to intended outcomes, the State interest is communicated to stakeholders. This offers stakeholders the opportunity to apply local expertise and perspectives for more successful partnerships when applying for funding/cost shares.

## 2.2 The Why, What, and How of CVFPP Investment

Describing and justifying investments that will achieve the CVFPP goals depends upon applying an outcome-driven planning approach. Such an approach guides this CVFPP Investment Strategy, and has guided the types of management actions included in the 2017 refined SSIA portfolio.

The following sections discuss the hierarchy and details of flood management intended outcomes, the organization of the 2017 refined SSIA portfolio, and what kinds of outcomes are expected from this portfolio. Many of the concepts and the interconnectivity of the outcomes discussed here are associated with the overall prioritzation of the refined SSIA portfolio, and influenced the recommended investments. The prioritization of the 2017 refined SSIA portfolio is directly discussed in Section 3.

Figure 2-3. Levels of Outcome for Flood Management


The first step in applying the outcome-driven approach is to understand the heirarchy of outcomes on which everything else is based. Secondly, it is important to understand the distinctions and key dependencies among the levels of outcomes for flood management as shown in Figure 2-3:

- **Higher-level intended outcomes: the "why" of Central Valley flood management**
  - **Level 4: Sustainability.** Sustainability is defined here as a resilient, dynamic balance between societal values. This balance is contributed to in part by flood-specific outcomes, but also by other resource management efforts across the State.
  - **Level 3: Flood-specific resource and societal benefits.** These outcomes are specific to flood management (such as floodplain ecosystem productivity or economic damages from flooding) that contribute to societal values. Therefore, they are referred to as flood-specific outcomes in this plan. These outcomes depend on the lower level outcomes discussed below.

- **Lower level outcomes: the "what" and "how" of Central Valley flood management**

  - **Level 2: Physical Assets and Behaviors.** These outcomes form the "what" of Central Valley flood management. Changes to physical assets and behaviors such as floodplain land uses, flood infrastructure, or human responses to floods come about as a result of management action implementation. Therefore, these outcomes are referred to as management actions.

  - **Level 1: Enabling Conditions.** This is the "how" of flood management. Enabling conditions like funding mechanisms, programs, authorities, and other foundational features are needed to support successful CVFPP implementation and associated changes to physical assets and behaviors.

The actions that are recommended for producing the "how" and "what" of Central Valley flood management are ultimately driven by assumptions about management actions that will affect flood-specific outcomes, and by the ultimate desire to meaningfully contribute to societal values. Success is measured by the degree to which actions taken help bring about their related intended outcomes. Actual outcomes are tracked over time for the purpose of demonstrating the value and improve the effectiveness of investment with each planning cycle.

During implementation, action must first be taken to establish the enabling conditions that are needed to implement further management actions that support CVFPP implementation, which then (ideally) results in the achievement of intended flood-specific outcomes and societal values. This TM is ultimately focused on providing one of those enabling conditions: an investment strategy.

Appendix G expands on the levels of outcome concepts:

- **The why:** flood-specific outcomes that most effectively and resiliently contribute to societal values

- **The what:** changes to physical assets and behaviors through management actions that are needed to bring about those outcomes

- **The how:** establishing enabling conditions that can make those changes possible

## 2.3 2017 Refined SSIA Portfolio Organization and Expected Outcomes

Based on the concepts described above, the 2017 refined SSIA portfolio consists of interrelated management actions working together that could achieve flood-specific outcomes and CVFPP goals and result in a more resilient flood management system. This is an update to the SSIA presented in the 2012 CVFPP, and is refined based on new information gathered since 2012.

The 2017 refined SSIA portfolio comprises management actions that will be invested in over the 30-year planning horizon. Investment is divided into two types: capital and ongoing. Many management actions require only capital investment, whereas others require ongoing, annual investment sustained over the entire planning horizon. Because prioritization, funding, and financing for these two types of investment are different, they are discussed separately throughout the remainder of this CVFPP Investment Strategy TM.

Capital and ongoing investments are grouped into management action categories, and then divided into the four areas of interest: systemwide, urban, rural, and small communities. Each area of interest includes specific management action categories. All applicable tables presented in this section and upcoming sections are organized similarly.

Table 2-1. Management Action Categories by Area of Interest

| Capital Investment | Ongoing Investment |
|---|---|
| **Systemwide Actions** | |
| ■ Yolo Bypass multi-benefit improvements<br>■ Feather River-Sutter Bypass multi-benefit improvements<br>■ Paradise Cut multi-benefit improvements<br>■ Reservoir and floodplain storage | ■ State operations, planning, and performance tracking<br>■ Emergency management<br>■ Reservoir operations<br>■ Routine maintenance |
| **Urban Actions** | |
| ■ Levee improvements<br>■ Other infrastructure and multi-benefit improvements | ■ Risk awareness, floodproofing, and land use planning<br>■ Studies and analysis |
| **Rural Actions** | |
| ■ Levee repair and infrastructure improvements<br>■ Small-scale levee setbacks and floodplain storage<br>■ Land acquisitions and easements<br>■ Habitat restoration/reconnection | ■ Risk awareness, floodproofing, and land use planning<br>■ Studies and analysis |
| **Small Community Actions** | |
| ■ Levee repair and infrastructure improvements<br>■ Levee setbacks, land acquisitions, and habitat restoration | ■ Risk awareness, floodproofing, and land use planning<br>■ Studies and analysis |

Figures 2-4 and 2-5 present a high-level summary of the potential that each investment type has to contribute to the flood-specific outcomes. This table highlights a few important conclusions:

1. There are no silver bullets in flood and floodplain management. A diverse portfolio of investment is necessary to achieve a diverse set of intended outcomes and to effectively address all components of risk.

2. Systemwide and rural investments have the greatest potential to contribute to system resiliency and long-term sustainability across a broader set of outcomes.

3. Investments that impact densely populated areas (urban centers and small communities) are most effective at reducing risk to human lives and economic assets.

4. Ongoing investments do the work of maintaining system resiliency and allowing the system to continually evolve to more effectively contribute to societal values over time.

If CVFPP is to accomplish its goals and contribute in a resilient way toward all societal values, investment must be directed toward a diversity of actions (in type, size, and area) with varying strengths that complement and balance one another. Of course, individual projects will always differ in the extent to which they are effective based on site-specific circumstances and relationships to other actions within the system. The following discussion establishes broad investment principles for each of the systemwide, urban, rural and small community contexts that will aid the understanding of the prioritization of management actions within the 2017 refined SSIA portfolio.

Figure 2-4. Capital Improvement Actions: Flood-Specific Outcomes

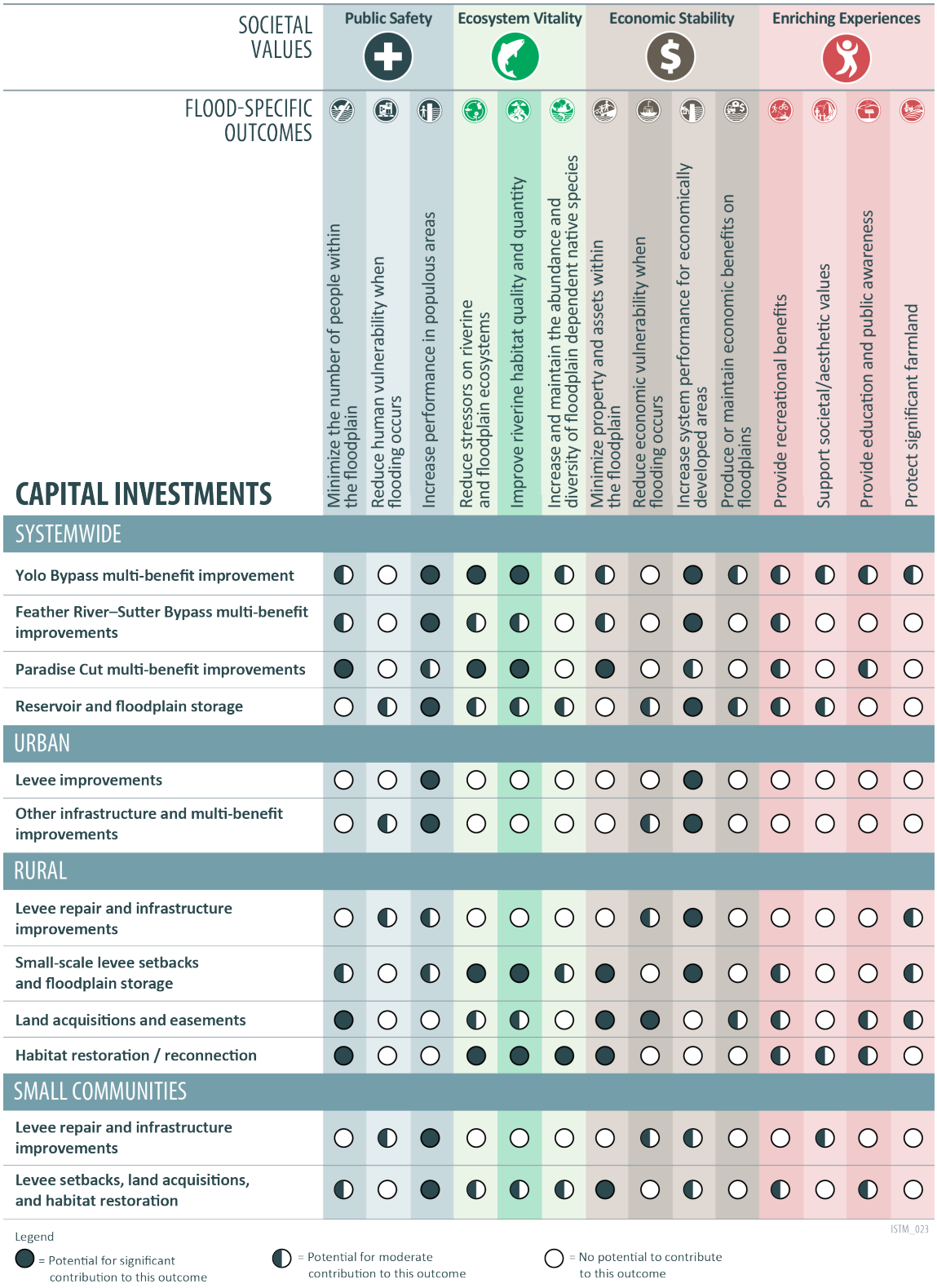
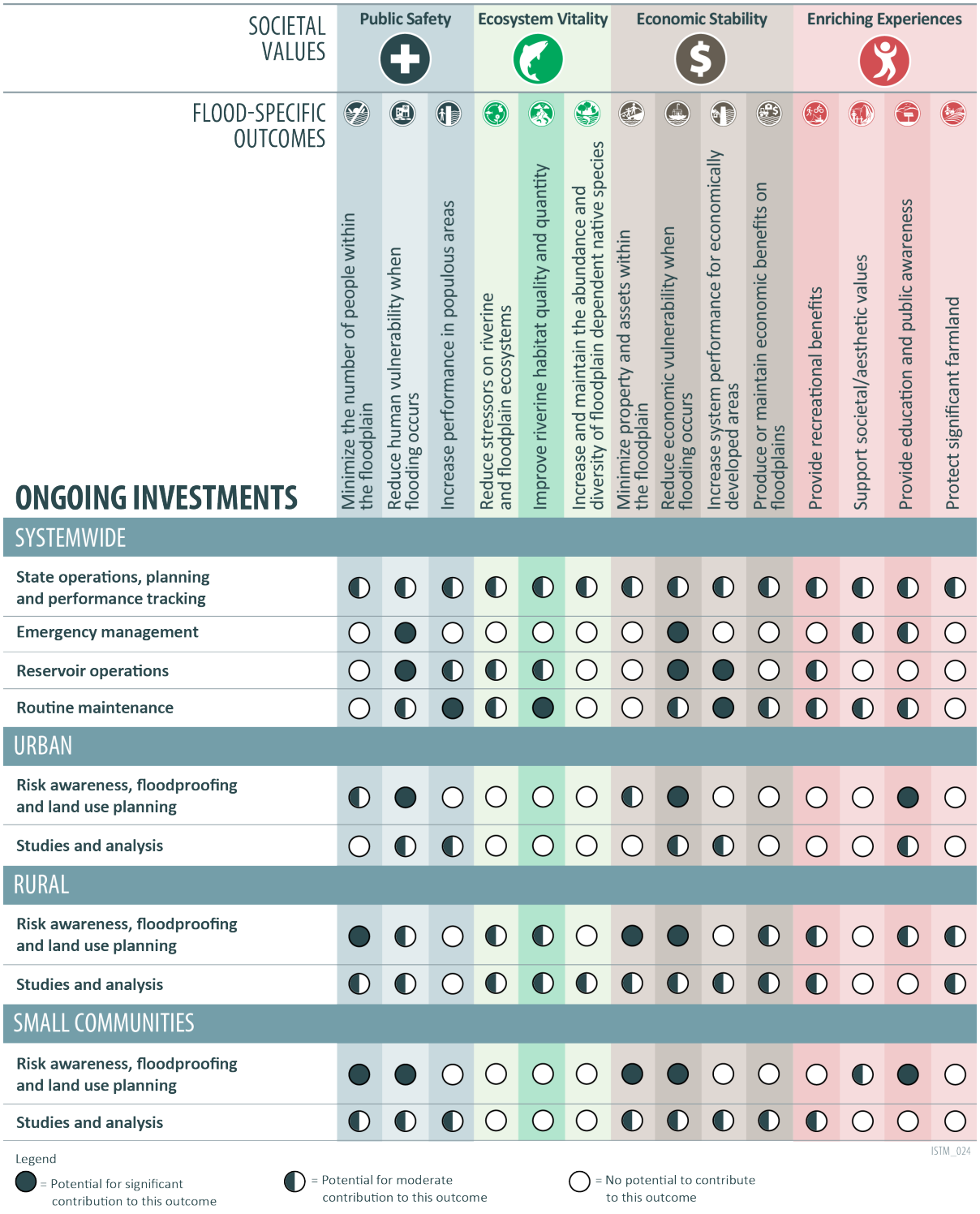


Figure 2-5. Ongoing Investment Actions: Flood-Specific Outcomes



### 2.3.1 A Balanced Systemwide Portfolio

Some types of actions have systemwide implications, with the potential to greatly bolster overall systemwide resiliency in a way that smaller-scale urban, rural, and small community actions cannot. This portfolio includes capital and ongoing investment in associated management action categories.

Proposed systemwide capital investment management actions were identified primarily through the Sacramento and San Joaquin BWFSs (DWR, 2016c and 2016d) and considered regional perspective articulated in the six RFMPs. The BWFSs provide a more detailed level of analysis and project development, including a cost-benefit analysis, than provided by the six RFMPs[1] alone. Therefore, the relevant intended outcome information for a balanced systemwide portfolio is briefly summarized in this discussion in a slightly different manner than for the urban, rural, and small community portfolios that follow. Partners and stakeholders are encouraged to refer to the Sacramento BWFS and the San Joaquin BFWS for additional detail influencing the 2017 refined SSIA portfolio.

Proposed systemwide capital investments in the 2017 refined SSIA portfolio include Yolo Bypass multi-benefit improvements, Feather River–Sutter Bypass multi-benefit improvements, Paradise Cut multi-benefit improvements, and reservoir and floodplain storage. Each of these management action categories provides different intended outcomes that contribute toward the societal values of public safety, economic stability, ecosystem vitality, and enriching experiences.

- **Systemwide capital investments:**
  - **Yolo Bypass multi-benefit improvements:** These proposed improvements would provide public safety and economic stability flood-specific outcomes by significantly reducing stage and the probability of levee failure in the bypass, thereby reducing the probability of dangerous floods. In addition, life and property and asset exposure would be reduced in proposed levee setback areas. The proposed ecosystem improvements would provide a substantial increase in habitat acres throughout the bypass. Finally, flood-specific outcomes could enrich recreational experiences through the addition of public lands from non-recreational uses to enhanced wildlife-related recreational uses.
  - **Feather River–Sutter Bypass multi-benefit improvements:** Potential Feather River-Sutter Bypass multi-benefit improvements could provide public safety and economic stability flood-specific outcomes by reducing stage and the probability of levee failure in the Feather River system, thereby reducing the probability of dangerous floods. In addition, life and property and asset exposure could be reduced in proposed levee setback areas. There is also the potential for increasing habitat acres through ecosystem enhancement and for providing enriching experiences. Flood-specific outcomes could include greater habitat acreage and enhanced wildlife-related recreational uses.

[1] Feather River Partners, 2014; FloodProtect, 2014; Mid and Upper Sacramento River Regional Flood Management Plan Partners, 2014; Reclamation District 2092, 2014; San Joaquin Area Flood Control Agency, 2014; San Joaquin River Flood Control Project Agency, 2014.

- **Paradise Cut multi-benefit improvements:** The proposed Paradise Cut multi-benefit improvements would provide public safety and economic stability flood-specific outcomes by reducing potential life, property, and asset risk exposure in proposed levee setback areas. The improvements would provide stage reductions and reduce the probability of levee failure in the San Joaquin River downstream of Paradise Cut, thereby reducing the probability of dangerous floods. The proposed ecosystem improvements would substantially increase habitat acres and would provide additional habitat for endangered species. Finally, flood-specific outcomes could enrich recreational experiences through the addition of public lands from non-recreational uses to enhanced wildlife-related recreational uses.

- **Reservoir and floodplain storage:** Reservoir and floodplain storage actions included in this category focus on increasing the availability of storage space for managing flood flows on a systemwide scale. All proposed reservoir and floodplain storage actions reduce peak flows during flood events to reduce the probability of dangerous floods that impact life safety and cause economic damages. In addition, transitory storage projects can provide significant habitat improvements.

Proposed systemwide ongoing investments in the 2017 refined SSIA portfolio include State operations, planning, and performance tracking; emergency management; reservoir operations; and routine maintenance actions. Each of these management action categories addresses one or more of the societal values of public safety, economic stability, ecosystem vitality, and enriching experiences.

- **Systemwide ongoing investments:**

  - **State operations, planning and performance tracking** is vitally important for establishing, funding, and maintaining the enabling conditions necessary for successful implementation of the CVFPP.

  - **Emergency management** primarily reduces life vulnerability and property and asset vulnerability through improved ability to evacuate people and economic assets during flood events.

  - **Reservoir operations** actions primarily reduce the probability of dangerous floods that impact life safety and cause economic damages by reducing peak flows during flood events. They can also reduce life and property and asset vulnerability through improvements in emergency response time and potentially utilize improved operational flexibility to provide improvements to flows for ecosystem purposes.

  - **Routine maintenance** is necessary for maintaining performance of the SPFC, particularly for providing public safety, economic stability, and ecosystem vitality

### 2.3.2 A Balanced Urban Portfolio

With urban areas already so densely developed, flood management opportunities within their boundaries are limited primarily to actions that improve public safety or economic stability. Although some opportunities exist in the urban footprint to improve ecosystem functioning or offer new opportunities for enriching experiences, these outcomes must largely be achieved in the rural or systemwide context associated with flood management improvements. The urban portfolio instead focuses on actions that most effectively and resiliently improve public safety and economic stability for urban areas.

#### *Reducing Vulnerability for Urban Areas*

Because it is very difficult to reduce or limit exposure in urban areas, further investment must manage residual risk by reducing human and economic vulnerability. This is accomplished in the urban setting by improving resourcefulness and evacuation capabilities in the face of impending floodwaters, and by increasing the ability of critical structures to withstand some flooding. The following action types contribute to these outcomes: risk awareness campaigns, floodproofing activities, and land use planning. These action types also bolster resiliency by introducing an element of risk reduction to the urban setting that is adaptable to changing flood risks over time.

#### *Increasing System Performance for Urban Areas*

Urban levee improvements increase system performance for urban areas, which can significantly help improve public safety and economic stability. However, they do not greatly increase the system's resiliency to stressors over the long term; they further harden, rather than add flexibility to, the flood management system, require ongoing maintenance to remain effective, and in fact can encourage risky behaviors (such as further development). Therefore, it is important that these investments are balanced with other systemwide efforts aimed at attenuating flood flows and reducing stage (like expansions to the Yolo Bypass) and at managing residual risk. Table 2-2 summarizes the potential that the different types of urban management action categories have for contributing to societal values, and to bolster resiliency toward meeting those values in a long-term and sustainable way.

Table 2-2. Urban Management Action Categories Potential to Contribute to Societal Values and the Resiliency of Those Outcomes Over Time

| Management Action Category | Contribution to Public Safety | Resiliency of Public Safety Outcomes | Contribution to Economic Stability | Resiliency of Economic Outcomes | Contribution to Vital Ecosystems | Resiliency of Ecosystem Outcomes | Contribution to Enriching Experiences | Resiliency of Enriching Experience Outcomes |
|---|---|---|---|---|---|---|---|---|
| Levee improvements | Very High | Low | Very High | Low | Low | Low | None | N/A |
| Other infrastructure and multi-benefit improvements | High | Low | High | Low | None | N/A | None | N/A |
| Risk awareness, floodproofing, and land use planning | Moderate | High | Moderate | High | Low | Low | Low | Low |

Note: Contribution rated as None, Low, Moderate, High, or Very High

Figure 2-6. Conceptual Urban Balanced Portfolio

*Relative levels of effort expended within each management action category.*

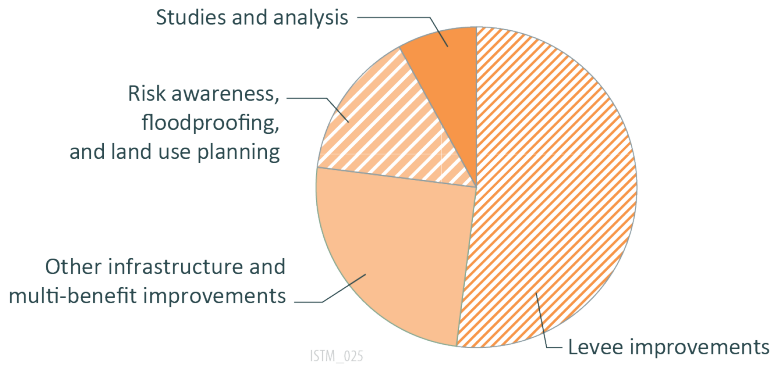



Figure 2-6 conceptually illustrates a balanced urban portfolio in terms of level of effort expended toward different management action categories. Although levee and other infrastructure multi-benefit improvements constitute the majority of actions in urban areas, a good proportion of urban activities should also be focused on risk awareness, floodproofing, and land use management. It is important to note, however, that this is *not* intended to show the relative cost of these management action categories in urban areas. Additionally, this is an *idealized* portfolio; the 2017 refined SSIA portfolio is not able to fully achieve this portfolio at this point in the CVFPP update cycle. Over time, the refined SSIA portfolio will work toward this balanced portfolio. The level of investment currently estimated for urban management action categories will be presented in Section 5.

### 2.3.3 A Balanced Rural Portfolio

The suite of potential management actions in rural areas represents the greatest potential to accomplish a broad variety of flood-specific outcomes that comprehensively address all components of flood risk. This is largely because these areas provide a greater ability to more closely integrate land use and flood management decisions in these areas so that risk can be managed across all of its components (exposure, vulnerability, and hazard). Furthermore, flood management actions can be paired with habitat restoration and other efforts to produce multiple benefits.

#### *Reducing Exposure and Vulnerability in Rural Areas*

Management actions that limit exposure and vulnerability are also needed in rural areas to address residual risk and to boost system resiliency toward long-lasting public safety and economic stability. Two management action types in the rural footprint are aimed primarily at managing human and economic exposure and vulnerability:

- Land acquisitions and easements
- Risk awareness, floodproofing, and land use planning

Easements are much more common than land acquisitions and can come in many different forms. The most basic flood management easements are flowage easements on high-risk agricultural land, or easements that keep high-risk land in agricultural production and place restrictions on other types of development. Land acquisitions and easements are extremely effective at limiting human and economic exposure going forward by dis-incentivizing or restricting human settlement or economic development in high-risk floodplains. They may also

reduce economic vulnerability by incentivizing land use decisions and management that is more compatible with occasional flooding. Another potential outcome from such actions is the preservation of farmland in some areas. Land acquisitions and easements also open up the possibility of leveraging the land for habitat restoration or other activities with ecosystem outcomes (for example, if an agricultural easement contains an agreement to conduct wildlife-friendly agricultural practices).

Risk awareness and land use planning activities also work to limit exposure by dis-incentivizing or restricting human settlement and/or economic development in high-risk floodplains. Furthermore, risk awareness and land use planning reduce human and economic vulnerability by making floodplain residents and businesses more aware of and prepared for potential flooding. Floodproofing activities specifically target economic vulnerability by making some critical facilities and farmsteads less vulnerable to damages when flooding occurs.

Finally, habitat restoration and reconnection management actions in rural areas are an important component of a balanced portfolio because rural areas often contain the best and most cost-effective opportunities for improving ecosystem functionality. These management actions also have the potential to contribute to societal values in resilient ways. For instance, habitat restoration may limit life and economic exposure within the project footprint, and increase public safety and economic resiliency by transitioning the land use to one that benefits from, rather than is harmed by, oncoming floodwaters. If project footprints are big enough and in areas that might have otherwise been developed, this may bolster overall system resiliency.

#### *Increasing System Performance for Rural Areas*

Some of the more traditional rural management actions are aimed primarily at reducing economic risk on floodplains by improving or maintaining performance of the flood conveyance system:

- Rural levee repair and infrastructure improvements
- Small-scale levee setbacks and floodplain storage

However, these management actions differ greatly in their potential to bolster resiliency toward these economic flood-specific outcomes and to contribute to other societal values.

Many rural levee and infrastructure improvements, for instance, may reduce economic resiliency if they reduce system adaptability and lead to counterproductive risk intensification. This is a particular concern for levee upgrades or the construction of new levees in rural areas. These activities typically do not have significant potential for contributing to other societal values.

Small-scale levee setbacks and floodplain storage activities provide a more resilient approach to improved system performance for rural areas because they make room for, rather than concentrate, floodwaters. These types of actions also have the potential to contribute to other flood-specific outcomes. For instance, they may contribute to public safety by limiting life exposure in the project footprint, and contribute to vital ecosystems if leveraged to improve the landscape in ways recommended by the CVFPP Conservation Strategy. These activities also sometimes open areas for recreational use or other enriching experiences that were previously unavailable.

Table 2-3 summarizes the potential of the different types of rural management actions to contribute to societal values, and their potential to bolster resiliency in terms of the system's ability to continue contributing meaningfully to those outcomes over time.

Table 2-3. Rural Management Action Categories Potential to Contribute to Societal Values and the Resiliency of Those Outcomes Over Time

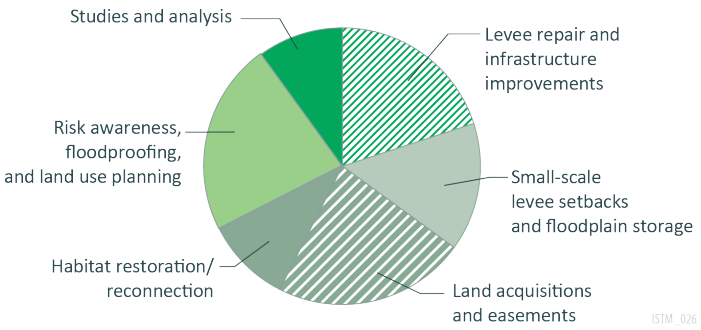
| Management Action Category | Contribution to Public Safety | Resiliency of Public Safety Outcomes | Contribution to Economic Stability | Resiliency of Economic Outcomes | Contribution to Vital Ecosystems | Resiliency of Ecosystem Outcomes | Contribution to Enriching Experiences | Resiliency of Enriching Experience Outcomes |
|---|---|---|---|---|---|---|---|---|
| Levee repair and infrastructure improvements | Low | Low | Moderate | Low | Low | Low | Low | Low |
| Small-scale levee setbacks and floodplain storage | Low | Moderate | Moderate | Moderate | Moderate | High | Moderate | High |
| Land acquisitions and easements | Moderate | Very High | High | Very High | Low | High | Moderate | High |
| Habitat restoration and reconnection | Moderate | Very High | Moderate | Very High | Very High | High | Moderate | High |
| Risk awareness, floodproofing, and land use planning | Moderate | High | High | High | Low | High | Moderate | High |

Note: Contribution rated as None, Low, Moderate, High or Very High

Based on the preceding discussion, Figure 2-7 conceptually illustrates a balanced rural portfolio in terms of level of effort expended toward different management action categories. A diverse portfolio of flood management actions in rural areas can contribute to all four societal values in a resilient way. To do so, efforts would reflect Figure 2-7 in their fairly even distribution of actions taken toward all potential rural management action categories, with a slightly greater focus on these two:

Figure 2-7. Conceptual Rural Balanced Portfolio

*Relative levels of effort expended within each management action category.*




- Land acquisitions and easements
- Risk awareness, floodproofing, and land use management

Additionally, this is an *idealized* portfolio; the 2017 refined SSIA portfolio isn't able to fully achieve this portfolio at this point in the CVFPP update cycle. Over time, the refined SSIA portfolio will work toward this balanced portfolio. The level of investment currently estimated for rural management action categories is presented in Section 5.

### 2.3.4 A Balanced Small Communities Portfolio

Like urban areas, small communities in floodplains contain higher risks to human life than rural areas, and the density of development somewhat limits the types of management actions available. However, unlike urban areas, the smaller scale of development and openness of the surrounding landscape often allows for a more diverse and resilient approach to flood management. It also provides solutions that address all components of risk and contain more multi-benefit opportunities.

#### *Reducing Exposure and Vulnerability in Small Communities*

When viable, levee setbacks, land acquisitions, and floodplain storage activities represent the most resilient means of improving system performance within the small community footprint; they tend to limit exposure and add to system capacity rather than concentrating flows. These types of activities also have the potential to contribute to other societal values by providing more flood-adaptive land that could be leveraged for habitat restoration or other enriching experiences.

Residual risk is managed for small communities the same way that it is in urban areas, through investments in risk awareness, floodproofing, and land use planning activities. Risk awareness targets human vulnerability by increasing residents' understanding of flood risk and incentivizing them to better plan and prepare for flood emergencies. In small communities, risk awareness activities have the added benefit of potentially limiting exposure by incentivizing new settlement to occur outside of higher risk areas. Floodproofing activities target economic vulnerability by improving the ability of critical facilities and other floodplain properties to withstand some flooding without significant damage. This also contributes to public safety by ensuring that critical facilities are still able to provide basic and emergency services during a flood. Finally, land use planning activities (like flood insurance requirements or building codes) can assist in reducing both life and economic vulnerability and exposure by incentivizing more flood-adaptive land use within the higher risk floodplain areas.

#### *Increasing System Performance for Small Communities*

Improved or new small community levees and structures, when targeting areas that are already densely populated, may further reduce the risk of lives lost from flooding. However, these investments must be undertaken with caution, as they can also lead to risk intensification, and may work against long-term system resiliency by reducing flexibility and concentrating flood flows. Table 2-4 summarizes the potential that the different types of small community management actions have for contributing to societal values, and their potential to bolster the resiliency of the system to continue providing those outcomes over time.

Table 2-4. Small Community Management Action Categories Potential to Contribute to Societal Values and the Resiliency of Those Outcomes Over Time

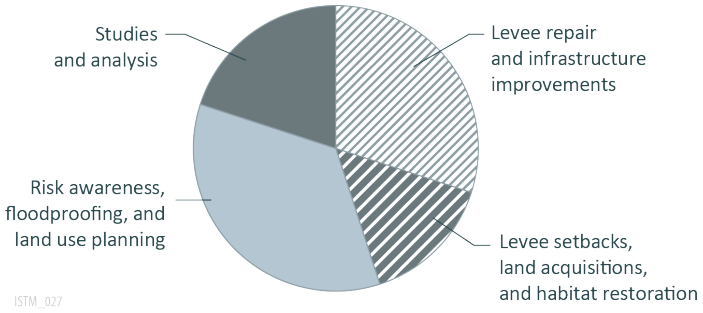
| Management Action Category | Contribution to Public Safety | Resiliency of Public Safety Outcomes | Contribution to Economic Stability | Resiliency of Economic Outcomes | Contribution to Vital Ecosystems | Resiliency of Ecosystem Outcomes | Contribution to Enriching Experiences | Resiliency of Enriching Experience Outcomes |
|---|---|---|---|---|---|---|---|---|
| Levee repair and infrastructure improvements | High | Low | Moderate | Low | None | N/A | Moderate | Low |
| Levee setbacks, land acquisitions, and habitat restoration | High | High | Moderate | High | Moderate | High | Moderate | High |
| Risk awareness, floodproofing, and land use planning | High | High | Moderate | High | Low | High | Moderate | High |

Note: Contribution rated as None, Low, Moderate, High or Very High

Based on the preceding discussion, Figure 2-8 provides a conceptual example of what an effective and balanced small community portfolio looks like in terms of level of effort expended toward different action types. While often effective, opportunities for land acquisitions and easements, small-scale levee setbacks, and floodplain storage activities can be limited. Risk awareness, floodproofing, and land use planning activities are therefore more heavily emphasized as more widely accessible and still resilient ways of managing risk for small communities.

Figure 2-8. Conceptual Small Communities Balanced Portfolio

*Relative levels of effort expended within each management action category.*




Additionally, this is an *idealized* portfolio, the 2017 refined SSIA portfolio is not able to fully achieve this portfolio at this point in the CVFPP update cycle. Over time, the refined SSIA portfolio will work towards this balanced portfolio. The level of investment currently estimated towards small community management action categories will be presented in Section 5.

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# 3.0 Prioritizing Investment to Support Intended Outcomes

The broad investment guidelines for the types of balanced action portfolios likely to be most effective for the four areas of interest across the Central Valley are described in Section 2. This section applies those guidelines and takes a deeper look at what makes up each of the management action categories in the 2017 refined SSIA portfolio and how they were prioritized relative to one another. The 2017 refined SSIA portfolio represents the updated programmatic vision for the SPFC, and does not represent a funding decision, permitting decision, or endorsement of specific projects.

**Section 3 Highlights**

- Section Outline:
  - Efforts to Develop a Database of Potential Management Actions
  - Process for Building a Portfolio
  - Portfolio Prioritization
- Key Section Takeaways:
  - Multiple planning efforts completed or initiated since 2012 provided the necessary information to develop the 2017 refined SSIA portfolio.
  - CVFPP planning process is intentionally strategic and cyclical, to be updated on 5-year intervals.
  - The 2017 refined SSIA portfolio was prioritization based on flood-specific outcomes grounded in a qualitative scoring approach.

## 3.1 Efforts to Develop a Database of Potential Management Actions

Multiple planning efforts completed or initiated since 2012 provided a wealth of data, cost, and other information that supported the identification and refinement of SSIA investment opportunities across the Central Valley. These efforts, described below, served as key data sources supporting the updated cost estimate for the 2017 refined SSIA portfolio.

### 3.1.1 State-Federal Feasibility Studies

State-federal feasibility studies and their approval by the USACE Civil Works Review Board (Review Board) play a major role in securing funding for federal projects. During the last 5 years, USACE has undertaken several feasibility studies primarily in urban areas protected by the SPFC and completed the American River Common Features and the West Sacramento River General Re-Evaluation Report (GRR) feasibility studies. These two feasibility studies were

reviewed by the Review Board in December 2015, and the Review Board recommended USACE support for the projects. Chief's Reports on these two projects are being prepared by USACE. The Chief's Report is the formal tool for USACE to communicate its recommendations to Congress for project construction authorization and eventual appropriations.

A third feasibility study, Lower San Joaquin Feasibility Study Phase 1, is being completed for the Stockton urban area and is scheduled to be submitted to the Review Board in August 2017. These three projects are all moving closer to providing 200-year protection for major urban areas in the Central Valley.

Cost estimates for implementing activities identified in the feasibility studies were included in the 2017 refined SSIA portfolio. Both the RFMPs and the State-federal feasibility studies provided a potential data source from which to sum a cost estimate for urban levee improvements in the Sacramento and San Joaquin Basins. To avoid double-counting, only the State-federal feasibility study cost estimates were used. USACE estimates were given deference for several reasons:

- Urban levee improvements identified in the RFMPs are generally consistent with those described in the USACE feasibility studies.
- State and local investments in urban areas historically have been made in collaboration with USACE and supported by its feasibility studies.
- State-federal feasibility studies provide a greater degree of consistency in cost estimation.
- The USACE Civil Works Review Board has already recommended support for several feasibility studies by in recent years.

Several other studies that DWR is anticipated to partner in were included in the cost estimation for the studies and analysis management action category under the urban area of interest. An estimate of $4M per study was applied to these studies to cover the cost of State participation. These studies include the Sacramento River GRR, Cache Creek Settling Basin GRR, Woodland Lower Cache Creek Feasibility Study, Yuba Goldfields Study, Yuba River GRR, Lower San Joaquin Feasibility Study Phase 2, Merced County Streams GRR, and the Central Valley Integrated Flood Management Study (CVIFMS) Phase 2.

### 3.1.2 Basin-Wide Feasibility Studies

The BWFSs for the Sacramento Basin and the San Joaquin Basin recommended a range of multi-benefit actions to refine larger-scale actions in the SSIA in multiple phases; accordingly, their level of detail ranges from a full feasibility-level analyses to a reconnaissance-level look at potential concepts. Options for meeting the goals and objectives of the BWFS were formulated using various combinations of bypass, storage, and weir expansions in the SPFC. These options were evaluated on the basis of their effectiveness at increasing system resiliency, promoting integrated and multi-benefit opportunities in a cost-efficient manner. Conceptual designs and cost estimates were prepared for features included in the various options evaluated in the BWFS. Before any of these actions can advance to project-level studies, it will be necessary to perform further analysis, design, and cost estimating associated with those refinements. However, the

BWFSs still represent some of the most detailed descriptions and cost estimates available for the 2017 CVFPP Update.

### 3.1.3 Regional Flood Management Planning

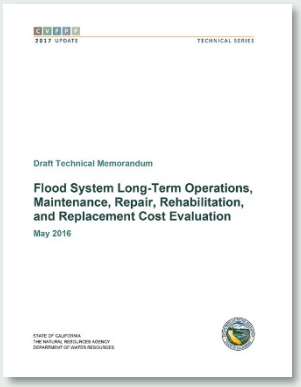
The six RFMPs provide information about various regionally supported management actions and project opportunities, along with associated costs and timelines. The RFMP cost estimating methods were not uniform among the six regions, and costs were not available for all listed projects. However, these plans provided the basic information needed to identify regional priorities and flood risk reduction projects, and to begin the process of compiling comparative costs.

In many cases, separate regions provided the same or slightly alternative projects as those evaluated within the BWFS, State-federal feasibility studies, or other regional plans. Adjustments were made to avoid double-counting and ensure that the most recent information was included in the 2017 refined SSIA portfolio. For example, deference was given to the State-federal feasibility studies for a large portion of the regional proposed urban improvement cost estimates because they are commonly performed with a standardized level of effort and methodology. In general, the RFMPs provided the majority of the cost estimates for rural and small community management actions.

### 3.1.4 OMRR&R Workgroup and Technical Memorandum

An OMRR&R workgroup was convened to identify true long-term OMRR&R costs over a 50-year time horizon in the SPFC planning area. The workgroup developed cost estimates based on reviewing a variety of sources and input received from DWR staff, LMA representatives, and regional stakeholders/ and experts. Projected OMRR&R costs identified by this workgroup focus on *future* ongoing annual maintenance and repair, rehabilitation, and replacement needs. Although discussed in the TM, the workgroup's cost estimates do not account for necessary deferred maintenance and repairs required to address known design deficiencies. The workgroup focused instead on the true cost of long-term OMRR&R throughout the SPFC moving into the future *after deferred maintenance is completed*. Other key efforts supporting the CVFPP, such as the RFMPs, address needed deferred maintenance and repairs. DWR's flood project inspections and Flood System Repair Project (FSRP) also provided information on deferred maintenance and repair needs to supplement what was described in the RFMPs. These efforts collectively identified solutions to address deferred maintenance and repairs in support of a more resilient flood management system.

## Understanding the True Cost of OMRR&R




Many parts of the flood system are aging and experiencing a substantial backlog of deferred maintenance resulting in part from a lack of consistent funding. In response, the 2012 CVFPP included the improvement of operations and maintenance as the first of its supporting goals. Additionally, several LMAs[1] have passed assessments pursuant to the requirements of Proposition 218 during the past 5 years to address deferred maintenance.

While progress has been made to address these issues, necessary ongoing maintenance is still critically underfunded. Within their budgets and assurances, maintainers must make difficult decisions and prioritize their work to sustain a functioning flood control system. Societal expectations, changing standards, regulatory requirements, and multiple uses of the flood management system have all influenced the current cost of OMRR&R.

DWR convened an OMRR&R workgroup after adoption of the CVFPP in 2012 to identify true long-term OMRR&R costs of current and proposed urban and rural facilities[2] in the SPFC planning area over a 50-year time horizon.[3] This true-cost analysis is meant to include both the State and local shares of OMRR&R activities, and assumes no accumulation of future deferred maintenance. The workgroup developed cost estimates based on review of a variety of sources and input received from DWR staff, LMA representatives, and regional stakeholders and experts.

Projected OMRR&R costs identified by this workgroup focus on future needs:

- Future ongoing annual routine maintenance needs, estimated at $88M annually
- Future repair, rehabilitation and replacement needs, estimated at $43M annually
- Total future OMRR&R estimate: $131M annually

**Total future OMRR&R cost estimate:**
$131M annually

The workgroup's cost estimates do not account for necessary deferred maintenance and repairs required to address known design deficiencies. The OMRR&R Workgroup focused instead on the true cost of long-term OMRR&R throughout the SPFC after deferred maintenance is complete. The OMRR&R TM provides a justification for these cost estimates to support this CVFPP Update.

Deferred OMRR&R costs were identified by RFMPs and other sources:

- Deferred ongoing annual routine maintenance needs estimate: $18M to $22M annually
- Deferred repair, rehabilitation, and replacement needs estimate: $20M to $25M annually
- Total deferred OMRR&R estimate: $38M to $47M annually

**Total deferred OMRR&R cost estimate:**
$38M to $47M annually

Other key efforts supporting the CVFPP, such as the RFMPs, address needed deferred maintenance and repairs. DWR's flood project inspections and Flood System Repair Project (FSRP) also provided information on deferred maintenance and repair needs to supplement what was described in the RFMPs. These efforts collectively identified solutions to address deferred maintenance and repairs in support of a more resilient flood management system. The present value of deferred and future repair, rehabilitation and replacement needs are reflected in the capital investments of the 2017 refined SSIA portfolio. Deferred and future annual routine maintenance needs are reflected in the ongoing investments of the 2017 refined SSIA portfolio.

[1] LMAs passing assessments since 2012 include TRLIA, RD 784, RD 999, RD 900, RD 1001, RD 10, RD 2103, RD 536, and San Joaquin County.

[2] The estimated true long-term OMRR&R costs assume fully functioning facilities that meet applicable standards. The true-costs analysis included the following urban and rural SPFC facilities: levees, channels, major structures (as described in CWC Section 8361 and 12878 and administered by DWR, and include weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants), and minor structures (stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments). Non-project levees and non-project ecosystem and multi-benefit features are not included within the OMRR&R true costs provided by the OMRR&R workgroup.

[3] Although the CVFPP has a 30-year time horizon, a 50-year time horizon was chosen for this effort because it better corresponds to the typical design life of flood management infrastructure.

### 3.1.5 Other Action and Cost Estimation Efforts

To provide a comprehensive 2017 refined SSIA portfolio, DWR led additional efforts to estimate potential opportunities and their associated cost for important flood and floodplain management activities not sufficiently captured by the major studies listed above. These supplemental efforts included (1) the State operation/planning cost estimation effort, (2) the emergency management cost estimation effort, and (3) the floodplain management cost estimation effort.

The emergency management cost estimation effort and floodplain management cost estimation effort resulted in estimated capital investments for potential future agricultural or conservation land acquisitions and easements in rural areas and small communities; ongoing emergency management on a systemwide scale; and ongoing risk awareness, flood-proofing, mapping, and land use planning for urban, rural, and small community areas of interest. DWR led this cost-estimation effort and documented its important findings and the detailed methodology used to develop these costs. The emergency management cost estimation support and floodplain management cost estimation support is provided in Appendix D.

The State operation/planning cost estimation effort resulted in estimated ongoing funding needs to support future State flood management operations, planning, coordination with federal agencies, systemwide tool and model development, and the development of a new performance tracking system that will track the effectiveness of future flood investments. DWR led this cost-estimation effort and documented its important findings and the detailed methodology used to develop these costs. The State operations, planning, and performance tracking effort is described in Appendix D. Additionally, this effort accounted for the costs associated with addressing the eight flood-management-related policy issues described in the 2017 CVFPP Update, which includes DWR and other agency staffing and resource needs.

## 3.2 Process for Building a Portfolio

Individual flood management projects typically follow a fairly linear life-cycle (planning, design, implementation, operations, maintenance, and eventually abandonment or replacement). The CVFPP is intended to continually inform State investment in such projects, and to more broadly inform the State's general participation in Central Valley flood management. In this way, the planning process for Central Valley systemwide and strategic flood protection differs from an individual project's life-cycle because strategic planning is intentionally cyclical, to be updated on 5-year intervals. Several important characteristics are inherent to these cyclical updates:

- Potential management actions can be at various stages of development and refinement in any given update.

- Plans or projects that did not make a strong enough case for State investment in one cycle can be refined and reconsidered in a future update.

- Individual actions (proposed plans and projects) can be better and more optimally integrated with other actions (taking into account interdependencies) so that State investments work together to cost-effectively and resiliently achieve their intended outcomes.

Figure 3-1 provides a more detailed look at the various steps in the CVFPP planning cycle that formulated the 2017 refined SSIA portfolio. Management actions provided by the several sources described in Section 3.1 were at different stages within the cycle at any given time during the 2017 CVFPP Update, and work has continued throughout the process.

### 3.2.1 Collection of Potential Management Actions

Potential management actions were identified through multiple planning and implementation efforts completed or initiated since 2012. As discussed in more detail in Section 3.1, these efforts include State-Federal feasibility studies, BWFSs, RFMPs, OMRR&R TM, and other efforts that provided detail on emergency and floodplain management activities and State operation, planning, and performance tracking activities. The BWFSs and RFMPs also included ecosystem restoration or enhancement actions that were guided by the Draft CVFPP Conservation Strategy. These identification efforts formed the basis of a continually updated collection of potential CVFPP management actions that are organized in an Excel database.

### 3.2.2 Selection of Actions with Potential State Interest

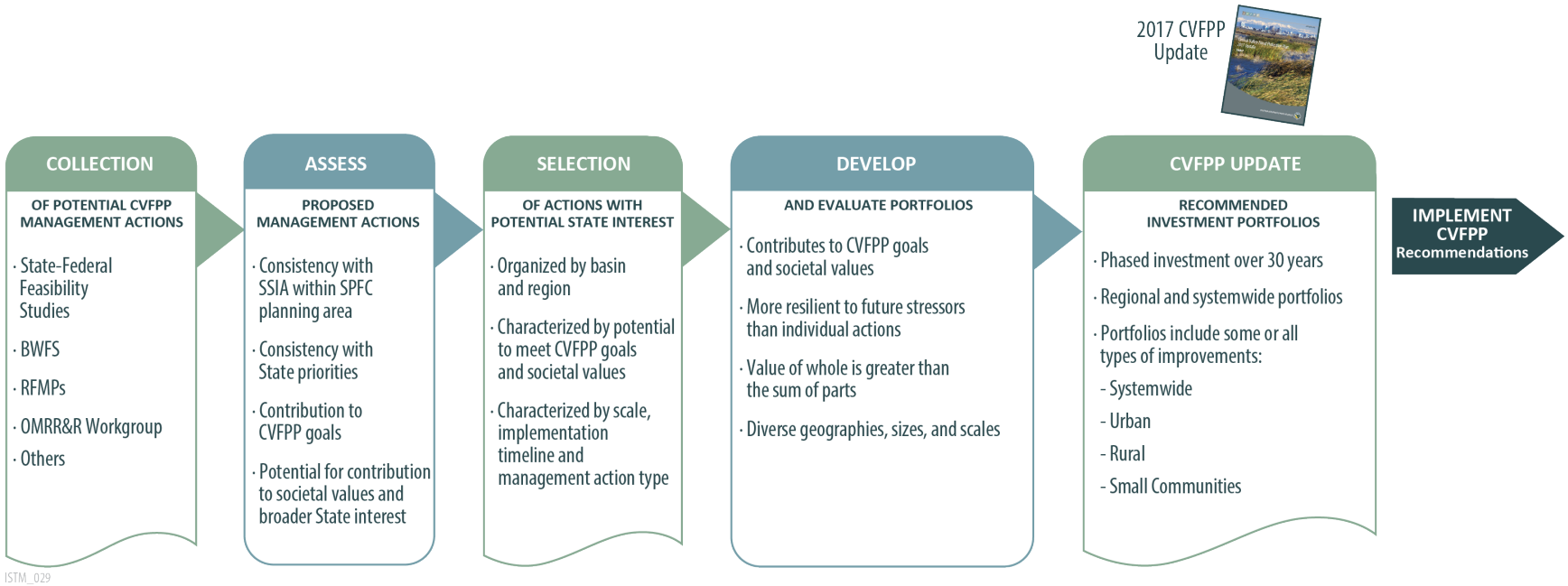
Before prioritizing investment, DWR first screened the collection of proposed actions against a set of basic criteria to test relevance to the 2017 CVFPP Update:

- The action is located within the SPFC planning area (as defined in the 2012 CVFPP).
- The action is consistent with the SSIA and could contribute to CVFPP goals and associated societal values.
- The action is consistent with the State and federal policies regarding wise use of floodplains.
- Actions protecting a small community (as designated in the 2012 CVFPP) were automatically retained.

Only actions that are relevant to the SPFC, consistent with the SSIA, seem likely to contribute to one or more CVFPP goals and associated societal values, and are consistent with the State and federal policies for wise use of floodplains passed through the first screen. This assessment effort resulted in a selection of actions with potential State interest. This selection is organized by basin and region, with projects characterized by their potential to meet intended outcomes, their scale, and their implementation timeline.

It is important to note that all actions not meeting the criteria for the selection will remain in the collection of potential actions and can be appropriately refined or modified to better meet state interest in future CVFPP updates.

Figure 3-1. 2017 CVFPP Update Development Process



### 3.2.3 A Refined SSIA Portfolio

Actions taken across different areas within a region or river basin often affect or interact with other actions taken upstream or downstream, and can sometimes have secondary consequences unrelated to the intended outcomes of the investment. The effectiveness of any one action can, therefore, not be evaluated without considering dependencies and interactions with other actions in the same region or basin. This step of the CVFPP planning process considers an action's potential to be combined with others to more resiliently balance State investment across multiple action types and areas of interest. This step also considers expertise from many State and local partners.

All management actions in the 2017 refined SSIA portfolio were grouped into discrete categories of management action types in an Excel prioritization database. The details of these management actions and the management action types used to classify the 2017 refined SSIA portfolio are provided in Appendix B. After management actions were discretely classified, they were rolled up into either the capital or ongoing investment categories organized by the four areas of interest (systemwide, urban, rural, and small community). These portfolios of management actions were then assessed and scored for their potential to contribute to the four broader societal values and flood-specific intended outcomes. Section 3.3 provides details on how management actions were scored and prioritized.

### 3.2.4 Implementation of the 2017 Refined SSIA Portfolio

Although recent improvements to the SPFC began in 2007 as State bond funds became available, the 2017 CVFPP Update provides a refined SSIA portfolio of actions needed to improve flood risk management over the next 30 years. Continued implementation of the CVFPP will be achieved in coordination with federal, State, and local agencies and programs. The State will implement projects with its partners as funding is secured and as projects mature from planning to design, permitting, and construction. DWR has five major flood management programs with specialized roles in CVFPP implementation:

- Flood Management Planning
- Floodplain Risk Management
- Flood Risk Reduction Projects
- Flood System Operations and Maintenance
- Flood Emergency Response

These programs are discussed further in Section 8 to highlight their roles in project implementation.

### 3.2.5 Accountability through Performance Tracking

Progress toward achieving the CVFPP goals can be measured as management actions are implemented. Performance tracking of outcomes associated with the CVFPP and its goals is aligned with the following societal values described in Section 2:

- Provide for public health and safety
- Sustain vital ecosystems
- Support a stable economy
- Provide opportunities for enriching experiences

Achieved outcomes must be tracked, measured, and compared to intended outcomes. Performance tracking is what allows the planning cycle to continually inform a new collection of potential CVFPP management actions. Without this step, it is impossible to know whether goals are being met and whether our current cause-and-effect assumptions and dependencies within the flood-management system are correct. In other words, this step is crucial for ensuring that future CVFPP updates make adjustments for continued evolution toward greater flood-management effectiveness and a more resilient flood-management system that delivers broad, sustained benefits over time. Performance tracking also provides a system of accountability and a method for demonstrating return on investment for the California taxpayer.

## 3.3 Portfolio Prioritization

Section 2.6 established broad investment guidelines for management action portfolios in terms of level of activity, or resources, that should be dedicated to particular action types. These guidelines were used to inform a scoring and prioritization method developed as part of the study and planning efforts described above. This section describes the process for scoring management actions in the 2017 refined SSIA portfolio and provides detail on the Excel management action prioritization database.

### 3.3.1 Scoring Management Actions

***Qualitative Scoring Approach***

The wide diversity of sources that identified potential management actions for the *collection* and the subsequent *selection* of management actions resulted in wide variation in the level of detail provided for specific project information. For example, an especially high level of detail and understanding has been developed for actions studied in the State-federal feasibility studies and BWFSs. In contrast, the management actions identified through the RFMPs, OMRR&R TM, and other efforts are generally described at the higher, reconnaissance- or planning-level scales, which are inherently less detailed. Therefore, scoring of all management actions was first based on a mostly qualitative assessment of whether an action had the *potential* to contribute to outcomes of interest, as opposed to a more quantitative assessment of the action's actual performance with regard to those outcomes. The following discussion describes this qualitative scoring approach.

**Purpose of the Scoring Process**

The scoring process was intended to highlight and reward those actions that seemed to have potential to do more of the following:

- Contribute to highly weighted flood-specific outcomes and societal values, with weights differing for the four areas of interest (system, urban, rural, small communities)
- Contribute to multiple flood-specific outcomes and/or societal values
- Increase system resiliency

The following examples of two substantially different theoretical actions help illustrate how scoring might be applied across such great variability. A floodplain storage management action in a rural area might score well because it has the potential to contribute to public safety, economic stability, and ecosystem vitality through transitory storage, groundwater recharge, and habitat enhancement. However, a levee improvement action that serves only to protect a critical facility in a densely populated area could score similarly well because of the high weight, or importance, assigned to critical facility functionality within densely populated areas. These two actions could receive the same overall score. This point is important because it illustrates that a management action need not necessarily be multi-benefit to receive a high score.

**Methodology: Nested Weighted Sums for Societal Values and Flood-Specific Outcomes**

The management actions carried forward into the *selection* were assessed for whether or not they seemed likely to contribute to flood-specific intended outcomes and broader societal values. Each management action or action type within the *selection* was scored against criteria using a series of nested "weighted sums." These nested sums were used to explicitly account for the expected ways that proposed actions might change physical assets and behaviors to contribute to tangible, flood-specific outcomes, and further how those achievements might contribute toward broader societal values.

**Assessing an Action's Potential to Contribute to Societal Values**

The highest level of assessment within the nested weighted sums is an assessment of the action's potential to contribute to a resilient, dynamic balance among the four societal values, weighted by the various degrees to which each of those values depends on effective flood management in order to maintain that balance. The potential for a management action to bring about these outcomes of State interest ($P_{SI}$) is described as follows:

$$P_{SI} = (w_{PS} \times P_{PS}) + (w_{ES} \times P_{ES}) + (w_{ECO} \times P_{ECO}) + (w_{EX} \times P_{EX})$$

where:

$w_{PS}$ = relative importance of flood-specific outcomes that provide public health and safety

$w_{ES}$ = relative importance of flood-specific outcomes that support a stable economy

$w_{ECO}$ = relative importance of flood-specific outcomes that sustain vital ecosystems

$w_{EX}$ = relative importance of flood-specific outcomes that provide opportunities for enriching experiences

and:

$P_{PS}$ = 0 or 1, with 1 indicating that the management action has the potential to generally improve public health and safety (by reducing risk of lives lost or injured from flooding)

$P_{ES}$ = 0 or 1, with 1 indicating that the management action has the potential to bring about outcomes that support a stable economy (by balancing economic risk and reward on floodplains)

$P_{ECO}$ = 0 or 1, with 1 indicating that the management action has the potential to bring about outcomes that help to sustain ecosystem vitality

$P_{EX}$ = 0 or 1, with 1 indicating that the management action has the potential to bring about outcomes that provide enriching experiences

The CVFPP's primary goal is to improve flood risk management (both in terms of public safety and economic stability), and flood management's primary role toward the broader balance between societal values is risk reduction. Additionally, flood management also plays an important role in the promotion of ecosystem functions. Therefore, the relative importance of flood management's contributions to the societal values are weighted based on the results of the sensitivity analysis below:

- $w_{PS}$ = 0.325
- $w_{ES}$ = 0.325
- $w_{ECO}$ = 0.25
- $w_{EX}$ = 0.10

The above weighting is intended to balance the societal values according to the primary and supporting goals of the CVFPP. A brief sensitivity analysis was performed on the societal value weights to test the results' sensitivity to changes in the weighting scheme. Table 3-1 presents the weights considered.

Table 3-1. Sensitivity Testing of Societal Value Weighting

| Weighting Test | Societal Values Weighting | | | | Potential Score |
|---|---|---|---|---|---|
| | Public Safety | Economic Stability | Ecosystem Vitality | Enriching Experiences | |
| 1[1] | 0.325 | 0.325 | 0.25 | 0.1 | 1 |
| 2 | 0.225 | 0.225 | 0.5 | 0.05 | 1 |
| 3 | 0.3 | 0.3 | 0.3 | 0.1 | 1 |
| 4 | 0.4 | 0.2 | 0.3 | 0.1 | 1 |

Note:
1. Weighting selected for analysis

The sensitivity analysis found that the relative performance of each action did not change significantly unless one societal value dominated all of the others, such as in the fourth weighting test. This is because the scoring is set up partially to highlight the types of actions capable of contributing to multiple intended outcomes (guided by the CVFPP's supporting goal of promoting multi-benefit projects), and partially because many of the actions that scored

especially highly still score highly even with slight changes in the weighting scheme. The weighting used in Test 1 was selected because it represents the closest nexus with the CVFPP goals while still balancing across the societal values.

### Weighted Sums for Flood-Specific Outcomes

Not all criteria associated with the intended flood-specific outcomes were weighted the same. They varied depending on area of interest. To demonstrate this, weighting of flood-specific outcomes related to public health and safety are shown below. Weighting for all other flood-specific outcomes for the other three societal values were done in a similar fashion.

The score for an action's overall potential to reduce lives lost or injured as a result of flooding ($\mathbf{P_{PS}}$) is calculated as a weighted sum of its potential to minimize human exposure and vulnerability, while increasing system performance to minimize flood hazard:

$$P_{PS} = (w_{EX} \times P_{EX}) + (w_{VU} \times P_{VU}) + (w_{SY} \times P_{LH}) + (w_{O} \times P_{OTHER})$$

where:

$w_{EX}$ = Relative importance of minimizing number of people within the floodplain (human exposure)

$w_{VU}$ = Relative importance of reducing human vulnerability when flooding occurs

$w_{SY}$ = Relative importance of increasing system performance in populous areas (to minimize flood hazard)

$w_{O}$ = Relative importance of any other means of reducing risk to public safety not captured in the other terms

and:

$P_{EX}$ = 0 or 1, with 1 indicating that the management action has the potential to minimize number of people within the floodplain (human exposure)

$P_{VU}$ = 0 or 1, with 1 indicating that the management action has the potential to reduce human vulnerability when flooding occurs

$P_{SY}$ = 0 or 1, with 1 indicating that the management action has the potential to increase system performance in populous areas (to minimize flood hazard)

$P_{OTHER}$ = 0 or 1, with 1 indicating that the management action has the potential to reduce risk not captured in the other terms

### Weights Differ Based on Population

The importance of (or weight assigned to) specific outcomes was varied depending on whether the action was thought to primarily impact a rural versus densely populated area. Section 2 provided broad guidance for the types of actions and outcomes that are likely to be most effective towards the four societal values when considering a rural, urban, or small community context. This guided the weighting procedure used to score management actions within the s*election.* For example, the outcome of limited exposure was weighted higher relative to increased performance in rural areas than in urban areas.

Project descriptions were then used to assess the potential for individual proposals within a given management action category to contribute to each outcome. Table 3-2 provides the weights assigned to flood-specific outcomes and societal values for both densely populated and rural areas.

Table 3-2. Scoring Criteria and Sub-Criteria

| Societal Value | Flood-Specific Outcome | Flood-Specific Weight | | Societal Value Weight |
|---|---|---|---|---|
| | | Densely Populated | Rural Areas | |
| Public Health and Safety | Minimize number of people within the floodplain | 0.15 | 0.42 | 0.325 |
| | Reduce human vulnerability when flooding occurs | 0.39 | 0.42 | |
| | Increase system performance in populous areas | 0.45 | 0.15 | |
| | Other: Action includes other components that contribute to Public Health and Safety | 0.01 | 0.01 | |
| Ecosystem Vitality | Reduce stressors on riverine and floodplain ecosystems | 0.05 | 0.05 | 0.25 |
| | Improve the riverine and floodplain habitats and ecosystems | 0.55 | 0.55 | |
| | Increase and maintain the abundance and diversity of floodplain dependent native species | 0.4 | 0.4 | |
| Economic Stability | Minimize property and assets within the floodplain | 0.05 | 0.35 | 0.325 |
| | Reduce economic vulnerability when flooding occurs | 0.30 | 0.25 | |
| | Increase system performance for economically developed areas | 0.40 | 0.15 | |
| | Produce or maintain economic benefits on floodplains | 0.2 | 0.2 | |
| | Other: Action includes other components that contribute to Economic Stability | 0.05 | 0.05 | |
| Enriching Experiences | Provide recreational benefits | 0.2 | 0.2 | 0.10 |
| | Support societal/aesthetic values | 0.2 | 0.2 | |
| | Provide education and public awareness | 0.2 | 0.2 | |
| | Protect significant farmland | 0.4 | 0.4 | |
| Total: | | 1.00 | 1.00 | 1.00 |

### *Accounting for Scoring Shortcomings*

After results were produced and interpreted from the qualitative scoring, it was clear that the nested weights were unable to capture all of the nuances needed to prioritize investment within the complex flood management system. First, the method does not provide a way to capture and rightfully account for the magnitude of benefit that some of the management actions could potentially provide (when information on magnitude of benefit is available). Second, the scoring procedure lumped small communities and urban areas together as "densely populated" areas, but in reality, these two areas have some significant differences in risk reduction opportunities. Finally, the methodology did not provide a means for prioritizing critical repairs over other repair and rehabilitation activities. Therefore, a secondary layer of scoring was applied to management actions falling into at least one of the following three categories:

- BWFS management actions and some other management action types from DWR-led efforts, for which a higher level of understanding exists about relative performance and magnitude of benefit

- Some small community actions, for which the "densely populated" label and weighting scheme did not properly account

- Critical maintenance and repairs for rural areas

In all cases, this second layer of scoring represented a boost, or additional credit, on top of the original score. This approach was used (instead of a multiplier of some sort) so that it is possible to distinguish between actions with a higher level of certainty or understanding, and actions based purely on a qualitative assessment of potential. This allowed actions with a known high magnitude of benefit to score better than other actions having only the potential to contribute to a multitude of highly valued outcomes.

### Magnitude of Benefit for BWFS Management Actions

A limited number of actions' scores were boosted to account for magnitude of benefit. For instance, some systemwide investments (like the Yolo Bypass multi-benefit improvements) not only contribute to a multitude of intended outcomes, but do so in a way that is much more significant than any small-scale levee improvement or setback project. Overall, an especially high level of detail and understanding has been developed for actions studied in the State-federal feasibility studies and BWFSs. Actions from these studies could therefore be evaluated and scored based on more quantitative analyses. When enough information was available for particular actions, they were rated as having a low, medium, or high level of contribution to certain flood-specific outcomes of interest. This adjustment reconciled the management actions' overall total score.

### Variance of Opportunities between Densely Populated Areas

Although both urban areas and small communities are densely populated in a limited geographical space, each presents diverse ways to approach opportunities for risk reduction:

- Urban areas tend to have more physical restrictions, directing risk reduction measures more to strengthening in-place levees and other infrastructure, maintaining channel capacity and increasing emergency management. Land uses are usually less flexible, space limited, and property acquired, limiting applicable management actions.

- Small communities tend to have more open space around them, with greater potential for management actions such as levee setbacks and floodplain storage. Floodplain risk awareness campaigns, floodproofing, and implementation of land use management policies are particularly effective at risk reduction for small communities and can be implemented fairly quickly.

For instance, it may be more feasible to evacuate the residents of a small community with improved notification and risk awareness activities, than it would be in a large urban center. Additionally, floodproofing improvements, including elevation of structures, may be more feasible in small communities than in urban areas..

Due to the grouping of urban areas and small communities, scoring had to be reconciled to account for these differences. When enough information was available, some scores for small community management actions were boosted with an adjusted score of low, medium or high level of contribution to certain flood-specific outcomes (similar to adjustments made for the BWFS actions described previously). Total scores for these management actions reflect these changes.

### Maintenance and Critical Repairs for Rural Areas

Improved routine maintenance and critical repairs may improve flood system performance in rural areas. The qualitative scoring process did not capture the urgency of some of these critical repairs due to the one-size-fits-all approach to capital investments for repair, rehabilitation, and replacement, and the large cost usually associated with these activities. Therefore, where enough information was available, the score for critical repair actions were boosted with a rating of low, medium, or high level of contribution to certain flood-specific outcomes, and total scores were adjusted accordingly.

### A Note on Cost Effectiveness

This type of qualitative scoring procedure at a program level is very different from asking if a particular project is the most cost-effective way to achieve specific objectives set at a more local scale. This latter form of assessment requires a detailed understanding of the extent to which various alternative approaches may help achieve a set of objectives (i.e. an understanding of the magnitude of benefit of any one project) relative to the cost of each alternative. This kind of more detailed and technical assessment is necessary when a grant program must make project-specific funding decisions, but is not necessary for the higher-level investment strategy that is being developed here. In the future, there could be an opportunity to build some way to account for cost effectiveness into the prioritization database.

***Total Score***

After the qualitative scoring process was considered and the shortcomings (as discussed) were accounted for, a total score was calculated for individual management actions by using this formula.

$$P_{SI} = (w_{PS} \times P_{PS}^*) + (w_{ES} \times P_{ES}^*) + (w_{ECO} \times P_{ECO}^*) + (w_{EX} \times P_{EX}^*)$$

$$T_{Score} = P_{SI} + S_H$$

where:

* = adjusted weighted sum for flood-specific outcomes

$S_H$ = shortcoming (high, medium, or low if applicable)

$T_{Score}$ = total management action score

A total score was used to develop State priorities that could then help guide investment phasing. In order to do this, scoring thresholds were established to indicate which management action categories were high, medium, or low priorities. Table 3-3 presents the scoring thresholds used to inform investment phasing. Section 4 describes other considerations influencing investment phasing. Section 6 provides more details on each phase of investment and the level of investment towards each management action type that is called for in each phase.

Table 3-3. Scoring Thresholds

| Priority | Management Action Score | Phase |
|---|---|---|
| High | $T_{Score} \geq 0.28$ | Phase 1: 2017–2027 |
| Medium | $0.22 \leq T_{Score} < 0.28$ | Phase 2: 2027–2037 |
| Low | $0 < T_{Score} < 0.22$ | Phase 3: 2037–2047 |

### 3.3.2 Capital Investment Priorities

All action categories have a role in achieving CVFPP goals and societal values. However, some have a greater benefit systemwide or do more to increase resiliency in support of intended outcomes, while others will have a greater marginal effect if taken sooner rather than later. Table 3-4 shows how various action categories scored, and articulates how these scores translate into priorities.

Systemwide capital investments generally scored well and are high priority because of their high levels of contribution to CVFPP goals and all four societal values, and because they represent more resilient means of increasing system performance by adding adaptive capacity to the floodplain. Actions that reduce flood risk or the probability of flooding for already urbanized or otherwise densely populated areas also scored well, because these actions will significantly contribute to the CVFPP's primary goal. In rural areas, land acquisitions and easements often scored well and are high priority because of their positive impact on limiting life and economic exposure that relate to the CVFPP primary goal. Furthermore, land acquisitions and easements

can be bundled with improvements that contribute to other flood-specific outcomes such as improved system performance, increased habitat, and the preservation of culturally significant farmland.

Other action categories demonstrate a greater degree of variability in their scores and priority. This is heavily dependent on what is known about the proposed management actions, their interdependencies with other actions, and where they are located in the system. For example, rural and small community levee repair and other infrastructure improvements range from low to high priority. Higher priority actions in those categories tended to be critical repair and rehabilitation actions that improve levee performance to levels that match current land uses, thereby rebalancing risk on the floodplain. Lower priority actions tended to be improvements for areas not densely populated or developed, and some larger scale improvements with the potential to result in risk intensification.

Table 3-4. Capital Investments Priority of the 2017 Refined SSIA Portfolio Over 30 Years

| Management Action Category and Area of Interest | Data Source | Achieved Scores[1] (All Scores > 0) | | Priority |
|---|---|---|---|---|
| | | Average Score | Standard Deviation | |
| **Systemwide** | | | | |
| Yolo Bypass multi-benefit improvements | BWFS | 1.23 | 0.78 | High |
| Feather River–Sutter Bypass multi-benefit improvements | BWFS | N/A[2] | N/A[2] | Low |
| Paradise Cut multi-benefit improvements | BWFS | 2.60 | 1.48 | High |
| Reservoir and floodplain storage | BWFSs and RFMPs | 0.99 | 0.92 | Medium to high |
| **Urban** | | | | |
| Levee improvements | USACE | 0.52 | 0.69 | Medium to high |
| Other infrastructure and multi-benefit improvements | BWFSs, RFMPs, and OMRR&R Workgroup | 0.52 | 0.86 | Medium to high |
| **Rural** | | | | |
| Levee repair and infrastructure improvements | BWFSs, RFMPs, and OMRR&R Workgroup | 0.18 | 0.12 | Low to medium |
| Small-scale levee setbacks and floodplain storage | BWFSs and RFMPs | 0.37 | 0.31 | Medium to high |
| Land acquisitions and easements | RFMPs and floodplain management effort | 0.25 | 0.1 | Medium |
| Habitat restoration/reconnection | RFMPs | 0.21 | 0.15 | Low to medium |
| **Small Community** | | | | |
| Levee repair and infrastructure improvements | BWFSs, RFMPs, and OMRR&R Workgroup | 0.47 | 0.77 | Low to high |
| Levee setbacks, land acquisitions, and habitat restoration | RFMPs and floodplain management effort | 0.19 | 0.12 | Low to medium |

Notes:
1. The maximum achieved scores by any management action was 4.75. The total possible score was 13.
2. Feather River–Sutter Bypass multi-benefit improvements were not scored because an array of multi-benefit actions is not anticipated to be recommended until after Yolo Bypass improvements are implemented. See page 3-5 of the Draft CVFPP.

### 3.3.3 Ongoing Investment Priorities

Many of the actions requiring ongoing, annual investment are high priority for their importance for long-term sustainability and resiliency. For example, emergency management and floodplain management activities represent effective and resilient means of reducing risks to lives and property as described in Section 2, and many floodplain management activities may provide additional benefits for ecosystems and enriching experiences. Also, the implementation, maintenance, and refinement of any management action is not possible without the enabling conditions established through baseline funding for State operations, technical assistance, planning, and performance tracking. Table 3-5 shows how various ongoing action categories scored, and show how these scores translate into priorities.

Table 3-5. Ongoing Investments Priorities of the 2017 Refined SSIA Portfolio Over 30 Years

| Management Action Category and Area of Interest | Data Source | Achieved Scores (All Scores>0) | | Priority |
|---|---|---|---|---|
| | | Average Score | Average Score | |
| Systemwide | | | | |
| State operations, planning, and performance tracking | RFMPs and State operations/planning effort | 0.21 | 0.16 | Medium to High |
| Emergency management | RFMPs and emergency management effort | 0.26 | 0.07 | High |
| Reservoir operations | BWFSs | 0.51 | 0.35 | High |
| Routine maintenance | RFMPs and OMRR&R Workgroup | 0.24 | 0.13 | Medium to High |
| Urban | | | | |
| Risk awareness, floodproofing, and land use planning | RFMPs and floodplain management effort | 0.25 | 0.15 | Medium to High |
| Studies and analysis | RFMPs and USACE | 0.24 | 0.06 | Medium |
| Rural | | | | |
| Risk awareness, floodproofing, and land use planning | RFMPs and floodplain management effort | 0.20 | 0.15 | Medium to High |
| Studies and analysis | RFMPs | 0.14 | 0.07 | Medium |
| Small Community | | | | |
| Risk awareness, floodproofing, and land use planning | RFMPs and floodplain management effort | 0.13 | 0.12 | Medium to High |
| Studies and analysis | RFMPs and Small Communities Program | 0.21 | 0.08 | Medium |

Note:
1. The maximum achieved scores by any management action was 4.75. The total possible score was 13.

# 4.0 Other Factors Influencing Funding

## Section 4 Highlights

- Section Outline:
  - Historical Expenditures
  - Political Sentiment
  - Cost Share Agreements
  - USACE Benefit-Based Cost Shares
  - State Liability
  - Ability to Pay
  - Willingness to Pay
  - Competing Demands and Complementary Actions
  - Challenges for Local Funding
- Key Section Takeaways:
  - External influences have a substantial impact on the implementation of CVFPP.
  - Political, economic, and feasibility considerations must be weighed before implementation can occur.
  - Many limitations affect the timing of investment.

Ideally, all high-priority investments would be implemented immediately. However, many factors shape the timing and sequence of investment.

The type and amount of funds available for implementation at various times during the 30-year planning horizon depend on other factors such as historical spending, political will to fund projects, the benefits anticipated from management actions, and the possibility of matching funds. Factors influencing this timeline are described in Table 4-1. A few of these factors are discussed in detail below.

## 4.1 Historical Expenditures

Historical expenditures provide the baseline for comparing future expenditures. This CVFPP Investment Strategy TM compiles the historical expenditures of local, State, and federal agencies that contributed to flood management in the Central Valley in Appendix A.

Table 4-1. Factors External to State Planning that Influence the Investment Strategy

| Factor | Influence |
|---|---|
| Historical expenditures | Historical expenditures provide the baseline for comparing future expenditures. This CVFPP Investment Strategy TM compiles the historical expenditures for local, State, and federal agencies that contributed to flood management in the Central Valley in Appendix A. |
| Political sentiment | Some funding mechanisms require the support of voters, the California Legislature, or policy makers. Also, proposed financing mechanisms will require new legislation to be established. The political viability of both types of mechanisms must be considered, because voters and policy makers have opposed some in the past. |
| Cost share agreements | Hundreds of projects have been cost-shared with USACE in California. In many cases, the USACE and DWR have an existing agreement on the cost shares for certain management actions. Also, many of the implementing programs (both State and federal) have cost-share percentages in place. |
| USACE benefit-based cost shares | Benefits of a project or plan are the desirable outcomes for which one or more beneficiaries would be willing to pay, though actual payment need not occur. Benefits can be measured in physical units such as physical damage avoided, acres of restored habitat, or avoided loss of life. Benefits are also measured in monetary units (dollars) when possible for the purpose of providing a common unit of measurement across all physical benefits, and to determine cost shares that are fair and that cover all costs. Other approaches to estimating benefits are avoided cost, which is the cost that would occur without the project but that is avoided or delayed with the project, and alternative cost, which is the cost of the lowest-cost, feasible alternative project that provides the same or greater level of physical benefits. |
| Ability to pay | According to generally accepted economic principles for allocating costs of public projects, beneficiaries pay for costs of the project based on the benefits they receive. This is known as the benefits received principle, or alternatively as the beneficiary pays principle. However, not all beneficiaries may be able to pay for their benefits, due to their financial circumstances. In these cases, the costs allocated to such beneficiaries may be adjusted to reflect their ability to pay. For this plan, ability to pay will limit the cost shares of some beneficiaries in rural and small communities. Note that when one or more beneficiaries have their allocated cost reduced based on ability to pay, another funding source must be identified to make up the difference in order to fund the project. |
| Willingness to pay | Willingness to pay (WTP) is a measure of the monetary magnitude of benefits accruing to one or more beneficiaries. It indicates the value in dollars of what beneficiaries would be willing to give up in order to receive the desirable outcomes of a project, assuming their funding capacity is not limited (see ability to pay). WTP can be observed directly from beneficiaries' actions, imputed using statistical or other models, or estimated from survey results. Other approaches to estimate benefits are avoided cost, the cost that would occur without the project but that is avoided or delayed with the project, and alternative cost, the cost of the lowest-cost, feasible alternative project that provides the same or greater level of physical benefits. |
| Competing demands and complementary actions | Capital and ongoing investments of the CVFPP can be competitive with other public services for funding or serve as part of a multi-benefit project to leverage additional funding sources. The investment strategy considers how available funding sources are limited and competitive at the State, national, and international scale. In addition, several ongoing efforts and several being planned may occupy or influence the same footprint as the SPFC Planning Area. |
| Challenges for local funding | Local flood management agencies face two significant challenges when raising funds for improvements to the system: Proposition 218 and development fees. Proposition 218 amended the California Constitution to restrain property-related fees that are not for "water, sewer, or refuse collection services." Local agencies must seek approval by either a majority of the property owners who would be subject to the fee, or from two-thirds of the registered voters in the same area. Flood management agencies must comply with this requirement to increase rates or fees. Additionally, many local flood management agencies are partially funded through development fees or special projects assessments that can be limited by assessment-zone boundaries. These assessment-zone boundaries impose substantial limitations on the uses of funds. This is important because downstream flooding can be caused by upstream activities. In addition, a solution or best management action for a flooding issue might be located outside the assessment-zone boundary. |

## 4.2 Political Sentiment

A number of the funding mechanisms require support from voters, the California Legislature, or policy makers. Some funding mechanisms require voter approval, including local agency assessments (due to Proposition 218), local taxes and bonds, and State propositions. Also, some proposed funding mechanisms will require new legislation. The political viability of these mechanisms must be considered, because voters and policy makers have opposed some of them in the past. However, as the need for investment in water management continues to expand due to growing need and insufficient past funding, a reevaluation of these mechanisms is prudent.

## 4.3 Cost-Share Agreements

USACE has shared in the cost of hundreds of flood management projects in California, and DWR and USACE have partnered with local agencies on numerous flood management projects within the Central Valley. In many cases, USACE and DWR have existing agreements on the cost shares for certain management actions. Also, many implementation programs (both State and federal) have cost-share percentages in place. Tables 4-2 and 4-3 summarize the target cost-share ranges for State, federal, and local partners.

Table 4-2. Target Cost Share Ranges, Capital Investments

| Management Action Category and Area of Interest | Target Cost Share Range (%) | | |
|---|---|---|---|
| | State | Federal | Local |
| **Systemwide** | | | |
| Yolo Bypass multi-benefit improvements | 40–80 | 30–50 | 0–20 |
| Feather River–Sutter Bypass multi-benefit improvements | 40–80 | 0–50 | 0–20 |
| Paradise Cut multi-benefit improvements | 40–80 | 0–50 | 0–20 |
| Reservoir and floodplain storage | 10–50 | 65–75 | 0–20 |
| **Urban** | | | |
| Levee improvements | 10–50 | 55–65 | 10–40 |
| Other infrastructure and multi-benefit improvements | 10–50 | 55–65 | 10–40 |
| **Rural** | | | |
| Levee repair and infrastructure improvements | 50–75 | 0–10 | 25–60 |
| Small-scale levee setbacks and floodplain storage | 50–75 | 0-20 | 0–40 |
| Land acquisitions and easements | 70–100 | 0–10 | 0–20 |
| Habitat restoration/reconnection | 70–100 | 0–20 | 0–20 |
| **Small Community** | | | |
| Levee repair and infrastructure improvements | 50–100 | 0–20 | 0–50 |
| Levee setbacks, land acquisitions, and habitat restoration | 50–100 | 0–20 | 0–30 |

Table 4-3. Target Cost Share Range, Ongoing Investments

| Management Action Category and Area of Interest | Target Cost Share Range (%) | | |
|---|---|---|---|
| | Local | State | Federal |
| Systemwide | | | |
| State operations, planning, and performance tracking | 0 | 100 | 0 |
| Emergency management | 0 | 100 | 0 |
| Reservoir operations | 0 | 100 | 0 |
| Routine maintenance | 20–30 | 70–80 | 0 |
| Urban | | | |
| Risk awareness, floodproofing, and land use planning | 10–30 | 25–50 | 25–50 |
| Studies and analysis | 10–50 | 0–25 | 25–65 |
| Rural | | | |
| Risk awareness, floodproofing, and land use planning | 0–50 | 20–50 | 50–75 |
| Studies and analysis | 0–25 | 20–50 | 25–65 |
| Small Community | | | |
| Risk awareness, floodproofing, and land use planning | 0–50 | 20–50 | 50–75 |
| Studies and analysis | 0–25 | 20–50 | 25–65 |

The target cost-share ranges are based partially on this historical precedent (often informing the low end of the range) and partially on optimistic assumptions about the State and federal agencies' changing trend toward a more comprehensive assessment of public interest beyond benefit-cost ratios. This assessment might include broader consideration of other societal values, as reflected in CVFPP goals and in the federal government's updated "Principles and Requirements for Federal Investments in Water Resources" released in March 2013 (Council on Environmental Quality [CEQ], 2013). Also, the cost-share ranges are shown for large management action categories. Therefore, the cost-share ranges represent what will be the result of a combination of varied cost-share agreements for a multitude of individual projects within that broader category. For example, if we expect that about half of the projects within a given category will justify a State cost share of only 50%, but the other half might justify a higher State cost share of 75%, the target cost share range would then likely fall between those numbers, from 60 to 70%.

Finally, the CVFPP investment strategy assumed that existing, in-progress projects would retain their established cost share agreements between local, State, and Federal partners throughout their existing programs. However, new management actions included in the 2017 refined SSIA portfolio will target the cost share ranges as presented below.

### 4.3.1 Developing Local Cost Share Targets

The target cost-share ranges in Tables 4-2 and 4-3 reflect an underlying assumption that local ability and willingness to pay is limited (see Sections 4.5 and 4.6), so an attempt is made to target larger investment from State and federal sources where State or national interest in the potential outcomes from that particular action category is likely to be high. So, while local

ranges are often low, this does not necessarily imply that there is a low local interest in that type of activity, but rather that funding can likely be attained from other sources. Alternatively, local cost-share ranges are higher for those action categories for which a significant portion of potential projects in that category are likely limited in their potential to contribute to broader societal values.

### 4.3.2 Developing Federal Cost Share Targets

Federal cost shares can and do vary over time based on changes in laws and policies. National budget conditions, political beliefs, and individual agency policies affect federal participation in funding water management projects. Recent political shifts provide mixed signals for future federal participation levels. On the one hand, Congress appears to place high priority on reducing federal spending, but bipartisan interest in infrastructure investment has also been expressed.

The standards by which federal water resources agencies, specifically USACE, judge their participation in and contribution to water management projects may change over time. In the past, USACE has followed a fairly strict approach of judging projects largely based on benefit-cost analysis, with relatively smaller consideration given to other criteria. For decades, standards (Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies) issued in 1983 have governed most federal water investments, these standards are commonly referred to as the Principles and Guidelines (United States Water Resources Council, 1983). However, in 2013, the Obama Administration released the Principles and Requirement for Federal Investments in Water Resources, an updated Principles and Guidelines that included a final set of principles and requirements that broaden the criteria and reduce the relative importance

## Principles and Requirements for Federal Investments in Water Resources

Relevant excerpts from the 2013 Final Principles and Requirements:

*The following Principles constitute the overarching concepts the Federal government seeks to promote through Federal investments in water resources now and into the foreseeable future.*

*A. **Healthy and Resilient Ecosystems.** Federal investments in water resources should protect and restore the functions of ecosystems and mitigate any unavoidable damage to these natural systems…*

*B. **Sustainable Economic Development.** Alternative solutions for resolving water resources problems should improve the economic well-being of the Nation for present and future generations.*

*C. **Floodplains.** Federal investments in water resources should avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities…*

*D. **Public Safety.** Threats to people, including both loss of life and injury, from natural events should be assessed in … the decision making process.*

*E. **Environmental Justice.** Agencies should ensure that Federal actions identify any disproportionately high and adverse public safety, human health, or environmental burdens of projects on minority, Tribal and low-income populations (and) seek solutions that would eliminate or avoid disproportionate adverse effects on these communities.*

*F. **Watershed Approach.** A watershed approach to analysis and decision making facilitates evaluation of a more complete range of potential solutions and is more likely to identify the best means to achieve multiple goals over the entire watershed. It is imperative that assessments evaluate the interaction of a potential Federal investment with other water resources projects and programs within a region or watershed.*

of quantitative benefit-cost analysis (CEQ, 2013). These new standards are commonly referred to as Principles and Requirements (P&R).

The 2013 Principles and Requirements were the first step in a new process for determining federal interest and participation in water resources projects. In 2014, interagency guidelines were released (CEQ, 2014) that provide more direction to agencies on how to evaluate projects. Importantly, the role of benefit-cost analysis has been reduced and is now one of several measures that contribute to an assessment of sustainable economic development. These measures can include net economic benefits (i.e., benefit-cost analysis), the distribution of benefits among groups, effects on unemployment and other social criteria, and environmental effects.

Federal agencies are adapting their internal guidelines and procedures to respond to the 2013 Principles and Requirements. The broader set of principles for making federal investment decisions appears to be more consistent with the multi-benefit, integrated approach of the CVFPP. Overall, these changes in how federal agencies evaluate project participation, along with the shifts in political priorities at the federal level, suggest an opportunity to build support for greater federal participation in CVFPP implementation. The recommended range for federal cost sharing is optimistic, but reflects the broader federal interest in local infrastructure and benefits of flood management.

### 4.3.3 Developing State Cost-Share Targets

State participation in funding or financing water management projects is in most cases set by the statute authorizing participation. Often the relevant statutes set an upper limit on the State's share of project cost and sometimes on the dollar value of the contribution. Examples of other factors or criteria that can affect the State's contribution include the following:

- Whether the contribution is for capital outlay or ongoing expenses
- The geographic scope of project benefits (e.g., system-wide improvements)
- The financial capacity of local partners
- Whether the State has a specific, identified public interest or duty in a project outcome, such as environmental restoration
- Whether the project serves a defined disadvantaged community or group

The Governor's Water Action Plan (DWR, 2014) supports the use of State funding to share in the cost of projects providing water storage for multiple purposes:

> The administration will work with the Legislature to make funding available to share in the cost of storage projects if funding partners step forward. The state will facilitate among willing local partners and stakeholders the development of financeable, multi-benefit storage projects, including working with local partners to complete feasibility studies.

Cost shares associated with recent statewide water-related bond measures provide a benchmark for recommendations. As directed by the legislature, DWR developed guidelines for cost sharing associated with bond measures passed in 2006 (Propositions 84 and 1E). The Cost Share Guidelines for State-Local Cost Shared Flood Programs and Projects (DWR, 2010) set a "base level" cost share for the State of 50% of total project cost, with variation from that amount for specific reasons. For example, the State's share for a project serving a disadvantaged community could be as high as 90%. Projects providing ecosystem restoration or multiple benefits could receive up to 70% State cost share.

The Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Act) was passed by voters in November 2014. It authorizes bonds to finance a variety of infrastructure improvements, generally not to exceed a State share of 50%. For example, Chapter 5 of the Act provides a State cost share of up to 50% for improvements to drinking water infrastructure improvement. Chapter 8 of the Act provides up to 50% State funding for public benefits (including flood control, water quality, and ecosystem improvements) of water storage projects. For projects providing predominantly statewide benefits, or for projects that address a critical need, the State may provide full funding.

## 4.4 USACE Benefit-Based Cost Shares

A common method for determining cost shares is to relate them directly to the outcomes and benefits, and to the identified entities or groups who receive those benefits. This is the standard approach by federal water management agencies, including USACE. The USACE Planning Guidance Notebook (Engineer Regulation [ER] 1105-2-100) describes the process for determining cost allocation and cost shares states "Multiple-purpose studies and projects are cost shared in accordance with the cost-sharing policies applicable to each project purpose required. Before determining the required cost sharing for projects, an allocation of total project costs to each purpose must be accomplished" (USACE, 2000).

In simple terms, two steps are involved. The first step is to allocate costs among project purposes (for example, among flood control, ecosystem restoration, and recreation) using a benefits-based method called separable costs/remaining benefits. The second step is to split the cost allocated to each purpose into cost shares that identify how much different entities pay. Existing law, policy, or agreements may determine how costs are shared for a particular project purpose. Appendix E of the USACE Planning Guidance Notebook provides details on procedures for estimating benefits and costs, and for determining cost shares.

The citizens of California passed Propositions 1E and 84 in November 2006, which made approximately $4.9 billion in general obligation bonds available to rebuild and repair California's most vulnerable flood control structures that protect homes and prevent loss of life. The State leveraged a portion of the bond funds with local funds to implement federal flood risk reduction projects in advance of Congressional authorization. In many cases, the State and local agencies are seeking credit for these projects under two authorities: Section 104 of the Water Resources Development Act (WRDA) of 1986 (Public Law 99-62) and Section 2003 of the WRDA of 2007 (Title 42 of the United State Code, Sections 1962d to 5b) referred to here as Section 221. The federal government may afford credit for project or project features completed

by a local sponsor that secured Section 104 or Section 221 approvals. If the federal government affords credit, that credit can be used to offset future State and/or local contributions toward congressionally authorized flood risk reduction projects.

## 4.5 Ability to Pay

According to generally accepted economic principles for allocating costs of public projects, beneficiaries pay for costs of the project based on the benefits they receive. However, not all beneficiaries may be able to pay for their benefits, due to their financial circumstances. In these cases, the costs allocated to such beneficiaries may be adjusted to reflect their ability to pay. When one or more beneficiaries have their allocated cost reduced based on ability to pay, another funding source must be identified to make up the difference in order to fund the project.

The following principles are commonly used when discussing apportioning taxes or assessments for publicly provided goods or services:

- The **benefit-received principle** states that individuals and businesses should pay for costs of a project or public service based on the benefits they receive from it. This is alternatively known as the "beneficiary pays principle" or simply the "benefits principle." Paying based on benefits received is consistent with how consumers of private goods decide on whether to make a purchase, which is based on the benefits they expect to receive. Each consumer compares the perceived benefit to the advertised cost. In the case of a publicly provided good or service, such as flood control or public roads, taxes or assessments imposed on different groups would be based on the direct use of the service or, more likely for flood management, on an analysis of benefits received by each group. One or more groups may disagree with the size of the benefit, and therefore the tax or assessment they are assigned.

- The **ability-to-pay principle** states that the tax or assessment should be determined by the financial capacity of the beneficiaries —their income and wealth. A related concept is the notion of progressive taxation, in which individuals and businesses with larger incomes pay more taxes, both in absolute terms and relative to income, than those with lower incomes.

Basing payment on ability-to-pay alone can create two significant side-effects. First, any reduction in revenue from lower-income groups must be made up from other groups, at least to the point where project costs are fully covered. Second, higher-income groups may opt out of the project by choosing not to participate in it or by voting against any tax or assessment needed to fund the project. In practice, decisions about how to pay for public goods and services are often made through a political process in which benefits received, ability-to-pay, perceived fairness, and other considerations play a role. Negotiation over the distribution of cost is common. Also, existing law may determine or restrict how these two principles are used to set taxes or assessments (see the discussion of California's Proposition 218 in Section 4.9).

As outlined in a 2011 California Debt and Investment Advisory Commission (CDIAC) report, Debt Burdens of California State and Local Governments: Past, Present and Future (Wassmer and Fisher, 2011), one approach to evaluating the feasibility and reasonableness of a proposed tax measure is to assess its affordability: whether individuals and governments can afford the tax

(and its associated debt) and everything else they want to purchase. One measure of ability to pay is the effective tax rate (ETR).

The total ETR on a parcel is equal to the total taxes on the home divided by the assessed value of the home. The taxes consist of ad valorem taxes and fixed charges. Ad valorem taxes are percentage taxes applied to the net assessed value of the home. Under California Proposition 13 passed in 1978, general ad valorem taxes are capped at 1.00 percent of net assessed value and nearly all of that goes to counties, cities, and school districts. Ad valorem taxes above 1.00 percent must be passed by local voters, including payment for any voter-approved GO debt issued by public entities, such as cities, school districts, community college districts, and water districts. In contrast, fixed charges and assessments are not impacted by the value of the home. These charges, among them Mello-Roos special taxes and special assessments, finance public facilities and services such as city and school facilities, street and storm drain maintenance, and park maintenance. Because fixed charges are not impacted by changing values, homes with high fixed charges will have their tax rates decrease as their assessed value increases.

In a 1991 report, the CDIAC established the following total ETR guideline, which has since become the industry standard: New parcel taxes should be calculated such that "the total tax burden on residential property [does not] exceed 2.00 percent of the anticipated fair market value of each improved parcel upon completion of all public and private improvements" (CDIAC, 1991). The purpose of the 2.00 percent cap is to prevent public agencies from overburdening properties with property taxes. At some point, a high tax burden may have an impact on property marketability and attractiveness, residential population, residential spending habits, and ultimately local tax revenues.

In addition, low existing total ETRs may be positively correlated with tax election successes. A Rand Foundation study, Schools, Taxes, and Voter Behavior: An Analysis of School District Property Tax Elections (Alexander and Bass-Golod, 1974), looked at 1,600 school district property tax elections held in California from the mid 1950s to 1972 and found that the existing taxes, the proposed taxes, and the change in taxes were all smaller in the successful elections than in the failed elections.

It should be noted that Proposition 13 also restricts increases of assessed value to an inflation factor not to exceed 2.00 percent per year and limited reassessment to cases of (1) a change in ownership or (2) completion of new construction. Low assessed value, therefore, may not necessarily reflect a home's condition or a property owner's income. In areas where home assessed values are, on average, lower than market value, property owners may not consider a high ETR a burden. A more useful calculation of ETR would rely on the home's market value rather than its assessed value, but market value is more difficult to determine than assessed value.

Table 4-4 shows the effective tax rates for the counties within the SPFC Planning Area, and shows that a majority of the parcels fall in the low and average ETR groups. If ability to pay were measured by staying under the 2% threshold, there is capacity to levy additional assessments for the SPFC.

Table 4-4. Effective Tax Rates by County

| County | Low Effective Tax Rate Group (1.00% to 1.20%) | | | Average Effective Tax Rate Group (1.20% to 1.60%) | | | High Effective Tax Rate Group (greater than 1.60%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Percent of Parcels in Range | Average Effective Tax Rate for the Group | Average Existing FY 2015–2016 Property Taxes | Percent of Parcels in Range | Average Effective Tax Rate for the Group | Average Existing FY 2015–2016 Property Taxes | Percent of Parcels in Range | Average Effective Tax Rate for the Group | Average Existing FY 2015–2016 Property Taxes |
| Butte | 87.5% | 1.08% | $2,292 | 9.0% | 1.32% | $1,600 | 3.6% | 2.21% | $1,677 |
| Colusa | 69.8% | 1.08% | $3,320 | 19.6% | 1.30% | $1,388 | 10.6% | 2.03% | $1,091 |
| Fresno | 23.3% | 1.13% | $3,128 | 70.9% | 1.26% | $2,992 | 5.8% | 2.11% | $2,410 |
| Glenn | 68.8% | 1.08% | $2,590 | 19.0% | 1.36% | $1,307 | 12.2% | 2.18% | $1,392 |
| Madera | 84.1% | 1.11% | $2,664 | 10.6% | 1.33% | $2,472 | 5.3% | 2.35% | $1,938 |
| Merced | 71.6% | 1.11% | $2,808 | 21.7% | 1.33% | $2,482 | 6.7% | 2.26% | $1,757 |
| Sacramento | 42.3% | 1.15% | $3,852 | 46.4% | 1.32% | $3,487 | 11.3% | 2.20% | $4,552 |
| San Joaquin | 40.3% | 1.11% | $3,601 | 45.3% | 1.36% | $3,670 | 14.4% | 2.20% | $4,517 |
| Solano | 40.7% | 1.13% | $3,189 | 52.7% | 1.29% | $4,807 | 6.6% | 2.18% | $5,326 |
| Stanislaus | 63.2% | 1.11% | $2,904 | 28.1% | 1.31% | $3,164 | 8.8% | 2.24% | $3,570 |
| Sutter | 34.5% | 1.13% | $3,449 | 52.7% | 1.34% | $2,860 | 12.8% | 1.85% | $3,358 |
| Tehama | 93.2% | 1.02% | $1,273 | 3.5% | 1.28% | $1,016 | 2.5% | 2.73% | $429 |
| Yolo | 42.9% | 1.11% | $4,782 | 39.5% | 1.35% | $5,100 | 17.6% | 2.02% | $5,777 |
| Yuba | 31.7% | 1.13% | $2,993 | 47.0% | 1.29% | $1,621 | 21.3% | 2.08% | $2,591 |

The revenue generation potential from local assessments is estimated in Table 4-5. The calculations are intended to identify the reasonable increase in tax burden that could be placed on parcels within the SPFC Planning Area for flood management activities. However, the difference between current tax burdens and the two percent cap does not represent total funds available for flood management, because those properties are likely to also be taxed for other property-related and public services going forward.

Table 4-5 compares the difference in the revenue generated using the effective tax rate for the county and the two percent "maximum" tax rate cited by CDAC. The analysis then assumed that up to 10% of this increase could be available for flood management activities. This resulted in approximately $57 million per year. Table 4-5 also shows that this implies an average increase of $200 additional dollars per year, per parcel.

Using the difference between the ETR of the assessed value and the CDIAC ETR limit of 2% of the assessed value as a proxy for ability to pay may understate the real ability to pay. The CDIAC report 2% limit was based on fair market value. Because Proposition 13 has suppressed the real market value of many properties, so an ETR based on the fair market value would be higher. This analysis used assessed value because that information was readily available.

## 4.6 Willingness to Pay

Willingness to pay (WTP) is a measure of the monetary magnitude of benefits accruing to one or more beneficiaries. It indicates the value in dollars of what beneficiaries would be willing to give up in order to receive the desirable outcomes of a project, assuming their financial capacity is not limited (see "ability to pay" above). WTP can be observed directly from beneficiaries' actions, imputed using statistical or other models, or estimated from survey results.

WTP for a good can be directly observed when potential beneficiaries make decisions to give up something of value in exchange for the good. In the case of privately owned and consumed goods, such as clothes or food, purchasing decisions and observed prices usually provide reliable WTP information. For goods that provide joint benefits to many at once, such as regional flood management facilities, no single beneficiary would likely bear the cost. Collective decisions to fund, construct, and manage such public goods are made by governments (or government-like organizations). Determining WTP for goods provided jointly is much more difficult. The observed actions of the local government and its constituents to fund flood management depend on more than simply perceived benefits; they also depend on politics, on voting behavior and requirements, and on legal restrictions on the mechanisms that can be used and the amounts raised.

Table 4-5. Estimated Revenue Generation Potential from Local Assessments

| County | Actual Average Effective Tax Rate | Existing Tax Revenue | Revenue at Maximum Recommended Tax Rate (2%) | Tax Revenue Increase from Max Rate | Percent of Max Revenue applied to Flood Control (10%) | Revenue Increase per Parcel |
|---|---|---|---|---|---|---|
| Butte | 1.1108% | $33,049,543 | $59,505,839 | $26,456,296 | $2,645,630 | $184 |
| Colusa | 1.1173% | $9,071,957 | $16,239,071 | $7,167,114 | $716,711 | $232 |
| Fresno | 1.2492% | $15,984,651 | $25,591,821 | $9,607,170 | $960,717 | $186 |
| Glenn | 1.1526% | $1,568,035 | $2,720,866 | $1,152,831 | $115,283 | $159 |
| Madera | 1.1563% | $14,254,985 | $24,656,206 | $10,401,220 | $1,040,122 | $193 |
| Merced | 1.1727% | $44,137,063 | $75,274,261 | $31,137,198 | $3,113,720 | $203 |
| Sacramento | 1.3037% | $474,322,193 | $727,655,431 | $253,333,238 | $25,333,324 | $203 |
| San Joaquin | 1.3328% | $102,739,973 | $154,171,629 | $51,431,655 | $5,143,166 | $128 |
| Solano | 1.2795% | $113,435,237 | $177,311,820 | $63,876,583 | $6,387,658 | $323 |
| Stanislaus | 1.2304% | $15,112,886 | $24,565,809 | $9,452,923 | $945,292 | $195 |
| Sutter | 1.2991% | $86,188,867 | $132,690,120 | $46,501,252 | $4,650,125 | $174 |
| Tehama | 1.0405% | $158,416 | $304,499 | $146,084 | $14,608 | $112 |
| Yolo | 1.3193% | $116,279,375 | $176,274,350 | $59,994,975 | $5,999,497 | $263 |
| Yuba | 1.3315% | $10,511,300 | $15,788,660 | $5,277,359 | $527,736 | $111 |
| **Total** | | **$1,036,814,481** | | **$575,935,899** | **$57,593,590** | **$200** |

A number of factors may affect voters' willingness to approve a new assessment or tax, including their existing total ETR; their income; the amount, nature, or purpose of the tax itself; and public perceptions. Furthermore, these factors may affect different property owners to different extents: Owners of residential property may be more influenced by the existing total ETR, while owners of non-residential property may be more influenced by the purpose of the tax or public opinion. These differences make it important to consider the type of funding mechanism and who is voting to properly assess willingness to approve and the ultimate success of the funding mechanism. For example, in a property-owner election, both residential and non-residential owners will vote, but those who rent property will not vote. However, in a registered voter election, residential property owners and renters will vote, but non-residential owners will not vote.

Property owners or registered voters need to see a return on their investment; they need to perceive tangible benefits in their day-to-day lives from increased flood protection facilities. Making the risk of an unlikely, though catastrophic, event tangible is a challenge. More immediate benefits can include lower home and auto insurance rates in areas with frequent flooding. Individuals are likely to perceive more benefit from the flood protection facilities and be more willing to pay for them when severe storms or flood events have occurred recently.

Gaining voter approval for public goods such as flood management is a challenge due to the range of opinions and information available to voters. Different individuals and groups may disagree about the risks they face and benefits they would receive, both in absolute magnitude and relative to other groups. Groups may also believe that funding already exists to pay for proposed improvements, either from other sources (such as the State or federal government) or from greater efficiencies and cost savings at the local agency. These factors can result in the defeat of local referenda to raise taxes or assessments even when analysis indicates that benefits exceed the costs of the tax or assessment. Therefore, gaining support for increasing funding for both physical (dams, levees, and reservoir maintenance) and nonphysical (emergency management plans and public awareness campaigns) management actions rely on the public's perceptions about these factors.

The willingness of the public to invest in flood management is affected by the economic condition of an area, by public priorities, and perceptions, and by competition for limited resources. Local areas with "robust economies, growing populations and tax bases, and professional planning staff often take their own initiative to reduce and manage flood risk to levels acceptable to the community" (USACE, 2014a). Small and disadvantaged communities are generally not capable of implementing flood risk reduction measures and resist measures being imposed on them. Also, these communities often do not have the resources to take advantage of assistance when it is available.

## 4.7 Competing Demands and Complementary Actions

CVFPP investments can be competitive for funding with other public services or serve as part of a multi-benefit project to leverage additional funding sources. The CVFPP investment strategy considers how available funding sources are limited and competitive at the state, national, and international scale. In addition, several ongoing and planned efforts may occupy or influence the same footprint as the SPFC Planning Area. Activities that the CVFPP may be able to synergistically work with to enhance the State values and the effectiveness of the plan are important to consider.

The investment strategy's priorities and schedule must be politically and financially achievable in the context of these other competing demands and programs. Some competing and related activities that could affect implementation of the investment strategy are discussed below.

### 4.7.1 Other State Activities

***Competing Activities for Funding***

At the State level, funding for flood management competes with other State obligations such as education, health, transportation, criminal justice, and social services. Table 4-6 shows the distribution of the State's four most recent GO bonds. Education (both K-12 and higher) and health are the biggest recipients of the State's revenues. Funding for flood management activities is included in the water category.

Table 4-6. Total Authorized GO Bond Debt in California

| Category | Authorized GO Bonds ($ billion) | | | |
|---|---|---|---|---|
| | 1999 | 2005 | 2011 | 2015 |
| Correctional | 4.1 | 4.1 | 2.8 | 2.8 |
| Education | 22.4 | 51.1 | 58.6 | 58.6 |
| Miscellaneous | 1.7 | 2.5 | 3.3 | 2.9 |
| Transportation | 5.6 | 7.2 | 40.0 | 40.6 |
| Water | 3.8 | 14.0 | 22.9 | 30.5 |
| **Total** | **37.7** | **78.9** | **127.6** | **135.2** |
| Per capita | 1,127.20 | 2,191.90 | 3,385.50 | 3,461.30 |

Sources: State of California, 2015, 2016; California Department of Finance, 2016b

***Delta Levee Investment Strategy***

The Sacramento–San Joaquin Delta Reform Act of 2009 directed the Delta Stewardship Council to provide a Delta Plan that reduces risks to people, property, and outlines the State's interest in the Delta. The Delta Stewardship Council supported the Delta Plan through the draft Delta Levee Investment Strategy (DLIS), an updated prioritization of levee investments.

The Delta is part of the overall system for which the Central Valley Flood Protection Plan (CVFPP) has guided the State's participation in managing flood risk in areas protected by the State Plan of Flood Control (SPFC) as directed by the Central Valley Flood Protection Act of 2008. Collaboration between the investment strategies supporting the Delta Plan and CVFPP is necessary to deliver effective improvements in integrated flood management to the Central Valley and Delta.

### 4.7.2 Other Federal Activities

***Competing Activities for Federal Funding***

All federal agencies are dependent on Congressional authorizations and appropriations, which are driven by public opinion, often highly politicized, and subject to agendas set by Congress and each President's administration. This process creates competition among agencies for limited resources. The federal funding trend is moving away from projects that serve local or special interests.

Federal funding associated with flood management has typically come through USACE, the agency charged with flood and other infrastructure management. Federal funding for USACE declined from about 1 percent of the total federal outlays between 1962 and 1970 to about 0.2% of federal outlays between the early 1990s and the present (Office of Management and Budget, 2015). This decline in funding for USACE is a consequence of a political climate where there is opposition to projects paid for through federal taxes and a move to privatize or localize costs associated with projects.

***Complementary Federal Actions***

Additional information on complementary federal funding mechanisms are including in Section 6.2 Potential Federal Funding Mechanisms.

## 4.8 Challenges for Local Funding

### 4.8.1 Proposition 218

Proposition 218 (enacted November 5, 1996) was the voters' response to the increase in user fees, charges, and special assessments that local governments resorted to as a way to make up revenues after the enactment of Proposition 13. Some special districts levied non-property-related "general" taxes (which were not addressed by Proposition 13) after approval by a majority of their local voters.

Proposition 218 amended the California Constitution to restrain many of these local government practices (Public Policy Institute of California, 2014) with the following changes:

- Clarifies that local general taxes always require majority voter approval and local special taxes require approval by a two-thirds vote of the local electorate [California Constitution Article XIIIC, Sections 2(b) and (d)]

- Prohibits special districts from levying general taxes [California Constitution Article XIIIC, Section 2(a)]

- Makes it more difficult to levy special benefit parcel assessments, which were sometimes used to fund water supply and flood protection projects and other water programs (California Constitution Article XIIID, Section 4)

- Places the burden of proof on local agencies to demonstrate that assessments are proportional to the special benefit that each parcel receives from the facility or service [California Constitution Article XIIID, Section 4(f)]

- Requires that proposed assessments be approved through an election in which votes are weighted by the amount of assessment each parcel owner would have to pay [California Constitution Article XIIID, Section 4(g)]

The most significant change that Proposition 218 brought about is that it requires that local agencies comply with the substantive standards of the law, including these requirements:

- Each parcel must receive benefits that are in proportion to the share of the assessment levied against the parcel.

- The total assessment cannot exceed the cost of the property-related service provided to each parcel.

Many local agencies have found it difficult to satisfy these criteria (Public Policy Institute of California, 2014). These changes resulted in confusion about what "as an incident of property ownership" or for a "property-related service" included. Eventually, this was clarified through the California Supreme Court, which determined that water, sewer, and refuse collection utilities were not covered under the law because these services were charged to property rather than imposed as an incident of property ownership.

Proposition 218 states that before a rate or fee can be increased, an agency must ensure the following:

- Revenues derived from the fee or charge shall not exceed the funds required to provide the property-related service.

- Revenues derived from the fee or charge shall not be used for any purpose other than that for which the fee or charge was imposed.

- The amount of a fee or charge imposed upon any parcel or person as an incident of property ownership shall not exceed the proportional cost of the service attributable to the parcel.

- No fee or charge may be imposed for a service unless that service is actually used by, or immediately available to, the owner of the property in question. Fees or charges based on potential or future use of a service are not permitted.

- No fee or charge may be imposed for general governmental services … where the service is available to the public at large in substantially the same manner as it is to property owners [California Constitution Article XIIID, Section 6(b)].

- If an affected property owner challenges a fee or charge in court, the agency has the burden of proving that it has complied with these requirements [California Constitution Article XIIID, Section 6(b)(5)].

Also, the local agency must conduct a public hearing on the proposed change in rates, fees, or rate structure and "if written protests against the proposed fee or charge are presented by a majority of owners of the identified parcels, the agency shall not impose the fee or charge." If the property-related fees and charges are not for "water, sewer, or refuse collection services," the local agencies must seek approval by either a majority of the property owners who would be subject to the fee or charge, or from two-thirds of the registered voters in the same area. Flood-management agencies must comply with this requirement to increase rates or fees. However, it is important to note that there are a few exceptions to these requirements if the assessments, fees, charges, and rates were enacted before July 1, 1997.

### 4.8.2 Dependence on Development Fees

Many local flood management agencies are partially funded through development fees or special projects assessments that can be limited by assessment-zone boundaries. These boundaries impose substantial limitations on the uses of funds. This is important because downstream flooding can be caused by upstream activities. In addition, the solution or best management action for a flooding issue might be located outside the assessment-zone boundary.

Even in the absence of assessment-zone boundary issues, reliance on development fees is limited because these fees are dependent on economic cycles. Ten economic recesessions occurred between 1948 and 2011, an average of two per decade (National Bureau of Economic Research, 2015). Although each recession has been of different duration, on average they have lasted 11 months. Much like previous recessions that hit the manufacturing and construction sectors the hardest, the Great Recession (December 2007 through June 2009) had a significant impact on these sectors, particularly the construction sector in California. Because development fees are tied to construction projects, any reductions in construction has the potential to reduce these fees. Between 2007 and 2008, the value of authorized construction permits (both commercial and residential) in California fell by 33%. The reduction in the value of these permits was 43% between 2008 and 2009 (California Department of Finance, 2010).

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# 5.0 Investment Costs and Phasing

**Section 5 Highlights**

- Section Outline:
  - Overview of Total Investment Costs over 30 Years
  - Overview of Investment Phasing
  - Phased Capital Investments
  - Phased Ongoing Investments
  - Summary of Capital and Ongoing Costs over 30 years
- Key Section Takeaways:
  - Cost estimates indicate a total present value investment need of approximately $17 to $21 billion over the next 30 years.
  - The most effective and high-priority actions are phased first to the extent possible, given other financial or political influencing factors.
  - A ramping scheme was applied to ongoing investments to provide the State and its partner agencies with time to establish the necessary staff, resources, and mechanisms needed to accommodate the influx of annual funding while maintaining their routine activities.

This section presents the cost estimates for the 2017 refined SSIA portfolio, and builds upon Sections 2 through 4 to discuss the way investments could be sequenced to most effectively and resiliently contribute to CVFPP goals and societal values within the constraints of other considerations, such as ability and willingness to pay, or viability in the current political climate.

## 5.1 Overview of Total Investment Costs over 30 Years

### 5.1.1 Treatment of Capital and Ongoing Costs

The 2017 refined SSIA portfolio comprises management actions that could be invested in over the 30-year planning horizon. Investment is divided into two types: capital and ongoing. Many actions require only capital investment, whereas others require ongoing, annual investment sustained over the entire planning horizon. Because funding methods for these two types of investment are different, they are discussed and calculated separately:

- Capital investment in improvements, which often requires years to spend and implement, are described in *2016 dollars (present value)*
- Ongoing investment in improvements are described in terms of *annual levels* of investment *in 2016 dollars*

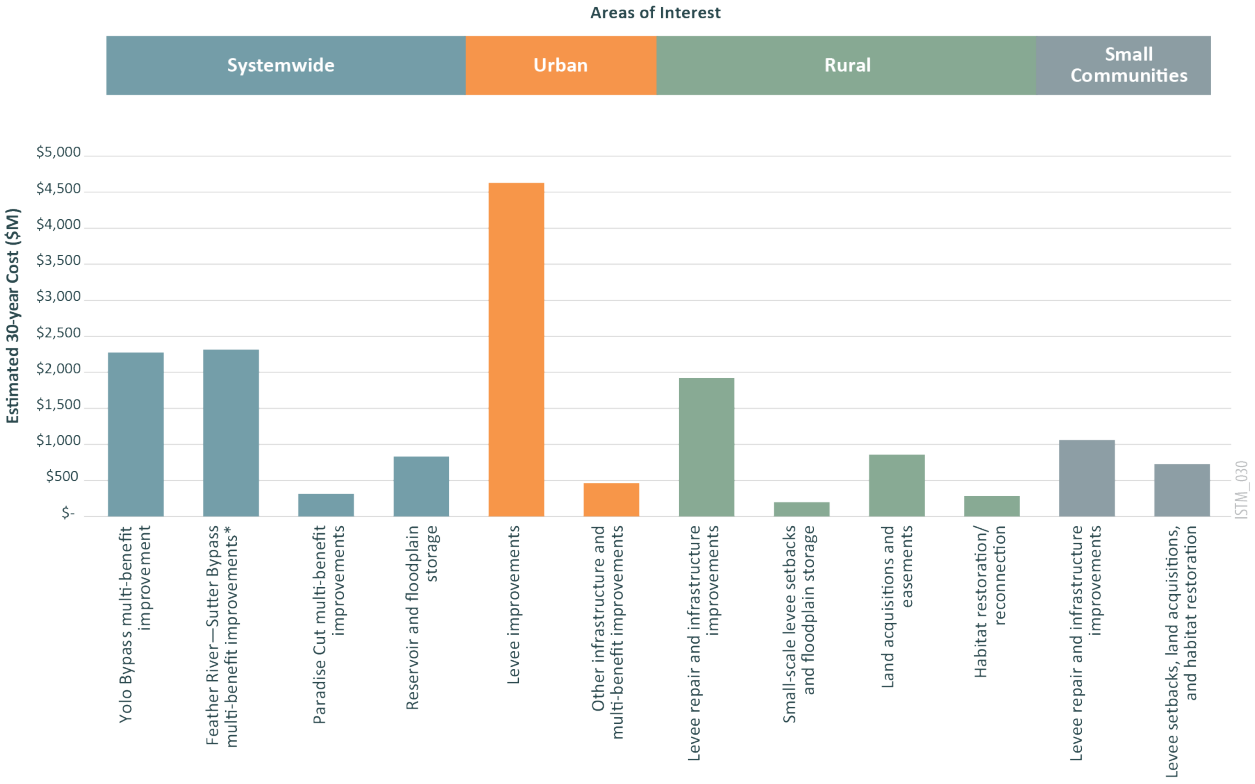
Future capital investments are converted to today's dollars using a present value analysis. Present value is the current worth of a future sum of money or stream of cash flow with one or more payments that has been discounted at a set market interest rate. Present value provides a common basis for comparing different investment amounts throughout time, which is critically important for a 30-year planning horizon. A discount rate of 3% was used for the present value calculations of capital investments in the 2017 refined SSIA portfolio. It is important to note that the present value of a future cash flow will always be less than the true future amount of that cash flow. This is due to the immediate ability to invest the cash flow received, generating a return.

In order to discuss the entire investment of the 2017 refined SSIA portfolio in today's dollar amount of $17 to $21 billion, present value terms were applied to both the capital and ongoing investments. In reality, the future ongoing investment will be higher due to escalating costs over time.

### 5.1.2 Capital Investment Costs over 30 Years

Implementation of capital improvements is estimated to cost approximately $12.7 to $17.1 billion over the next 30 years, as summarized in Figure 5-1. Table 5-1 elaborates on cost estimates and data sources for each management action category under each area of interest. This estimate is informed by the same efforts as described in Section 3.1. Many systemwide actions are expected to promote ecosystem functions and multi-benefit projects, as are some rural easements, levee setbacks, and floodplain storage actions. Therefore, costs for actions that promote ecosystem functions and multi-benefit projects are included in all areas of interest, and are embedded most within larger-scale activities, where feasible. An estimated cumulative capital and ongoing cost of approximately $1.3 billion in the 2017 refined SSIA portfolio contributes to the CVFPP supporting goals of promoting ecosystem functions and promoting multi-benefit projects (further discussed in this section).

## Figure 5-1. Total Capital Investment Over 30 Years




Note: Investments shown in the figure are the average of the estimated cost range.

*The high end cost estimate was used for the Feather River—Sutter Bypass multi-benefit improvements. This is due to the larger range of uncertainty compared to other systemwide improvements, given the Sacramento River BWFS recommendations to determine an array of multi-benefit actions through future study in close coordination with local and regional partners after Yolo Bypass improvements are implemented.

Table 5-1. Capital Investments of the 2017 Refined SSIA Portfolio Over 30 Years (2016 $)

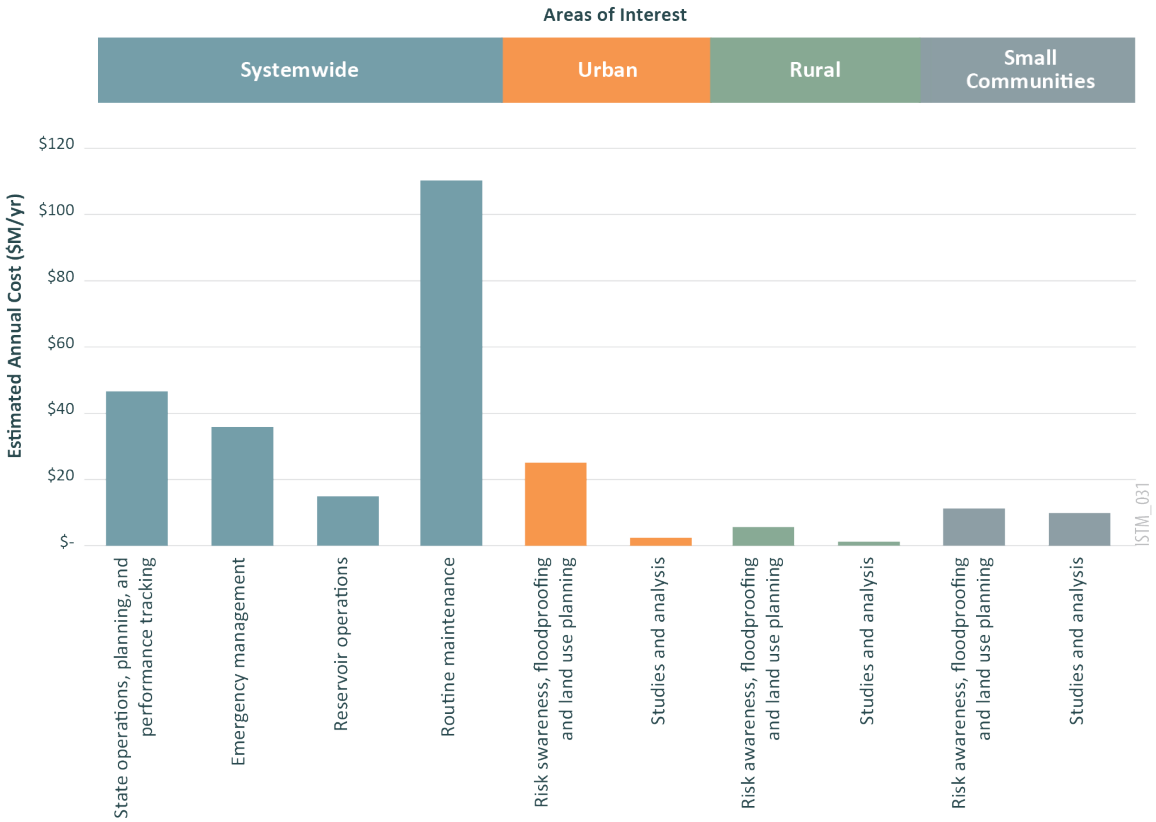
| Action Category and Area of Interest | Data Source | Sacramento | | San Joaquin | | Total | |
|---|---|---|---|---|---|---|---|
| | | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) |
| **Systemwide** | | | | | | | |
| Yolo Bypass multi-benefit improvements | BWFSs | $2,050 | $2,500 | $– | $– | $2,050 | $2,500 |
| Feather River–Sutter Bypass multi-benefit improvements | BWFSs | $600 | $2,300 | $– | $– | $600 | $2,300 |
| Paradise Cut multi-benefit improvements | BWFSs | $– | $– | $280 | $340 | $280 | $340 |
| Reservoir and floodplain storage | BWFSs and RFMPs | $130 | $150 | $620 | $750 | $750 | $900 |
| | **Subtotal:** | **$2,780** | **$4,950** | **$900** | **$1,090** | **$3,680** | **$6,040** |
| **Urban** | | | | | | | |
| Levee improvements | USACE | $3,240 | $3,960 | $900 | $1,100 | $4,140 | $5,060 |
| Other infrastructure and multi-benefit improvements | BWFSs, RFMPs, and OMRR&R Workgroup | $250 | $310 | $160 | $200 | $410 | $510 |
| | **Subtotal:** | **$3,490** | **$4,270** | **$1,060** | **$1,300** | **$4,550** | **$5,570** |
| **Rural** | | | | | | | |
| Levee repair and infrastructure improvements | BWFSs, RFMPs, and OMRR&R Workgroup | $1,000 | $1,230 | $720 | $880 | $1,720 | $2,110 |
| Small-scale levee setbacks and floodplain storage | BWFSs and RFMPs | $100 | $120 | $70 | $90 | $170 | $210 |
| Land acquisitions and easements | RFMPs and floodplain management effort | $490 | $590 | $280 | $340 | $770 | $930 |
| Habitat restoration/ reconnection | RFMPs | $250 | $300 | $10 | $10 | $260 | $310 |
| | **Subtotal:** | **$1,840** | **$2,240** | **$1,080** | **$1,320** | **$2,920** | **$3,560** |
| **Small Community** | | | | | | | |
| Levee repair and infrastructure improvements | BWFSs, RFMPs, and OMRR&R Workgroup | $820 | $1,010 | $110 | $140 | $930 | $1,150 |
| Levee setbacks, land acquisitions, and habitat restoration | RFMPs and floodplain management effort | $520 | $630 | $120 | $150 | $640 | $780 |
| | **Subtotal:** | **$1,340** | **$1,640** | **$230** | **$290** | **$1,570** | **$1,930** |
| | **Capital Total:** | **$9,450** | **$13,100** | **$3,270** | **$4,000** | **$12,720** | **$17,100** |

Notes:
1. All estimated dollar values are in 2016 dollars and indicate an investment over 30 years.
2. Feather River–Sutter Bypass multi-benefit improvement cost ranges are included for completeness, but additional study is needed to refine recommended improvements, including consideration of improvements to Tisdale and Colusa Weirs.
3. An estimated cumulative capital and ongoing cost of $1.3B within the 2017 refined SSIA portfolio contributes to the CVFPP supporting goals of promoting ecosystem functions and promoting multi-benefit projects, embedded most within larger scale activities.
4. Deferred *and* future repairs, rehabilitation and replacement costs are included within this capital estimate. *Deferred* repairs, rehabilitation and replacement costs estimated at $20M to $25M/year (present value $444 to $543M). *Future* repairs, rehabilitation, and replacement costs estimated at $43M/year (present value $740-$900M), respectively. These costs are included where the OMRR&R Workgroup is denoted as a source.

### 5.1.3 Ongoing Investment Costs over 30 Years

Implementation of ongoing improvements is estimated to range in cost annually from $226 to $276 million. Figure 5-2 summarizes annualized costs for the ongoing investments by each area of interest. Ongoing investments are discussed in annualized dollar values throughout this section. This estimate is informed by the same efforts as described in Section 3.1. Table 5-2 elaborates on cost estimates and data sources for each management action category under each area of interest.

Figure 5-2. 30-year Total of Ongoing Investment




Note: Investments shown in the figure are the average of the estimated cost range.

Table 5-2. Ongoing Investments of the 2017 Refined SSIA Portfolio Per Year (2016 $)

| Action Category and Area of Interest | Data Source | Sacramento | | San Joaquin | | Total | |
|---|---|---|---|---|---|---|---|
| | | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) |
| **Systemwide** | | | | | | | |
| State operations, planning and performance tracking | RFMPs and State operations/planning effort | $21 | $26 | $20 | $24 | $41 | $50 |
| Emergency management | RFMPs and emergency management effort | $16 | $20 | $16 | $20 | $32 | $40 |
| Reservoir operations | BWFSs | $1 | $1 | $12 | $14 | $13 | $15 |
| Routine maintenance | RFMPs and OMRR&R Workgroup | $70 | $86 | $29 | $36 | $99 | $121 |
| | **Annual Subtotal:** | **$108** | **$133** | **$77** | **$94** | **$185** | **$226** |
| **Urban** | | | | | | | |
| Risk awareness, floodproofing and land use planning | RFMPs and floodplain management effort | $4 | $5 | $8 | $10 | $12 | $15 |
| Studies and analysis | RFMPs and USACE | $2 | $2 | $1 | $1 | $3 | $3 |
| | **Annual Subtotal:** | **$6** | **$7** | **$9** | **$11** | **$15** | **$18** |
| **Rural** | | | | | | | |
| Risk awareness, floodproofing and land use planning | RFMPs and floodplain management effort | $1 | $2 | $3 | $4 | $4 | $6 |
| Studies and analysis | RFMPs | $1 | $1 | $1 | $1 | $2 | $2 |
| | **Annual Subtotal:** | **$2** | **$3** | **$4** | **$5** | **$6** | **$8** |
| **Small Community** | | | | | | | |
| Risk awareness, floodproofing and land use Planning | RFMPs and floodplain management effort | $5 | $6 | $5 | $6 | $10 | $12 |
| Studies and analysis | RFMPs and Small Communities Program | $10 | $12 | $– | $– | $10 | $12 |
| | **Annual Subtotal:** | **$15** | **$18** | **$5** | **$6** | **$20** | **$24** |
| | **Ongoing Annual Total:** | **$131** | **$161** | **$95** | **$116** | **$226** | **$276** |

Notes:
1. Estimated dollar values are in 2016 dollars and indicate annual investments made over 30 years. They have not been discounted to present value nor escalated for inflation.
2. Present value of total ongoing investments is approximately $5B over 30 years.
3. A cumulative capital and ongoing cost of $1.3B within the 2017 refined SSIA portfolio contributes to the CVFPP supporting goals of promoting ecosystem functions and promoting multi-benefit projects, embedded most within larger scale activities.
4. Deferred *and* future routine operation and maintenance costs are included within this ongoing estimate. *Deferred* routine operation and maintenance costs are estimated at $18M to $22M/year. *Future* routine operation and maintenance costs are estimated at $88M/year. Both deferred *and* future maintenance is captured in the systemwide routine maintenance line item.

## 5.2 Overview of Investment Phasing

Ideally, the earliest investment would be focused on the most effective and high-priority actions first—those having the greatest potential to contribute to CVFPP goals and societal values, and boost system resiliency. However, Section 4 highlights some of the other considerations that affect program phasing, and the challenges with raising sufficient funds for full CVFPP implementation over 30 years. Some management actions may be implemented earlier if they are necessary precursors for the successful implementation of other future actions, or if they are more immediately feasible either financially or politically. Also, ability to pay and competing activities for funding will place some constraints on the amount of investments possible in the immediate future. Because of these constraints, high-priority investment costs are spread across all three phases.

The following overarching principles guided phasing of the 2017 refined SSIA portfolio:

- **React to unacceptably high levels of risk.** Actions related to improving systemwide performance and reducing the largest risks to life and property in densely populated areas should be funded as soon as possible. Although these actions will take a significant amount of investment, they are needed to achieve the primary goal of the CVFPP.

- **Prevent risk escalation, reduce residual risk, and increase resiliency.** Actions aimed at minimizing future exposure and reducing vulnerability to life and property (such as levee setbacks, floodplain storage, and agricultural or conservation easements) are among the most resilient means of improving flood risk management; they prevent risk escalation, minimize life and economic losses when flooding does occur, and increase or maintain adaptive capacity within the flood management system. They also have the highest potential for producing other ecosystem and social outcomes of interest. These more *proactive* and multi-benefit flood management solutions will make up the majority of investment once risk has been reduced for the more densely populated areas, but some investment in these activities should also start as soon as possible.

- **Maintain system performance:** Securing reliable and continuous funding for ongoing management activities that serve to maintain the system, encourage wise use of floodplains, and manage residual risk are important. Ongoing investment in operations and maintenance is also high priority to maintain flood management system performance, and thereby prevent escalating life and economic risk from infrastructure deterioration. It will take time to build up the capacity and revenues necessary to better maintain the system over the long term, but some increased spending is needed right away, especially for critical repairs.

- **Ramping of ongoing resources:** For ongoing investments, the State and its partner agencies will need time to establish the staff, resources, and mechanisms to accommodate the influx of dollars and ability to execute routine activities. Therefore, a ramping of investments was applied to only the ongoing annual management action categories. This ramping scheme is intended to help the State and its partners increase institutional capacity to undertake this major effort.

These guiding principles for prioritizing investment provide the basis for establishing three basic phases of investment focus:

- Phase 1 (2017 to 2027) aims at reactively addressing the highest levels of risk to lives and assets concentrated in the densely populated areas (urban and small communities).
- Phase 2 (2027 to 2037) aims at actively transitioning to more balanced flood management.
- Phase 3 (2037 to 2047) aims at proactively balancing flood management system investments for both capital and ongoing activities in a sustainable manner.

### 5.2.1 Phase 1

Many of the actions requiring ongoing, annual investment are high priority because of their importance for long-term sustainability and resiliency. For example, emergency management and floodplain management activities represent effective and resilient means of reducing risks to lives and property (Section 2), and many floodplain management activities may have additional ecosystem or enriching experience benefits. Also, the implementation, maintenance, and refinement of any management actions is not possible without baseline funding for State operations, technical assistance, planning, and performance tracking.

However, intense floodplain development in past decades outgrew the originally intended (mostly agricultural) purposes for which many of the levees and other infrastructure were built, leading to high threats to economic stability and life safety in densely populated areas. A prudent flood management approach must first react to and mitigate these high risk levels before fully transitioning to more proactive and resilient forms of flood and floodplain management. Therefore, actions that reduce flood risk (or the probability of flooding) for already urbanized or otherwise densely populated areas must be implemented soon, since these actions will most efficiently contribute to the primary goal of the CVFPP.

Current bond funding for project implementation is expected to be depleted by fiscal year 2019-2020. No funding will be available for continued implementation of the higher-priority actions unless new State, federal, and local funding becomes available. Because it may take time to increase funding sources for flood management, a balance must be found between building up a solid baseline of investments in proactive, resilient floodplain management, and large capital investments in systemwide and regional improvements that increase system performance for areas where risk levels are already too high.

Therefore, Phase 1 is aimed at reactively addressing the highest levels of risk to lives and assets concentrated in the densely populated areas (urban and small communities). To build the needed baseline of ongoing proactive investment, the following types of ongoing activities will be prioritized for the most significant increases in annual funding in Phase 1 (relative to current spending levels):

- Emergency management (preparedness, response, and recovery)
- Reservoir operations (studies such as forecast-coordinated and forecast-informed operations and increased objective releases)
- Routine operations and maintenance Risk awareness, land use planning, and floodproofing

The following capital investment actions are considered highest priority:

- Near-term Yolo Bypass multi-benefit improvements, including Upper Elkhorn design and permitting, Bryte landfill remediation, Lower Elkhorn levee setback, Sacramento Weir design and permitting, Sacramento Bypass levee setback, Sacramento Deep Water Ship Channel design and permitting, Cache Creek Settling Basin evaluation
- Land acquisitions and feasibility study for the Paradise Cut Bypass Expansion
- Some reservoir operations studies and floodplain storage investments, including acquisition of Dos Rios Ranch and Three Amigos, and completion of restoration activities for Three Amigos Transitory Storage Project
- Urban levee and infrastructure improvements
- Conservation and agricultural easements
- Critical rural levee repairs
- Beginning investment in small communities
- Some small-scale levee setbacks and floodplain storage in rural areas

### 5.2.2 Phase 2

Over time, many of the necessary capital improvements needed to react to and reduce currently unacceptable levels of risk in the more densely populated areas in the Central Valley will have been funded and implemented. This will make way for more active actions that strive to better align land use and flood management practices to more effectively manage residual risk and provide a broader suite of outcomes across all societal values. Also, for ongoing investments, the State and its partner agencies will need time to establish the staff, resources, and mechanisms to accommodate the influx of dollars and ability to execute routine activities. Therefore, a ramping of investment must be sought. This ramping scheme is intended to help the State and its partners increase institutional capacity to undertake this major effort.

Phase 2 aims at actively transitioning to more balanced flood management investments. However, there would still be high risks to lives and assets remaining in the Central Valley that could be addressed with some additional capital investments (like continuation of the Yolo Bypass multi-benefit improvements, and remaining urban levee improvements). New funding and financing mechanisms are required to implement medium-priority actions as described in Section 3.2. These mechanisms would especially provide stable funding for many important ongoing actions as they ramp up to levels needed for sustainable floodplain management in the future. This would allow for a transition from reactive to proactive planning, and provide stable funding for continued success with lower priority actions.

In this second phase of investment, funding would increase for O&M and floodplain management activities. Other ongoing activities would eventually also require additional annual revenues to be implemented at levels needed to more resiliently manage flood risk The following activities would seek increases in annual funding:

- State operations, planning, and performance tracking
- Studies and analysis for risk reduction in small communities, rural areas, and urban centers

In addition to these baseline investments, the following capital investments are recommended for Phase 2 of investment:

- Remaining urban levee improvements
- Continued implementation of the Yolo Bypass multi-benefit improvements including Lower Elkhorn ecosystem improvements; Upper Elkhorn levee setback and ecosystem improvements, Sacramento Weir extension, Sacramento Bypass ecosystem improvements, Lower Yolo Bypass levee setbacks, Levee fix-in-place and ecosystem improvements, Cache Creek Settling Basin improvements, Fremont Weir extension
- Design, permitting, and implementation of Paradise Cut Bypass Expansion
- Remaining reservoir operations studies and floodplain storage investments
- Remaining critical small community and rural levee repairs
- A small number of property acquisitions in small communities where most feasible
- Expansion of the conservation and agricultural easements program

### 5.2.3 Phase 3

Phase 3 aims at proactively balancing flood management system investments for both capital and ongoing activities in a sustainable manner. Upon completion of the higher-priority and medium-priority actions, the amount of risk to lives and assets would be considerably alleviated. Many future uncertainties may impose their effect on flood management needs, but the intent for lower-priority actions would still be to achieve effective and resilient long-term system management that balances investments across a wide variety of activities. Lower-priority capital investment actions would require additional study and refinement to fully evaluate their investment cost and contribution to CVFPP goals. Furthermore, the required capital investment should be a much smaller percentage of the overall 2017 refined SSIA portfolio as ongoing investments increase to a steady amount that more proactively manages risk and reduces the need for reactive capital spending. This last phase of investment is when adequate annual funding levels are anticipated to have been secured to pay for all needed ongoing expenses.

## 5.3 Phased Capital Investments

Although the earliest capital investments would ideally focus on the most effective and high-priority actions first, a variety of constraints and the high cost of proposed capital investments make such an approach impractical. Therefore, capital investments were spread across all three phases for some management action categories by percentage of total investment. These percentages are noted in the category description to which they were applied. This spreading of investment was common for systemwide capital improvements and urban levee improvements.

For capital investment in management action categories that did not have percentages applied, the prioritization and scoring process described in Section 3 determined phasing. Overall, scoring thresholds were used to create high, medium, and low priority levels, and priority level determined phase. Figure 5-3 and Table 5-3 shows how investment in each of the capital management action categories is phased over time. The following sections provide further detail on each management action category, and how various subsets of activities within that line item were grouped into Phase 1, 2, or 3.

Figure 5-3. Capital SSIA Phased by Area of Interest Over Time

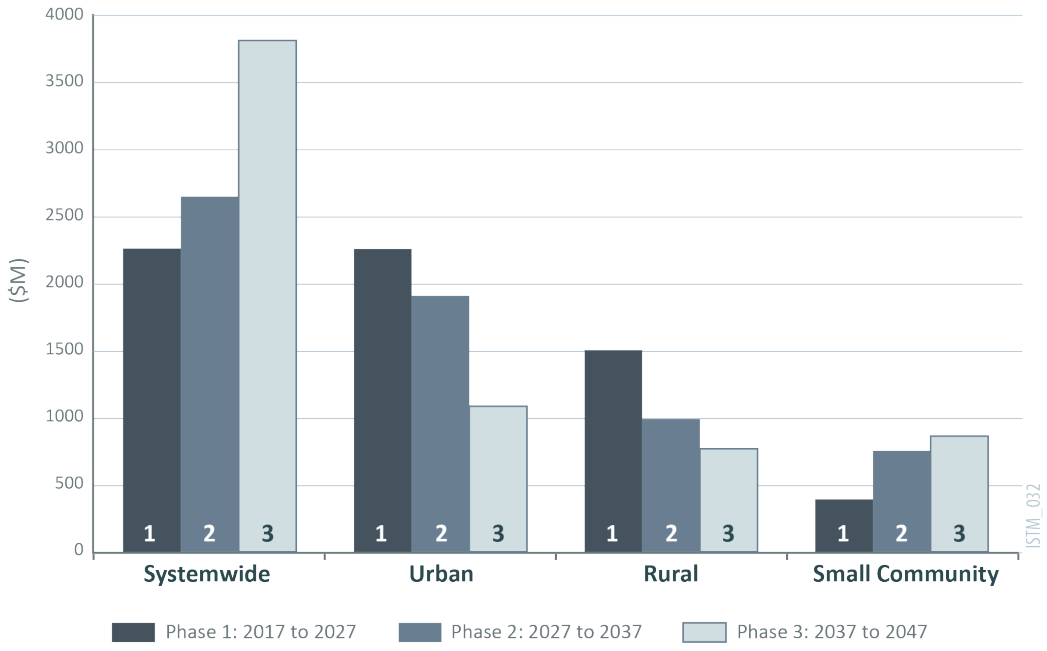


Table 5-3. Phased Capital Investments of the 2017 Refined SSIA Portfolio (2016 $)

| Action Category and Area of Interest | Data Source | Phase 1 | | Phase 2 | | Phase 3 | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) |
| **Systemwide** | | | | | | | | | |
| Yolo Bypass multi-benefit improvements | BWFSs | $920 | $1,130 | $920 | $1,130 | $200 | $250 | $2,040 | $2,510 |
| Feather River–Sutter Bypass multi-benefit improvements | BWFSs | $0 | $0 | $0 | $0 | $600 | $2,300 | $600 | $2,300 |
| Paradise Cut multi-benefit improvements | BWFSs | $30 | $30 | $250 | $310 | $0 | $0 | $280 | $340 |
| Reservoir and floodplain storage | BWFSs and RFMPs | $250 | $300 | $250 | $300 | $250 | $300 | $750 | $900 |
| | **Subtotal:** | **$1,200** | **$1,460** | **$1,420** | **$1,730** | **$2,750** | **$2,850** | **$3,670** | **$6,050** |
| **Urban** | | | | | | | | | |
| Levee improvements | USACE | $1,660 | $2,020 | $1,660 | $2,020 | $830 | $1,010 | $4,150 | $5,050 |
| Other infrastructure and multi-benefit improvements | BWFSs, RFMPs, and OMRR&R Workgroup | $310 | $380 | $20 | $20 | $80 | $100 | $410 | $500 |
| | **Subtotal:** | **$1,970** | **$2,410** | **$1,670** | **$2,040** | **$910** | **$1,110** | **$4,560** | **$5,550** |
| **Rural** | | | | | | | | | |
| Levee repair and infrastructure improvements | BWFSs, RFMPs, and OMRR&R Workgroup | $690 | $840 | $570 | $700 | $460 | $560 | $1,720 | $2,100 |
| Small-scale levee setbacks and floodplain storage | BWFSs and RFMPs | $150 | $190 | $10 | $10 | $10 | $20 | $170 | $220 |
| Land acquisitions and easements | RFMPs and floodplain management effort | $310 | $370 | $310 | $370 | $150 | $190 | $770 | $930 |
| Habitat restoration/reconnection | RFMPs | $180 | $220 | $20 | $20 | $60 | $70 | $260 | $310 |
| | **Subtotal:** | **$1,320** | **$1,620** | **$910** | **$1,110** | **$690** | **$840** | **$2,920** | **$3,560** |

Table 5-3. Phased Capital Investments of the 2017 Refined SSIA Portfolio (2016 $)

| Action Category and Area of Interest | Data Source | Phase 1 | | Phase 2 | | Phase 3 | | Total | |
|---|---|---|---|---|---|---|---|---|---|
| | | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) |
| Small Community | | | | | | | | | |
| Levee repair and infrastructure improvements | BWFSs, RFMPs, and OMRR&R Workgroup | $200 | $250 | $410 | $510 | $320 | $390 | $930 | $1,150 |
| Levee setbacks, land acquisitions, and habitat restoration | RFMPs and floodplain management effort | $40 | $50 | $210 | $250 | $390 | $470 | $640 | $770 |
| **Subtotal:** | | **$250** | **$300** | **$620** | **$760** | **$710** | **$860** | **$1,570** | **$1,920** |
| **Capital Total:** | | **$4,730** | **$5,790** | **$4,620** | **$5,650** | **$5,060** | **$5,670** | **$12,720** | **$17,080** |

Notes:
1. All table columns and row totals may not sum correctly and may not match Table 5-2 exactly due to rounding.
2. All estimated dollar values are in 2016 dollars and indicate an investment over 30 years.
3. Feather River–Sutter Bypass multi-benefit improvement cost ranges are included for completeness, but additional study is needed to refine recommended improvements, including consideration of improvements to Tisdale and Colusa Weirs.
4. Deferred *and* future repairs, rehabilitation and replacement costs are included within this capital estimate. *Deferred* repairs, rehabilitation and replacement costs estimated at $20M to $25M/year (present value $444 to $543M). *Future* repairs, rehabilitation and replacement costs estimated at $43M/year (present value $740 to $900M), respectively. These costs are included where the OMRR&R Workgroup is denoted as a source.

### 5.3.1 Systemwide Capital Investment

#### *Yolo Bypass Multi-benefit Improvements*

Yolo Bypass multi-benefit implementation will have broad systemwide flood management and ecosystem benefits beyond any single local agency's role and responsibilities. Implementation will cost approximately $2.0 to $2.5 billion, and will include land acquisition, levee setbacks and upgrades, habitat restoration, and many other activities described in much greater detail in the Draft Sacramento River BWFS (DWR, 2016a).

Some of these improvements must happen before others (such as land acquisitions preceding levee setbacks). These chronological dependencies and the large magnitude of the overall investment need for the entire set of individual Yolo Bypass multi-benefit actions make is necessary to spread costs across all three phases of investment. The following percentages were applied to the total estimated costs for Yolo Bypass multi-benefit improvements, resulting in the amounts shown in Table 5-3:

- Phase 1: 45%
- Phase 2: 45%
- Phase 3: 10%

#### *Feather River–Sutter Bypass Multi-benefit Improvements*

System-scale actions in the Feather River–Sutter Bypass are dependent on implementation and completion of Yolo Bypass improvements, which are not anticipated to reach completion until 2030 and beyond. The costs for future Feather River–Sutter Bypass multi-benefit improvements as presented in the Draft Sacramento BWFS range from $600 to $2,300 million. Future studies to evaluate the feasibility of these improvements, in close coordination with local and regional partners, will be needed. However, these improvements are lower priority and the estimated costs have been dedicated to Phase 3.

#### *Paradise Cut multi-benefit Improvements*

Costs for the Paradise Cut multi-benefit improvements were developed in the Draft San Joaquin River BWFS (DWR, 2016b) and are estimated to range between $280 and $340 million, including an initial land acquisition cost of approximately $30 million. The most immediate priority needed for implementing the Paradise Cut bypass expansion and ecosystem enhancements is to acquire the appropriate lands; costs for this activity are included in Phase 1. A more detailed feasibility study and additional stakeholder engagement will need to be completed to inform the design, permitting, and implementation of the bypass expansion in the future. Costs for performing these activities, along with the on-the-ground implementation, have been included in Phase 2, with completion by the beginning of Phase 3.

#### *Reservoir and Floodplain Storage*

Potential improvements to reservoirs and added floodplain storage are estimated to cost between $750 million and $900 million. This total estimate stems from a number of different sources. RFMPs provided an estimated cost of $140 million for New Bullards Bar outlet modification on the Yuba River, which was included in this management action category. This project is expected to increase the release capacity of the reservoir by adding a second gated spillway tunnel to the outlet works of the dam. Additionally, several costs were provided by the Draft

San Joaquin BWFS (DWR, 2016b), and include acquisition of Dos Rios Ranch, habitat and transitory storage at Three Amigos, increased objective releases for New Don Pedro Reservoir, increased flood storage in the Calaveras River Watershed, and subsidence solutions in Madera County.

Due to the large magnitude of these improvements and the viability of receiving necessary funds, costs were spread across all three phases of investment for planning purposes. The following percentages were applied to the total estimated costs for all reservoir and floodplain storage actions resulting in the amounts shown in Table 5-3:

- Phase 1: 33%
- Phase 2: 33%
- Phase 3: 33%

The priority actions already in progress, most immediately ready for implementation, and/or show the most promise for achieving the CVFPP's goals are listed below. It is anticipated that these priority actions will be supported by Phases 1 and 2 funding.

- Coordinate and provide project cost-share for completion of Folsom Dam Raise project
- Complete design, environmental documentation, and permitting for the project to construct a New Bullards Bar lower outlet
- Complete acquisition of Dos Rios Ranch
- Complete acquisition and restoration activities for Three Amigos Transitory Storage project
- Evaluate the feasibility of increasing upstream flood storage in New Hogan Lake or elsewhere in the Calaveras River Watershed

## Investment Contributions to Ecosystem and Multi-benefit Supporting Goals

An estimated cumulative capital and ongoing cost of $1.3B in the 2017 refined SSIA portfolio contributes to the CVFPP supporting goals of promoting ecosystem functions and promoting multi-benefit projects, embedded mostly within larger-scale activities. To calculate this total, assumed percentages were applied to each capital and ongoing investment for the primary and supporting goals. For this purpose, the supporting goal of promoting multi-benefit projects was assumed to not include any ecosystem enhancement investments, but only purely other multi-benefit components such as groundwater recharge, navigation, and agriculture.

For example, the rural capital management action type of small-scale levee setbacks and floodplain storage can contribute to four of the seven CVFPP primary and supporting goals. To calculate the investment of the management action category toward the applicable CVFPP goals, these assumed percentages were applied:

1. Reduce the chance of flooding: 45% of investment assumed
2. Reduce damages once flooding occurs: 5% of investment assumed
3. Promote ecosystem function: 25% of investment assumed
4. Promote multi-benefit projects: 25% of investment assumed

This methodology was applied to all of the capital and ongoing investments in the 2017 refined SSIA portfolio. Then, contribution amounts were summed for each primary and supporting goal for all the capital and ongoing investments. This is how the $1.3B was achieved for the supporting goals of promoting ecosystem function and promoting multi-benefit projects.

| Conceptual Example of Calculation for a Rural Capital Action Category | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Management Action Category | Average Investment Amount | Contribution to Goal | CVFPP Primary Goal | | | CVFPP Supporting Goals | | | |
| | | | Reduce Chance of Flooding | Reduce Damage | Improve Public Safety | Improve O&M | Promote Ecosystem | Promote Multiple Benefits | Improve Institution Support |
| Small-scale levee setbacks and floodplain storage | $195M over 30 years | Assumed Percentage | 45% | 5% | 0% | 0% | 25% | 25% | 0% |
| | | Contribution Amount | $87.75M over 30 years | $9.75M over 30 years | $0 | $0 | $48.75M over 30 years | $48.75M over 30 years | $0 |

Notes:
1. All estimates are in 2016 dollars and indicate investment over a 30-year timeframe.
2. The "reduce the chance of flooding" primary goal was considered as the flood-specific outcome of improving system performance, "reduce damages..." was considered exposure, and "improve public safety..." was considered vulnerability.
3. The "promote multi-benefit projects" supporting goal was assumed to not include any ecosystem enhancement investment (this category is primarily groundwater recharge actions).
4. Levee setback investments were assumed to be spread among the following goals: "reduce the chance of flooding," "reduce damages...," and "promote ecosystem functions." This assumption was made to account for the interdependencies and benefits received by implementing these types of actions. Land acquisitions investments for levee setbacks was also included.
5. CVFPP goals have been abbreviated.

### 5.3.2 Urban Capital Investment

*Urban community in Sacramento's pocket area*

As was discussed in Section 2, total State spending on flood risk reduction projects over the last decade totaled approximately $1.5 billion. It is difficult to break this investment down by the action categories developed for the 2017 CVFPP Update (since previous spending was not being tracked according to these categories). However, it is assumed that about two-thirds of this investment was focused on urban capital investments, with remaining funds being spent on storage or other systemwide efforts, and improvements for small communities. This implies a State capacity for implementing urban improvements of about $1 billion per decade. The total cost for urban capital improvements in the 2017 refined SSIA portfolio is between $4.5 and $5.6 billion. The State's target cost shares for these types of activities can be as high as 50%, so this implies up to $2.3 billion in total State investment. Therefore, planning aimed at spreading the total urban capital investment need over the 30-year implementation timeframe so that potential State contributions would not significantly exceed $1 billion per decade. This approach reflects capacity limitations in the State's ability to implement these actions within a 10-year timeframe, and financial limitations in terms of the ability to also fund other high-priority actions (outside the urban footprint) during Phase 1. The following discussion provides some additional detail on how the costs were estimated and divided among Phases 1, 2, and 3.

***Urban Levee Improvements***

State-federal feasibility study cost estimates were given deference to provide the costs estimates for urban levee improvements.

The major investments identified in the State-federal feasibility studies will be in urban areas protected by SPFC facilities.

Due to the large magnitude of these improvements and the viability of receiving necessary funds, costs were spread across all three phases of investment for planning purposes. The following percentages were applied to the total estimated costs for all urban levee improvements resulting in the amounts shown in Table 5-3:

- Phase 1: 40% ($1.6 to $2 billion)
- Phase 2: 40% ($1.6 to $2 billion)
- Phase 3: 20% ($0.8 to $1 billion)

Urban flood protection investments are generally shared among USACE, the State, and local agencies. Some communities' projects are in the feasibility and engineering phase, whereas others have been authorized or are being authorized for construction. The remaining feasibility studies and construction projects left to be completed in urban areas include the following:

- Continued implementation of ongoing USACE-authorized projects:
  - Initiate authorized West Sacramento Area Flood Control Agency (WSAFCA) construction
  - Initiate federal portion of Natomas Basin American River Common Features (ARCF) construction
  - Initiate Sacramento Bank Protection Phase II Construction (American River)
  - Initiate Stockton area levee construction, including western front levees
  - Complete ARCF 2014 WRDA sites
  - Complete Folsom Dam Joint Federal Project and Dam Raise
  - Complete Marysville Ring Levee improvements
  - Complete SAFCA levee accreditation for the Pocket Area and North Area
  - Complete SBFCA Feather River West Levee
  - Complete SJAFCA Smith Canal construction
  - Complete South Sacramento County Streams construction
  - Complete WSAFCA-approved construction, including Southport Levee Improvements
  - Complete RD 17 Improvements
  - Complete Star Bend Improvements
  - Complete Bear River Improvements
- Completion of State-federal projects recommended by the following feasibility studies:
  - Cache Creek Settling Basin General Reevaluation Report
  - Central Valley Integrated Flood Management Study (CVIFMS) Phase 2
  - Merced County Streams General Reevaluation Report
  - Sacramento River General Reevaluation Report
  - West Sacramento General Reevaluation Report (USACE, 2015b)
  - Woodland Lower Cache Creek Feasibility Study (USACE, 2010)
  - Yuba River General Reevaluation Report, including study of Yuba Goldfields
  - Sacramento River Basin Feasibility Study (ecosystem study)
  - Yuba River Ecosystem Restoration Feasibility Study
- Implementation of projects identified in the Lower San Joaquin River Draft Feasibility Report:
  - Lower San Joaquin River Feasibility Study, Phase 2

***Other Urban Infrastructure and Multi-benefit Improvements***

Although the levee upgrades and improvements identified in USACE estimates constitute the bulk of potential capital investment for urban areas, additional actions were identified by the RFMPs[1], BWFSs (DWR 2016a and 2016b), and OMRR&R Workgroup. These actions represent other opportunities for reducing urban flood risk and were used to estimate the investment required for other urban infrastructure and multi-benefit improvements. Additionally, habitat restoration activities conducted on or within urban infrastructure (such as replanting riparian vegetation in existing river bank gaps) are also included in this category. Estimated costs for these actions range between $410 and $510 million.

The priority actions already in progress, most immediately ready for implementation and/or show the most promise for achieving the CVFPP's goals are listed below. Based on the score threshold for the actions included in this category, it is anticipated that these priority actions will be supported by Phase 1 and 2 funding.

- Draft San Joaquin River BWFS cost estimates for the Mormon Channel Bypass, RD 17 levee improvements, and the associated levee setback at RM 52.

- OMRR&R Workgroup and RFMP cost estimates for deferred maintenance pipe penetration repairs or removal in urban levees, and for future levee and minor structure (such as stop logs or gated closure structures) repair, rehabilitation, and replacement activities. Giant reed and *Arundo donax* removal activities are included as well.

### 5.3.3 Rural Capital Investment

***Rural Levee Repair and Infrastructure Improvements***

The total estimated cost for rural levee repair and infrastructure improvements ranges between $1.7 and $2.1 billion, and includes critical legacy levee repairs, repair and rehabilitation of hydraulic structures, and new or upgraded retention and detention basins. The RFMPs identified most of these opportunities, with deferred maintenance constituting the bulk of the cost.

It was common for RFMP proposed critical levee repairs (typically including activities such as erosion repair, seepage repair, slope stability repair and levee overtopping) to be provided by DWR's Non-Urban Levee Evaluations Project (NULE) cost estimation methodology. The NULE cost estimates are order-of-magnitude estimates suitable for selecting and comparing conceptual remediation's selected for levee segments based upon preliminary and limited data and analyses. These estimates were not intended to be used as a basis for final design, or construction, or as an estimate of construction cost for construction planning. In light of these limitations, the NULE cost estimates were deferred to DWR's Flood System Repair Project (FSRP) program estimates for critical repair sites at an average of $4M per site.

[1] Feather River Partners, 2014; FloodProtect, 2014; Mid and Upper Sacramento River Regional Flood Management Plan Partners, 2014; Reclamation District 2092, 2014; San Joaquin Area Flood Control Agency, 2014; San Joaquin River Flood Control Project Agency, 2014

Another significant portion of this estimate, $400 to $490 million, is the cost of future levee and minor structure repair, and rehabilitation activities including pipe penetration removal and repair, giant reed and *Arundo donax* removal activities, as identified by the Draft OMRR&R TM.

Investment costs are relatively balanced across all three phases for rural levee repair and infrastructure improvements. New or improved levees in rural areas have potential to intensify risk in SPFC floodplains; therefore, it is recommended that only deferred maintenance and critical levee repair sites be given higher priority in rural areas.

### *Rural Small-scale Levee Setbacks and Floodplain Storage*

The RFMPs[2] and the BWFSs (DWR 2016a and 2016b) both contained information on potential small-scale levee setbacks and floodplain storage projects, with a total estimated cost of between $170 and $210 million.

The priority actions already in progress, most immediately ready for implementation, and/or showing the most promise for achieving the CVFPP's goals are listed below. Based on the score threshold, it is anticipated that these priority actions will be supported by Phase 1 funding.

- Draft San Joaquin River BWFS $63 million cost estimate for the levee setbacks at San Joaquin River mile 60 and 65
- A few RFMP levee improvement and setback projects with habitat restoration components

### *Rural Land Acquisitions and Easements*

**Land acquisitions and easements allow flood and floodplain managers more flexibility to manage flood risk and contribute toward societal values in a variety of ways.**

Rural agricultural or conservation land acquisitions and easements represent potential management action types that attenuate flood flows onto designated flowage easements or purchases that improve the system's flexibility to manage flood waters. The RFMPs identified some of these potential opportunities, but most of the cost estimates were provided by DWR's emergency and floodplain management effort. This effort used flood mapping and GIS tools to estimate agricultural and conservation land acquisition and easement potential within the 100-year floodplain and in a given radius of established small communities in each basin (see Appendix D for more details). These estimates range between $770 million and $930 million. Acquiring land or easements where flooding and development are both likely to occur can reduce risk intensification resulting from future population growth, especially if implemented before other less adaptable actions, like adding or hardening flood infrastructure.

[2] Feather River Partners, 2014; FloodProtect, 2014; Mid and Upper Sacramento River Regional Flood Management Plan Partners, 2014; Reclamation District 2092, 2014; San Joaquin Area Flood Control Agency, 2014; San Joaquin River Flood Control Project Agency, 2014

However, DWR does not currently have an active flood easement implementation program, and many of the acreages identified in the study may not be owned by landowners who are currently eager to participate in such a program if it were available. These issues pose timing challenges, so costs were spread across all three phases of investment for planning purposes. The following percentages were applied to the total estimated costs for all rural land acquisitions and easements, resulting in the amounts shown in Table 5-3:

- Phase 1: 40%
- Phase 2: 40%
- Phase 3: 20%

Ideally, Phase 1 investment would focus on areas that are very high risk and involve a willing group of landholders who show interest in the economic incentives being offered through the easement program. Acquisitions and easements also allow flood and floodplain managers more flexibility to choose different types of improvements in the future. Phase 1 investment would also focus on the areas that do the most to provide this flexibility, while also considering the potential to couple with habitat restoration or flood reconnection actions. When easements or acquisitions contribute to these broader societal values, opportunities arise for different types of funding mechanisms.

***Rural Habitat Restoration and Reconnection***

Guided by the CVFPP Conservation Strategy (DWR, 2016c), some RFMPs also identified opportunities for habitat restoration and reconnection projects with estimated costs ranging between $260 and $310 million. This is not the only category that contributes to ecosystem-related outcomes and CVFPP supporting goals. Ecosystem improvements within this category are meant to be in addition to those implemented within other categories, such as systemwide improvements. The actions in this category are distinct because they are focused primarily on habitat improvements or connection rather than reduction of flood risk.

*Wetlands in the Lower San Joaquin Region*

The priority actions already in progress, most immediately ready for implementation, and/or showing the most promise for achieving the CVFPP's goals are restoration of hundreds of acres of floodplains, improvement of water quality, and provision of habitat for salmonids, migratory birds, and waterfowl while maintaining agricultural production. Based on the score threshold, it is anticipated that these priority actions will be supported primarily by Phase 1 funding.

### 5.3.4 Small Community Capital Investment

***Small Community Levee Repair and Infrastructure Improvements***

*Small Community within the Mid-Upper Sacramento Region*

The estimated cost for currently identified repairs and improvements to levees and hydraulic structures is approximately between $930 million and $1.2 billion. Most of these costs reflect potential investments in levee repairs and improvements identified by RFMPs in the Sacramento Basin. This estimate also includes the cost for levee and hydraulic structure improvements identified in the Draft San Joaquin River BWFS (DWR, 2016b) for protecting the City of Firebaugh, along with other multi-benefit actions. Another significant portion of this estimate, $80 to $100 million, is the cost of *future* levee and minor structure repair and rehabilitation activities, including pipe penetration removal and repair, and giant reed and *Arundo donax* removal activities as identified by the Draft OMRR&R TM.

Small community levee repair and infrastructure improvements are considered anywhere from a low to high-priority investment, depending on location and the potential for risk management with more cost-effective (and less risk-intensifying) alternatives. Therefore, costs are somewhat similar for each phase of investment with an emphasis in Phase 2, because results from the Small Community Program feasibility studies should more specifically describe which improvements will be needed.

Because many management actions applicable to small communities would require annual and ongoing expenditure, only a limited amount of capital expenditure is recommended for small communities (split between more traditional levee improvements, and investment in property acquisition and retreat).

***Small Community Levee Setbacks, Land Acquisitions, and Habitat Restoration***

Cost estimates for these actions are composed mostly of the costs for potential land and property acquisition and easements estimated by DWR's emergency and floodplain management effort, which range approximately from $640 to $780 million. Higher priority will be given to these actions that limit future intensification of flood risk and add flexibility and resiliency to the flood management system. Levee setbacks and land acquisition in small communities require close coordination with local partners and landowners and compatibility with local land use plans. Therefore, investments in these actions are assumed to ramp up over time throughout the three phases, with limited progress occurring in Phase 1.

## 5.4 Phased Ongoing Investment

A ramping scheme was applied to planned ongoing investments for the State and its partner agencies to provide time for establishing the necessary staff, resources, and mechanisms needed to accommodate the influx of annual funding while maintaining their routine activities. The ramping scheme is based on the prioritization and scoring process described in Section 3. Overall, scoring thresholds were used to create high, medium, and low priority levels. Percentages for each priority level and phase were applied to all ongoing management action categories to create the buildup of investment costs over time. However, all ongoing activities are necessary for a well-functioning flood management system and will be supported before capital investments in all funding scenarios (as will be described later in Section 7). Table 5-4 shows the percentage of annual investments included in each phase for a given priority level, achieving full investment by the end of Phase 3.

Table 5-4. Ongoing Investment Ramping Scheme

| Priority | Investments |
|---|---|
| **Phase 1: 2017 to 2027** | |
| Low | 20% |
| Medium | 50% |
| High | 75% |
| **Phase 2: 2027 to 2037** | |
| Low | 50% |
| Medium | 75% |
| High | 100% |
| **Phase 3: 2037 to 2047** | |
| Low | 100% |
| Medium | 100% |
| High | 100% |

Figure 5-4 and Table 5-5 show how these ramping percentages affect all of the ongoing management action categories. All investment amounts are presented in annualized terms, where Phase 3 totals are the desired ongoing investment moving into the future. The following provides further detail on each management action category, and how various subsets of activities within that line item were grouped into Phase 1, 2, or 3.

Figure 5-4. Average Annual Ongoing Investment Phased Over Time

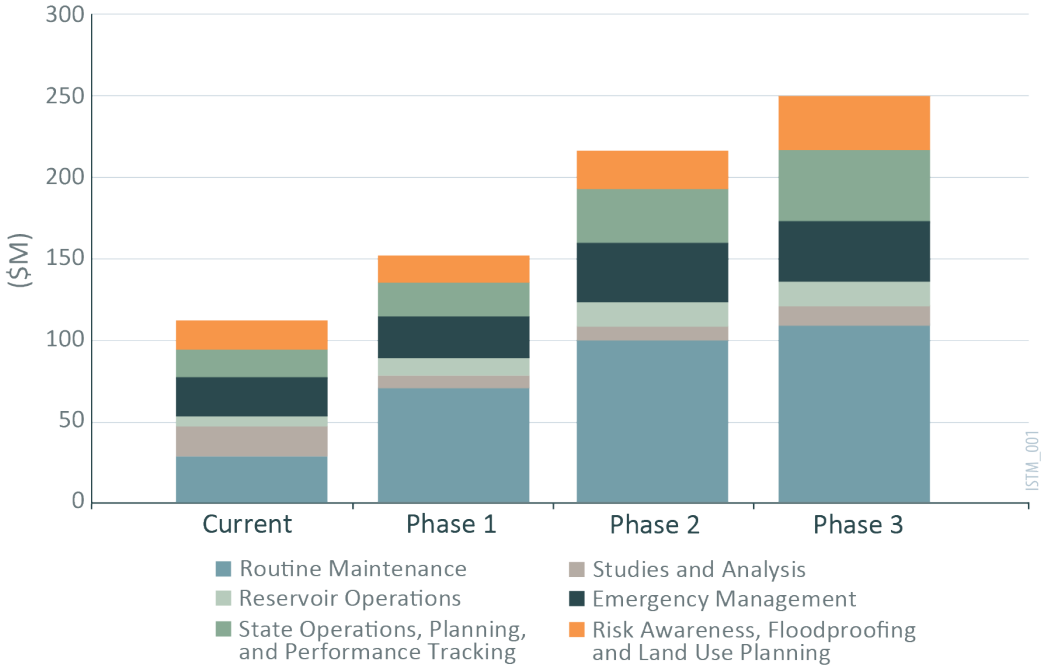


Table 5-5. Ongoing Investments of the 2017 Refined SSIA Portfolio Per Year (2016 $)

| Action Category and Area of Interest | Data Source | Phase 1 | | Phase 2 | | Phase 3 | |
|---|---|---|---|---|---|---|---|
| | | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) |
| **Systemwide** | | | | | | | |
| State operations, planning, and performance tracking | RFMPs and State operations/planning effort | $19 | $24 | $31 | $37 | $41 | $50 |
| Emergency management | RFMPs and emergency management effort | $24 | $30 | $32 | $40 | $33 | $40 |
| Reservoir operations | BWFSs | $10 | $12 | $13 | $16 | $13 | $16 |
| Routine maintenance | RFMPs and OMRR&R Workgroup | $65 | $80 | $91 | $111 | $99 | $121 |
| | **Annual Subtotal:** | **$119** | **$145** | **$167** | **$204** | **$186** | **$227** |
| **Urban** | | | | | | | |
| Risk awareness, floodproofing, and land use planning | RFMPs and floodplain management effort | $7 | $8 | $10 | $12 | $12 | $14 |
| Studies and analysis | RFMPs and USACE | $1 | $1 | $1 | $2 | $2 | $2 |
| | **Annual Subtotal:** | **$8** | **$10** | **$11** | **$14** | **$14** | **$17** |
| **Rural** | | | | | | | |
| Risk awareness, floodproofing, and land use planning | RFMPs and floodplain management effort | $2 | $2 | $3 | $4 | $4 | $5 |
| Studies and analysis | RFMPs | $0 | $0 | $1 | $1 | $1 | $1 |
| | **Annual Subtotal:** | **$2** | **$3** | **$4** | **$4** | **$5** | **$7** |
| **Small Community** | | | | | | | |
| Risk awareness, floodproofing, and land use Planning | RFMPs and floodplain management effort | $5 | $6 | $8 | $10 | $10 | $12 |
| Studies and analysis | RFMPs and Small Communities Program | $5 | $6 | $7 | $9 | $10 | $12 |
| | **Annual Subtotal:** | **$10** | **$12** | **$15** | **$18** | **$20** | **$24** |
| | **Ongoing Annual Total:** | **$138** | **$169** | **$197** | **$240** | **$224** | **$274** |

Notes:
1. Estimated values are in 2016 dollars and indicate annual investments made over 30 years. They have not been discounted to present value nor escalated for inflation.
2. Present value of total ongoing investments is approximately $5B over 30 years.
3. Deferred *and* future routine O&M costs are included within this ongoing estimate. *Deferred* routine operation and maintenance costs are estimated at $18M to $22M/year. *Future* routine operation and maintenance costs are estimated at $88M/year. Both deferred *and* future maintenance is captured in the systemwide routine maintenance line item.

### 5.4.1 Systemwide Ongoing Investment

***State Operations, Planning, and Performance Tracking***

Section 2 described the importance of enabling conditions that support effective implementation of the CVFPP over 30 years. State operations, planning, and performance tracking activities represent the State's contributions toward creating those enabling conditions.

Activities related to State operation, planning, and performance tracking is estimated to cost between $41 million and $50 million annually. This cost estimate includes necessary DWR and other State agency staff and resources to accomplish the recommendations for each policy issue described in the 2017 CVFPP Update. For example, a recommendation with regard to hydraulic and ecosystems baselines and program phasing is to "Convene workgroups to determine the legal and institutional mechanisms whereby the systemwide structural elements of the CVFPP can be implemented over multiple decades, accounting for local and regional benefits and impacts." The estimated costs to accomplish this recommendation have been included in the $41 to $50 million annual estimate. This estimate does not include any costs associated with federal or local agency operations, planning, or performance tracking. For more information, see Appendix D.1, State Operations/Planning Cost Estimation.

To support the wide variety of investments of the 2017 refined SSIA portfolio, the State also requires adequate capacity to administer program activities, continue planning and coordinating with federal agencies, and develop an initial performance tracking system for assessing the effectiveness of these flood management system investments. A performance tracking system would compare the actual outcomes of the CVFPP investment against intended outcomes. This would enable flood managers to make better-informed decisions on what types of actions and policies are working most effectively to achieve CVFPP goals.

Higher priority is assigned to maintaining State operations that support the implementation of flood management system improvements and to developing a performance tracking system for investments. Additionally, high priority is assigned to updates to the Flood System Status Report (DWR, 2016d) (mandated by legislation) and the SPFC Descriptive Document (DWR, 2016e) (if needed) that would accompany the future CVFPP Updates, which inform the CVFPB of performance and changes to the SPFC. These priority activities are anticipated to be funded by Phase 1.

### *Emergency Management*

*Flood exercises improve flood emergency readiness*

Emergency management is estimated to cost between $32 and $40 million annually. Cost estimates for local and operational area flood emergency response planning and preparedness are based on a combination of the RFMP project cost estimates and on DWR projections based on the three flood emergency response grant programs since 2013. This includes three flood emergency response plan updates for each of the 88 LMAs in the Sacramento and San Joaquin Basins. The emergency and floodplain management effort also estimated the cost of replacing/renewing flood fight supplies, updating flood information systems, adding new forecast points, exercising and equipping the State's flood emergency response teams, and other activities. This cost estimate only includes State and local costs estimated in the RFMPs.[3] Federal emergency management costs are not included.

The priority actions already in progress and/or most immediately ready for implementation to reduce vulnerability of people and property in high risk areas are listed below. It is anticipated that these priority actions will be supported or continue to be supported by Phase 1 funding. However, other additionally proposed emergency management activities may not be fully funded until Phase 2.

- Design and construct improved all-weather access roads on levee crowns for quick response to flood emergencies
- Enhance flood forecasting and notifications for rural and small communities by assessing and prioritizing needs, identifying additional forecasting points in Sacramento and San Joaquin basins, and providing flood forecasts and notifications
- Continue to maintain strategically located stockpiles of flood fight materials in the Sacramento and San Joaquin Valleys, and three locations in the Delta
- Provide technical and financial assistance to local agencies to help them develop local flood preparedness and response plans for their communities and conduct regional and local flood exercises, and engage local responders to improve flood emergency readiness at the local level

[3] Feather River Partners, 2014; FloodProtect, 2014; Mid and Upper Sacramento River Regional Flood Management Plan Partners, 2014; Reclamation District 2092, 2014; San Joaquin Area Flood Control Agency, 2014; San Joaquin River Flood Control Project Agency, 2014

- Develop and train staff on the use of the Flood Emergency Management System for the State-Federal Joint Flood Operations Center to manage, track, and report the flood emergency management and flood fight activities

### *Reservoir Operations*

Reservoir operations management actions such as forecast-coordinated operations (F-CO) and future forecast-informed operations (F-IO) were identified and refined by the RFMPs and San Joaquin River BWFS (DWR, 2016b). The total estimated cost of improved reservoir operations ranges from $13 million to $15 million annually. This cost estimate only reflects State costs associated with reservoir operations.

*New Bullards Bar Reservoir*

The priority actions most immediately ready for implementation or currently already in progress are listed below. It is anticipated that these priority actions will be supported by Phase 1 funding and ramp up throughout the other phases of investment.

- Continue to conduct F-CO and improve F-IO on Oroville Dam and the Feather River and New-Bullards Bar and the Yuba River
- Evaluate reservoir operations actions for New Don Pedro Reservoir in the Tuolumne River Watershed
- Develop a decision support system and other tools for reservoir operators to enhance both F-CO and F-IO and conduct operational exercises with reservoir operators that emphasize coordinated operations of reservoirs critical to flood management in the Central Valley

### *Routine Maintenance*

DWR's flood project inspections, Flood System Repair Program, and the RFMPs identified cost estimates for *deferred* systemwide routine maintenance that include activities such as comprehensive bypass or corridor vegetation and invasive species management, sediment removal, and rodent control. Deferred routine maintenance cost estimates are included in this ongoing investment category. Additionally, the OMRR&R Workgroup identified the *future* cost of routine maintenance, which includes the following activities:

- Routine levee and channel maintenance, such as rodent control, vegetation control, encroachments and pipe maintenance, bank erosion and repair, and sediment removal
- Minor structures maintenance, such as stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments

- Major structures maintenance, such as weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants

The total costs for *deferred* and *future* routine maintenance are presented separately. A combined routine maintenance estimated total ranges between $99 and $121 million annually.

- $18M to $22M annually for *deferred* routine maintenance
- $88M annually for *future* routine maintenance

**Total costs for deferred and future routine maintenance:**

- $18M to $22M annually for deferred routine maintenance
- $88M annually for future routine maintenance

A combined routine maintenance estimated total ranges between $99 and $121 million annually. This does not include any repair, rehabilitation and replacement costs; these are included in capital investments described earlier.

These costs do not include any repair, rehabilitation and replacement costs; these are included in capital investments described earlier. Deferred pipe penetrations and giant reed removal are part of capital investment because of the magnitude of their associated costs and how they will be paid for. This differentiation can often be a point of confusion because these types of activities are usually routine maintenance activities, but when deferred, escalate the level of effort required to correct them.

The higher-priority activities listed below will be carried out by the State on facilities for which it is responsible under California Water Code Section 8361. The State will also consider providing implementation grant funding to partner local agencies to ensure proper operation and maintenance of all SPFC facilities. Only a proportion of these priority activities can be funded with Phase 1 levels of funding, given that the State and local entities currently lack adequate capacity to implement the full suite of maintenance activities the flood system needs.

- Maintain all-weather levee crown roads for quick response to potential flood threats
- Enhance inspection and maintenance of the levees and channels of the SPFC under jurisdiction of the State
- Ensure that sites identified as requiring maintenance actions during spring inspections are properly maintained and repaired by fall before the flood season
- Coordinate inspection and timely maintenance of the levees under LMA jurisdictions
- Address long-standing impediments to sediment and debris removal
- Develop strategies for long-term system management and maintenance of the SPFC facilities, including strategies to address legacy system issues such as encroachment and pipe penetrations

## Breaking Down the Cost of Routine O&M and Repair, Rehabilitation, and Replacement

The OMRR&R Workgroup estimated an annual need of $131M for routine maintenance activities and for repair, rehabilitation, and replacement activities. Paying for these types of activities are very different. For the purposes of developing an investment strategy, cost estimates were divided into either capital or ongoing investments for the 2017 refined SSIA portfolio:

- Future and deferred routine maintenance activity cost estimates are captured in the ongoing system routine maintenance category.
- Future and deferred repair, rehabilitation, and replacement cost estimates are captured in the capital urban, rural and small community categories.

### Ongoing Annual Routine Maintenance:

- Routine maintenance activities include:
  - Comprehensive bypass or corridor vegetation and invasive species management
  - Sediment removal
  - Rodent control
  - Encroachments and pipe maintenance
  - Minor bank erosion and repair
  - Minor and major structure maintenance
- $18M to $22M annually – Deferred ongoing annual routine maintenance needs estimate identified by RFMPs and other sources
- $88M annually – Future ongoing annual routine maintenance needs estimate identified by OMRR&R Workgroup
- $110M average annual total. Captured in the Ongoing Systemwide Routine Maintenance investment category

### Capital Repair, Rehabilitation, and Replacement:

- Repair, Rehabilitation and replacement Activities include:
  - Critical seepage, erosion or slope stability levee repairs
  - Giant reed and *Arundo donax* invasive species removal
  - Encroachment replacement, removal or repair
  - Pipe penetration replacement, removal or repair
  - Minor and major structure full rehabilitation or replacement
- $20M to $25M annually – Deferred repair, rehabilitation, and replacement needs estimate identified by RFMPs and other sources
- $43M annually – Future repair, rehabilitation and replacement needs estimate identified by OMRR&R Workgroup
- $68M average annual capital investment total captured in the following management action categories:
  - $16M Urban – Other Infrastructure and multi-benefit improvements
  - $44M Rural – Levee repair and infrastructure improvements
  - $8M Small Community – Levee repair and infrastructure improvements

### Future Annual Routine Maintenance Estimate

| | | | | | |
|---|---|---|---|---|---|
| **Amount:** | **$131M/yr.** | - | **$43M/yr.** | = | **$88M/yr.** |
| **Description:** | OMRR&R Workgroup Estimate, Future Annual Routine Maintenance and RR&R activities | | OMRR&R Workgroup Future Annual RR&R Estimate | | OMRR&R Workgroup Future Annual Routine Maintenance Estimate |

### Total Average Deferred and Future Annual Routine Maintenance Estimate

| | | | | | |
|---|---|---|---|---|---|
| **Amount:** | **$88M/yr.** | + | **$22M/yr.** | = | **$110M annual average** |
| **Description:** | OMRR&R Workgroup Future Annual Routine Maintenance Estimate | | RFMP Deferred Annual Routine Maintenance Estimate | | Total Average Deferred and Future Annual Routine Maintenance Estimate |

### 5.4.2 Urban Ongoing Investment

***Urban Risk Awareness, Floodproofing, and Land Use Planning***

These actions are estimated to cost between $12 and $15 million annually. This estimate is based on proposed projects in various RFMPs and DWR's emergency and floodplain management effort. Estimates from this effort are based primarily on existing State expenditures for floodplain risk management programs and activities, with the majority of the costs focused on floodplain mapping. However, the numbers also include cost estimates for additional activities, including the creation and maintenance of an information management system, periodic channel capacity updates, sediment modeling, and land use planning. Opportunities identified in the RFMPs for floodplain management in urban areas include a mix of floodproofing and monitoring activities.

Higher priority will be given to actions that provide increased public risk awareness and notification for urban areas that have yet to receive structural improvements, especially if these activities involve critical facilities such as wastewater treatment plants, hospitals, or other emergency service facilities. These activities are anticipated to be included with Phase 1 funding levels, whereas some other activities may not be fully funded until Phase 2 or 3.

***Urban Studies and Analysis***

Cost estimates for ongoing studies and analysis were informed by proposed studies in the six RFMPs and by State-federal feasibility studies. The State-federal feasibility studies that are still in progress or will be initiated in the near future included in this estimate are the Sacramento General Reevaluation Report, West Sacramento General Reevaluation Report, Cache Creek Settling Basin General Reevaluation Report, Woodland/Lower Cache Creek Feasibility Study, Yuba River General Reevaluation Report, Merced County/Bear Creek Unit Feasibility Study, and the Lower San Joaquin Feasibility Study, Phase 2. The total annualized cost for urban areas is approximately $3 million.

In some cases, efforts to complete these remaining urban studies and analyses are already underway, so continuation of these efforts for urban areas would be funded in Phase 1. Therefore, most of the remaining urban studies and analyses are medium priority and are anticipated to be funded by Phase 2, allowing much needed small community feasibility studies and analysis to begin in Phase 1.

### 5.4.3 Rural Ongoing Investment

***Rural Risk Awareness, Floodproofing, and Land Use Planning***

These actions are estimated to cost between $4 and $6 million annually. Similar to the estimates for urban areas, this cost range estimate is based on a limited number of proposed projects in various RFMPs and DWR's emergency and floodplain management effort. Estimates from this effort are based on the same State expenditures and types of activities as discussed in the urban areas. Other opportunities identified in the RFMPs for floodplain management in rural areas focus primarily on land use planning and data sharing and management.

It is proposed that higher-priority annual investment in floodplain management represent a more modest increase from current spending levels, starting at $2 to $3 million annually for rural areas. This would mark the beginning of a trend toward greater investment over time in these

types of proactive, resilient actions. This initial level of investment, funded by Phase 1, should focus on the following:

- Efforts to establish flood structure protection area zones
- Educational and training opportunities and additional regulations for land use planners to help ensure sound floodplain management is considered in land use planning at the local level
- Collaboration with FEMA on investing in incentives for implementing proactive floodplain management activities

#### *Rural Studies and Analysis*

Cost estimates for ongoing studies and analysis were based entirely on the cost of studies proposed by the six RFMPs. The total annualized estimated cost for rural areas is approximately $2 million. Many of these studies and analyses include feasibility studies for smaller-scale levee and structure repairs, investigations for sediment management, and studies that focus on multi-benefit approaches to risk reduction.

While ongoing study and analysis is necessary even in Phase 1, most rural studies and analysis are medium to low priority, and anticipated to be funded by Phases 2 and 3. Funding for other more pressing rural investments such as flood risk notifications, emergency management, and high-priority capital investments will take priority over these types of studies and analyses.

### 5.4.4 Small Community Ongoing Investment

#### *Small Community Risk Awareness, Floodproofing, and Land Use Planning*

The cost for these actions is estimated between $10 and $12 million annually, based on a limited number of proposed projects in various RFMPs and DWR's emergency and floodplain management efforts. Floodplain risk awareness campaigns and implementation of land use management policies are particularly effective at risk reduction for small communities.

Therefore, it is proposed that higher priority be given to these annual investments because many of these actions can be implemented fairly quickly, especially with the bolstering and support of the National Flood Insurance Program (NFIP) Community Rating System implementation program. These activities may be fully supported within Phase 1, while some of the costlier floodproofing opportunities identified in the floodplain management effort may not start until Phases 2 and 3. This is because of current capacity constraints in floodplain management implementation programs and the need for continued coordination with local and federal partners.

#### *Small Community Studies and Analysis*

Cost estimates for ongoing studies and analysis were based entirely on the cost of studies proposed by the six RFMPs. The total annualized estimated cost for small communities ranges between $10 and $12 million. The majority of these analyses are small community feasibility studies for flood risk reduction improvements that could be funded through the Small Community Flood Risk Reduction Program. These feasibility studies will consider a wide range

of actions, such as structure buyout or flood-proofing structures, in addition to levee construction that could offer flexibility in addressing risk for small communities. These studies and analyses are assigned higher priority over similar studies in other areas of interest because much remains unknown about the best way to reduce and/or manage risk in the Central Valley's small communities. Most of these studies are anticipated to be funded by Phase 1.

## 5.5 Summary of Capital and Ongoing Costs over 30 Years

The total 30-year investment for the CVFPP is broken down by the two river basins and by the four areas of interest: systemwide, urban, rural, and small community. Table 5-6 represents the summation of the cost estimates provided by the State-federal feasibility studies, BWFSs (DWR 2016a and 2016b), RFMPs[4], OMRR&R Work Group, and other efforts. This summation is the critical "need" for SPFC investments demonstrated by multiple efforts and agencies with responsibility for improving and maintaining the SPFC. Both the 30-year capital investment and 30-year ongoing investment of the 2017 refined SSIA portfolio are summarized in Table 5-6 and Figure 5-5 in 2016 dollars.

Figure 5-5. CVFPP 30-Year Investment

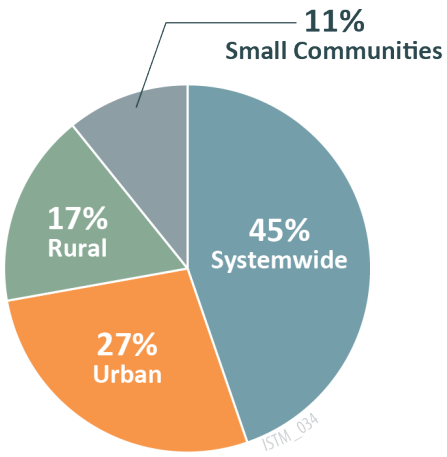



Table 5-6. Total Capital and Ongoing CVFPP Investments over 30 Years

| Area of Interest | Sacramento Basin | | San Joaquin Basin | | Total | |
|---|---|---|---|---|---|---|
| | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) |
| Systemwide | $5,920 | $7,240 | $1,910 | $2,340 | $7,830 | $9,580 |
| Urban | $3,560 | $4,350 | $1,200 | $1,460 | $4,760 | $5,810 |
| Rural | $1,860 | $2,280 | $1,130 | $1,370 | $2,990 | $3,650 |
| Small Community | $1,540 | $1,890 | $310 | $370 | $1,850 | $2,260 |
| **Grand Total:** | **$12,880** | **$15,760** | **$4,550** | **$5,540** | **$17,430** | **$21,300** |

Note:
Totals reflect annual ongoing investments converted to present value (2016 dollars) and summed with present value capital investment costs.

[4] Feather River Partners, 2014; FloodProtect, 2014; Mid and Upper Sacramento River Regional Flood Management Plan Partners, 2014; Reclamation District 2092, 2014; San Joaquin Area Flood Control Agency, 2014; San Joaquin River Flood Control Project Agency, 2014

Taken together, the cost estimates indicate a total present value investment need of approximately $17 to $21 billion over the next 30 years. The cost of implementing the full range of investments identified in the CVFPP represents a major increase from current and historical levels of funding, and will need to be phased over 30 years.

To better understand this major increase that will be required by all cost share partners, current and historical funding levels are needed relative to the proposed investments in management action categories. Table 5-7 present current estimated contributions of State, federal, and local partners to the 2017 refined SSIA portfolio's ongoing investments.

Table 5-7. Ongoing Investment Annual Comparison of the 2017 Refined SSIA Portfolio and Current Funding (2016 $ Million)

| Current Contribution to Ongoing Investments | | | | | | 2017 Refined SSIA Portfolio Ongoing Investments | | |
|---|---|---|---|---|---|---|---|---|
| Cost Share Partners and Current Activities | Data Source[1] | State ($M/year) | Federal ($M/year) | Local ($M/year) | Total ($M/year) | Area of Interest and Management Action Category | Data Source | End of Phase 3 Estimate ($M/year) |
| ▪ **State:** Flood System Assessment, Engineering, Feasibility, and Permitting Implementation Program | ▪ **State:** DFM Fiscal Database. Estimate does not include all DFM operating costs. Assumed 50% of spending in this program was for studies and analysis. This amount was subtracted from this estimate. | $18.5 | N/A | N/A | $18.5 | **Systemwide:** State operations, planning, and performance tracking | ▪ **RFMPs:** bypass and corridor management planning, regional programmatic permitting<br>▪ **DWR Operations/Planning Effort:** State activities and resources associated with implementation of a 30-year program | $41 to $50 |
| ▪ **State:** Flood Emergency Response Implementation Program<br>▪ **Local:** City, county, and special district disaster preparedness | ▪ **State:** DFM Fiscal Database.<br>▪ **Local:** Emergency response data only available for cities. Assumed the same percentage of overall flood management budget that cities spent on ER was spent by counties and special districts. | $23.0 | N/A | $0.5 | $23.5 | **Systemwide:** emergency management | ▪ **RFMPs:** emergency preparedness (e.g., all-weather patrol and access roads, training and planning), emergency response and recovery (e.g., flood fight, evacuations)<br>▪ **DWR Emergency Management Effort:** Flood emergency response planning (e.g., forecasting/gaging, alerts and early warning systems, evacuation mapping), flood emergency response preparedness (e.g., emergency response stockpile materials, training and exercising, Flood Operations Center) | $32 to $40 |
| ▪ **State:** Flood System Operations & Maintenance Implementation Program (reservoir operations activities) | ▪ **State:** DFM Fiscal Database. Assumed 25% of implementation program spending allocated to reservoir operations | $4.5 | N/A | N/A | $4.5 | **Systemwide:** reservoir operations | ▪ **RFMPs:** F-CO for Yuba and Feather Rivers, F-BO for Oroville, coordinated reservoir operations for Lower San Joaquin LMAs<br>▪ **DWR San Joaquin BWFS:** increase objective release from New Don Pedro in the Tuolumne River Watershed | $13 to $15 |
| ▪ **State:** Flood System Operations & Maintenance Implementation Program (routine maintenance activities) | ▪ **State:** DFM Fiscal Database. Assumed 75% of implementation program spending allocated to routine maintenance<br>▪ **Local:** Estimate based upon average LMA annual reporting (AB 156) data from 2009 through 2013. Two-thirds of the reported activities were assumed to be routine maintenance. | $13.5 | N/A | $15.5 | $29 | **Systemwide:** routine maintenance | ▪ **RFMPs:** routine O&M (e.g., rodent control, vegetation control, sediment removal, structure maintenance)<br>▪ **DWR OMRR&R Workgroup:** future routine maintenance, future inspections & assessment | $99 to $121 |
| ▪ **State:** Floodplain Risk Management Implementation Program (primarily risk assessment mapping)<br>▪ **Federal:** FEMA floodplain mapping | ▪ **State:** DFM Fiscal Database.<br>▪ **Federal:** FEMA: flood hazard mapping expenditures. | $17.6 | $2 | Unknown | $19.6 | **Urban, rural and small community:** risk awareness, floodproofing and land use planning | ▪ **RFMPs and DWR floodplain management effort:** floodplain mapping and delineations, flood risk awareness campaigns, land use planning, elevating and flood proofing structures, technical support | $26 to $33 |
| ▪ **State:** Flood System Assessment, Engineering, Feasibility, and Permitting Implementation Program<br>▪ **Federal:** USACE, surveys, feasibility, preconstruction engineering and design | ▪ **State:** DFM Fiscal Database. Assumed 50% of spending in this program was for studies and analysis.<br>▪ **Federal:** Average expenditures of years 2003 through 2016. | $18.5 | $1.6 | Unknown | $20.1 | **Urban, rural and small community:** studies and analysis | ▪ **RFMPs:** small community feasibility studies, 100-year studies and analysis, specialty studies (e.g., groundwater recharge analysis)<br>▪ **USACE:** urban 200-year level of protection analysis, specialty studies (e.g., geotechnical analysis, channel capacity analysis) | $15 to $17 |
| **Annual Subtotal:** | | **$95.6** | **$3.6** | **$16.0** | **$115.2** | | | **$226 to $276** |

Note:
1. Estimate based on historical State, Local, and Federal Expenditures, see Appendix A for all data tables and references.

N/A = Not applicable, this cost share partner does not participate in this activity.
Unknown = Current contribution by this cost share partner is unknown.

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# 6.0 Assessment of Potential Funding Mechanisms

## Section 6 Highlights

- Section Outline:
  - Potential State Funding Mechanisms
  - Potential Federal Funding Mechanisms
  - Potential Local Funding Mechanisms
  - Other Potential Private Partnerships
  - Summary of Potential Funding Mechanisms
- Key Section Takeaways:
  - A large set of potential funding mechanisms, including existing and proposed mechanisms, were considered for CVFPP Implementation
  - Existing mechanisms will need to be supplemented with some new mechanisms having a better nexus to project benefits

Many potential funding and financing mechanisms were considered for continued CVFPP implementation. (Throughout the remainder of this TM, the term "funding mechanism" could also include financing mechanisms). Any and all of these could be developed and applied at some point in the next 30 years to fund actions in the 2017 refined SSIA portfolio. This section discusses a range of funding mechanisms and their potential use for capital or ongoing investments, which is a critical distinction. For capital investment, the mechanisms include (1) existing, authorized funding streams of various kinds, such as the State general fund or local taxes and special benefit assessments, and (2) limited-duration capital finance mechanisms, such as GO bonds or local bonds.

The potential role for each funding mechanism within a flood investment strategy is dependent on three factors: applicability, reliability, and political viability.

### Funding Mechanism vs. Financing Mechanism

A funding mechanism is an instrument used to create a funding stream. A financing mechanism takes that revenue stream and issues debt to make a larger sum available immediately.

- Applicability to given action types is a function of two criteria:
  - **Mechanism type.** The nature of the mechanism's revenue stream (ongoing vs. limited-duration capital). In terms of the nature of a mechanism's revenue stream, there are important distinctions between those appropriate for ongoing investment versus those more suited to capital investment. State GO bonds, for example, must be paid back from

the State general fund over the authorized period, often 25 or 30 years. Bonds cannot be used for operational and routine maintenance expenses. Therefore, mechanisms available for ongoing investments do not include GO bonds or other funding sources that are limited to capital investments.

- **Nexus.** In terms of funding mechanisms, nexus refers to whether and how well the source of funding connects to the benefits received from the activity. Funding mechanisms have a strong nexus when the beneficiaries of the service pay for it in proportion to their share of the benefit. If a sufficient nexus cannot be established, the funding mechanism may not be appropriate for the activity being proposed unless there are other compelling reasons for using it. For example, water rates are assessed based on the benefit received (i.e., amount of water used) and the cost to produce this benefit (i.e., cost to deliver, treat, and purchase water). Many of the funding mechanisms that use property assessments have strict guidelines regarding the nexus between allocated costs and the resulting assessment. The principle of nexus is used in determining the best mechanism for each category type.

- Interannual reliability refers to the extent to which the availability of a given amount of revenue from a funding mechanism can be predicted for years or even decades into the future. This is a very different consideration from applicability. GO bonds, for example, are a very applicable funding mechanism for a host of 2017 refined SSIA portfolio investments, but it is difficult to rely on the passage of new bonds at given intervals into the future. The passage and approval of new GO bonds tends to depend on voter awareness of the need for investment and the public benefit that investment might provide. However, historical patterns show that for flood and water management, that awareness usually does not exist without a recent crisis or other triggering news story that encourages public willingness to pay for related investments.

- Political viability may also play a role in choosing between funding mechanisms for various action categories. Sometimes the most applicable and reliable mechanisms are the most difficult to develop or approve from a political perspective. (The challenges of Proposition 218 discussed in Section 1 provide a good example.) This is especially important when considering new funding mechanisms; those that are currently less politically viable may not be ready for use for several years or even a decade or more.

## 6.1 Potential State Funding Mechanisms

In the following sections, the applicability, reliability and political viability of each mechanism is assessed. A discussion then follows on the role that each mechanism plays within the CVFPP investment strategy and on its revenue generation potential over the CVFPP's 30-year implementation timeline.

### 6.1.1 State General Fund

The general fund is the predominant source of money for many ongoing State government programs. It covers costs not specifically designated for any other fund. The primary sources of revenue are personal income tax, sales tax, and bank and corporation taxes. Major activities

covered by the general fund include education, health and welfare programs, and corrections. A small percentage goes to DWR.

### *Applicability*

The general fund is typically used to fund ongoing operations. Because all state taxpayers contribute to the general fund, activities providing broad public benefit and management would have the strongest nexus. Much of the 2017 refined SSIA portfolio does have the potential to generate statewide public benefits; flood events can impair regional and statewide economic activity as a result of damage to commerce, transportation, and utilities. In addition, broad, statewide ecosystem benefits are provided by some flood management activities. This nexus indicates that the general fund would be a good funding source for ongoing activities that limit or reduce flood risk for people or significant economic assets, or which provide other broad benefits like ecosystem improvements or recreational opportunities. However, using the general fund to pay for capital improvements for flood management would be challenging due to the strong competition for this funding.

### *Interannual Reliability*

While DWR's Division of Flood Management (DFM) can reasonably expect to get some general fund support for ongoing activities each year, the level of support varies greatly depending on incoming GO Bond funds, and on the greater well-being of the California economy. Overall contributions to the broader general fund go down during recessions, and back up again during times of recovery and economic strength. Also, in the past, basic general fund contributions to flood management have decreased when it is slated to receive higher amounts of GO Bond funding.

### *Political Viability*

Any new contribution from the general fund would have to be approved through the State budgetary process, which is highly competitive for limited funds. Flood management programs in the Central Valley are managed by DWR's DFM. Given the competition for general fund revenue from other high-profile programs such as education, the political viability of significantly greater reliance on it for flood management might be low, unless Central Valley flood managers can improve public and policymaker awareness about the public benefits of ongoing flood management activities in the valley.

### *Role in a Flood Management Investment Strategy*

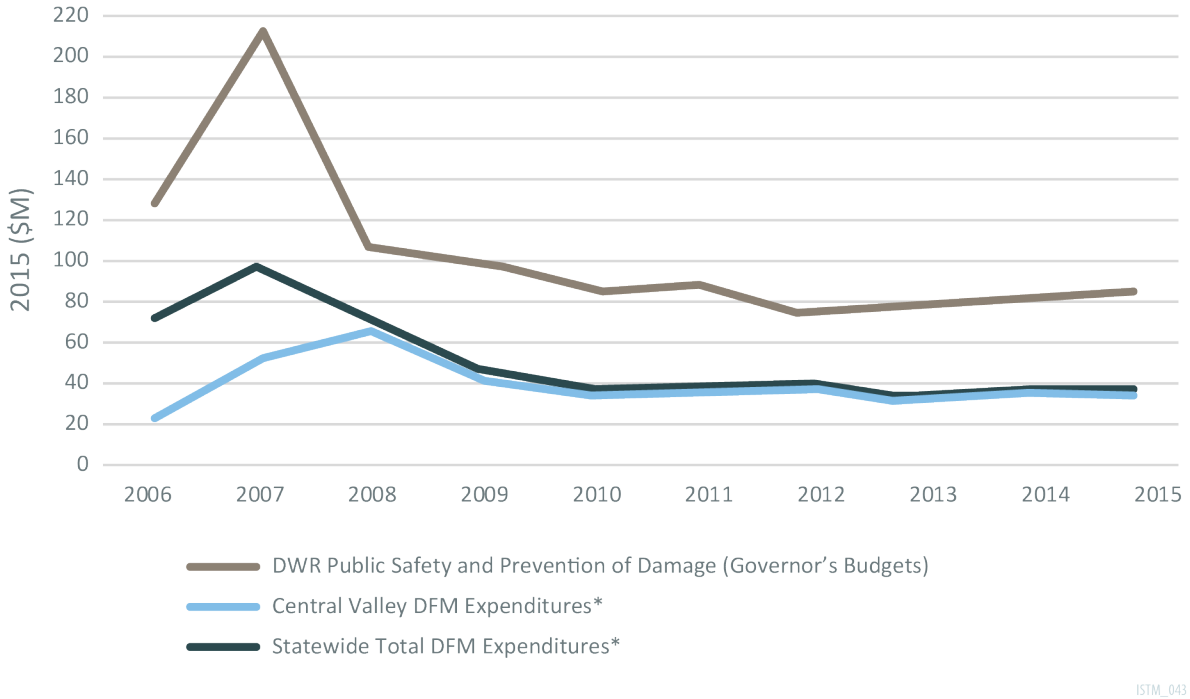
The general fund is already used to fund ongoing activities like emergency management, system O&M (including ecosystem restoration efforts), floodplain management, and State institutional capacity including development and use of technical tools and planning activities. Contributions to these kinds of activities are planned to continue, and may slowly increase over time as public and policymaker awareness increases about the broader public value of active system maintenance and proactive investment in floodplain and residual risk management.

### *Revenue Generating Potential*

DWR and DFM general fund expenditures in current year estimates are summarized in Appendix A.

Figure 6-1 shows DWR's general fund expenditures on statewide and Central Valley flood management activities (with money allocated through the Public Safety and Prevention of Damage account in the Governor's DWR budgets) for fiscal years 2006 through 2015. Funds for Central Valley Flood Management have fluctuated from a low of about $20 million in fiscal year (FY) 2006 to a high of $64 million in FY 2007. General fund expenditures dedicated to flood management averaged about $50 million annually and have, on average, accounted for about 50% of DWR's Public Safety and Prevention of Damage expenditures. The increase in GF contributions to Central Valley flood management between years 2006 and 2008 indicates, clear precedence for contributions to triple following an increase in awareness of flood risk, and to make up a greater portion of the broader Public Safety and Prevention of Damages category. (Public awareness about flood risk in California's Central Valley significantly increased in 2006 and 2007 following Hurricane Katrina and more small-scale Central Valley flooding in the winters of 2005 and 2006). If it is assumed possible for contributions to double again at some point over the next decade, that would translate to a revenue generation potential of $100 million per year in Phase 1. Even more optimistically, if it is assumed possible to double contributions from the maximum amount that was received in the last decade, then revenue generation potential in Phase 1 increases to $128 million annually. If a more modest increase is thereafter allowed of 25% per phase, then potential available general fund revenues increase to $160 million in Phase 2, and $200 million in Phase 3. This relies on a growing California economy and a sustained awareness of the public benefits of ongoing flood management in the Central Valley.

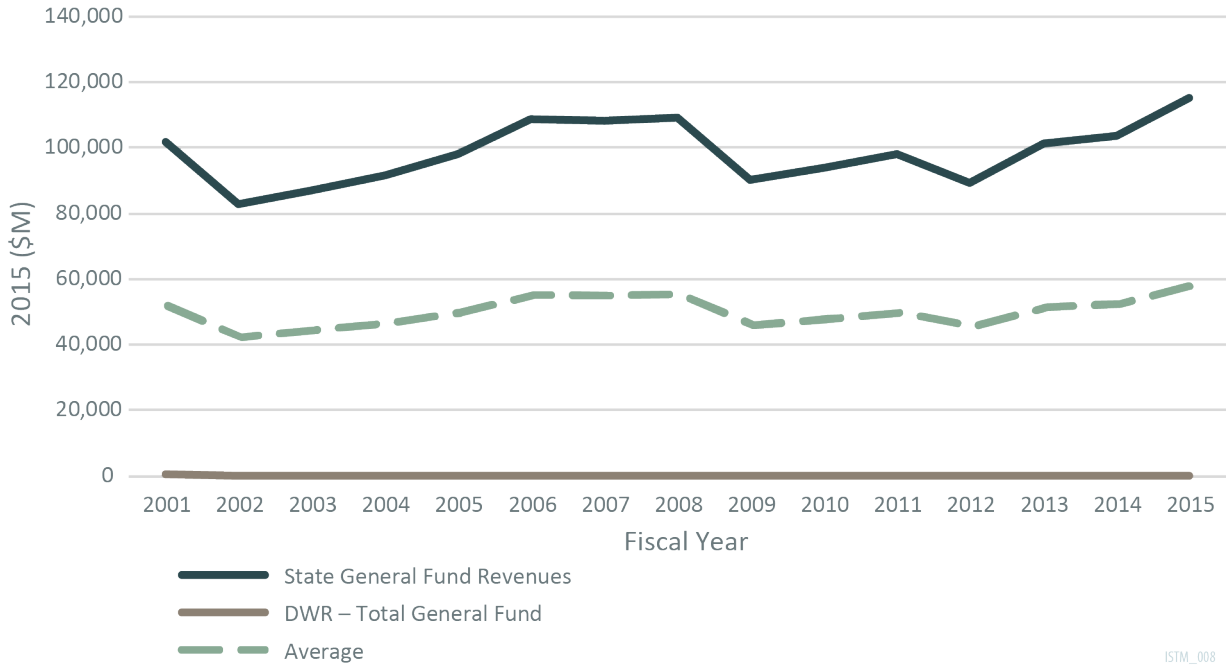
Figure 6-1. DFM Annual General Fund Expenditures, FYs 2006 to 2015




*Source: Governor's Budgets and DWR (2006 through 2016)*

These estimates may seem quite optimistic, but between FY 2001 and 2015, the proportion of the State General Fund revenues funding DWR flood expenditures ranged between 0.1% and 0.2%, and averaged 0.1% annually. Figure 6-2 shows the California State General Fund annual revenues and the contribution of the General Fund to DWR flood expenditures for FYs 2001 through 2015. A doubling of General Fund contributions to flood management would barely register within this broader picture of General Fund allocations.

Figure 6-2. California State General Fund Revenues vs DWR General Fund Flood Expenditures




*Sources: SCO, 2017; Governor's Budgets, 2001-2016*

### 6.1.2 Sacramento and San Joaquin Drainage District

The reutilization of the Sacramento and San Joaquin Drainage District as an assessment authority after any necessary legislative amendments are made is considered a State mechanism for the purposes of this discussion because it would require action by the California Legislature to implement. However, this district is later considered a local source of revenue in subsequent sections of the TM that discuss cost shares, because the revenues from the Sacramento and San Joaquin Drainage District would be generated from locals within the district's boundaries.

The California legislature created the State Reclamation Board (now the Central Valley Flood Protection Board) in 1911 with the objective of cooperating with the USACE in assuring an orderly process for controlling flooding along the Sacramento and San Joaquin Rivers and their tributaries. By 1913, funding these actions had become a problem, which prompted the legislature to create the Sacramento and San Joaquin Drainage District to give the California

State Reclamation Board the authority to acquire the necessary property and easements for flood control and the ability to levy assessments to construct and maintain facilities. Later modifications to the California Water Code limited the ability to levy an assessment for maintenance to projects that had been adopted before April 1, 1923. Although this drainage district is in the California Water Code, revisions would be necessary to cover new boundaries and add authority to be able to pay for ongoing obligations.

The Sacramento and San Joaquin Drainage District ceased levying assessments in the late 1930s as a large number of properties were sold for delinquent assessments. This degraded the value of the bonds to the point that they had to be greatly discounted. This experience was so difficult for the Sacramento and San Joaquin Drainage District that the State Reclamation Board concluded the assessment authority would no longer be used. The Sacramento and San Joaquin Drainage District effectively halted operations at this time, though it was—and still is—authorized under the California Water Code.

#### *Applicability*

If reutilized, the Sacramento and San Joaquin Drainage District would resume assessments to fund capital and ongoing management activities. Because the funds would come from the Central Valley, this mechanism would have a strong nexus as it would become another source for local cost shares, augmenting existing assessments and other local sources.

#### *Interannual Reliability*

Once reutilized, the Sacramento and San Joaquin Drainage District would provide a stable revenue source, with relatively small unexpected variation in assessments over time.

#### *Political Viability*

The district halted assessments in the late 1930s. The current political viability of this mechanism is uncertain. There will be concerns over whether the new assessment would overlap or be in addition to existing local agency assessments. However, this district potentially could be structured such that it would not be subject to Proposition 218 requirements, which would increase its likelihood of passage, although the reduced lack of local control might be an issue.

#### *Role in a Flood Management Investment Strategy*

The CVFPP investment strategy considers reutilization of the Sacramento and San Joaquin Drainage District and its assessments for all capital and ongoing action categories. It is assumed that this funding source could be developed and available within 10 years (with some funds already available before the end of Phase 1).

#### *Revenue Generating Potential*

The revenue generation potential from local assessments is estimated in Section 4, Table 4-5. The calculations are intended to identify the reasonable increase in tax burden that could be placed on parcels within the SPFC for flood management activities. However, the difference between current tax and assessment burdens and the two percent cap does not represent total funds available for flood management, because those properties are likely to also be taxed or assessed for other property-related and public services going forward.

Table 4-5 compares the difference in the revenue generated using the effective tax rate for the county and the two percent "maximum" tax rate cited by CDAC. The analysis then assumed that up to ten percent of this increase could be available for flood management activities. This resulted in approximately $57 million per year. Table 4-5 also shows that this implies an average increase of $200 additional dollars per year, per parcel.

#### *Steps Required to Implement*

The Sacramento and San Joaquin Drainage District is still authorized in the California Water Code. However, to be the most effective, the Water Code would need to be revised to update the boundaries so that it includes not just the area protected by the project, but areas that benefit from the ability to drain flood waters. It would also need to be changed to allow assessments to cover operations and maintenance. The existing assessment procedures would likely need revision.

### 6.1.3 State River Basin Assessment

A river basin assessment would generate revenue to invest in integrated water management. Assessment revenue would be used in the river basin where the fees originated and spread across integrated water management activities within the basin. This assessment would cover the whole watershed and be shared by water agencies within the basin. River-basin planning is based on the fundamental principles of equity, environmental protection, efficient development, balance, and cooperation. This approach seeks to reconcile these apparently competing interests and provide a comprehensive approach to planning. Planning at a river-basin scale is necessary to meet social, economic, and environmental priorities that are specific to each area, to properly account for relationships and dependencies within the basin, and to avoid a piecemeal approach.

#### *Applicability*

Flood and floodplain management activities often have consequences for up and downstream people and resources, making them a necessary component of the river basin approach, and applicable for funding from a river basin assessment. However, because flood risk management cannot address river basin priorities in isolation, only a percentage of the funds generated by a river basin assessment would be applicable for flood management activities.

Revenues from a river-basin assessment apply to any flood management action categories with the potential to contribute toward outcomes that benefit residents within the basin, and which should be integrated or at least leveraged alongside other land and water management activities in the basin. For the purposes of this CVFPP investment strategy, these criteria are most easily met by SSIA actions within the systemwide category, but many other action categories may also have basin scale effects. For example, a levee setback may help protect economic assets within the basin, while also providing critical habitat for species that utilize and provide services along the entire river corridor.

#### *Interannual Reliability*

Property taxes or assessments, once established, provide a predictable and stable revenue stream. In addition, these funds would be dedicated only to integrated water management within each basin, of which flood and floodplain management is an integral component. As such, revenues from a river basin assessment would have very high interannual reliability.

### *Political Viability*

Political viability may depend on the governance structure that is created to levy, collect, and allocate the funds. A new tax or assessment entity may be resisted by existing local agencies as a loss of local control, especially if the new entity were effectively a State agency. However, if the new entity were an authority made up of local agencies, it could more easily gain acceptance. Local agencies resist additional assessments due to their unpopularity and the requirements of Proposition 218. A State assessment could be a welcome alternative, especially if all or a majority of the assessment is returned to the river basin. In either case, significant work is necessary up front to develop a river basin governing structure and garner the necessary local and legislative support to make this funding mechanism a reality.

### *Role in a Flood Management Investment Strategy*

Almost all action categories within the 2017 refined SSIA portfolio have the potential to benefit or otherwise have some effect on people, economies, and resources at the river basin scale. Because its interannual reliability is so high, a river basin assessment might be especially helpful in boosting funding for some ongoing floodplain management activities, which are currently limited to less reliable general fund dollars for support. However, because of the work required to develop and establish a river basin tax or assessment, it is assumed that this mechanism is only available in Phases 1 and 2 of CVFPP implementation (no earlier than 2027).

### *Revenue Generating Potential*

The revenue generating potential of a river basin tax or assessment within the Sacramento and San Joaquin basins has not yet been analyzed. The approach for doing so would be similar to that described above for the Sacramento and San Joaquin Drainage District, with a river basin tax or assessment generating funds from the entire basin, as opposed to just those properties within the SPFC Planning Area. This could translate to significantly more funds available from the river basin assessment than from the drainage district. On the other hand, a river basin assessment would need to cover all water management activities within the basin, and only a portion of revenues would be allocated to flood and floodplain management. With those two competing factors in consideration, additional revenues available from a broader river basin assessment could at least equal half of those that are available from the Drainage District (up to approximately $25 million per year).

### *Steps Required to Implement*

A river-basin assessment could be an ad valorem assessment, parcel-based tax, or another form of a fee. An example fee would be the California Department of Forestry and Fire Protection's Fire Prevention Fee.

Several approaches to structuring the assessment are possible. River-basin authorities could be established by the legislature at the State level, where the river-basin assessment could vary by river basin with all the funds being collected at the State level and distributed back to the river-basin authorities. It is anticipated that the majority of funds generated by such funding mechanism, as much as 85 to 90%, would go back to the river basins, with the remaining funds used to support statewide efforts (for issues considered too expensive or outside the scope of a local agencies, such as climate change).

Implementing river-basin planning in California would be challenging due to existing agency structures, legislative authorities, and limited funding resources. To address these challenges, and transition to a river-basin-scale approach, the following actions are needed:

- Work with federal and local agencies and stakeholders to delineate State river-basin areas (SRBAs) throughout California.
- Focus the State's budgeting process for water-related investments according to the delineated SRBAs and identified river-basin priorities.
- Work with the local agencies to establish viable governance structures that enable agencies to work together and establish governance at the river-basin scale. For example, the Santa Ana Watershed Protection Authority could serve as a potential model. Regional water management groups established for integrated regional water management could be a starting point for such governance.
- Identify ways to consolidate coordination and planning efforts within river-basin planning, implementation, and regulatory efforts.
- Establish the funding mechanism in State legislation.

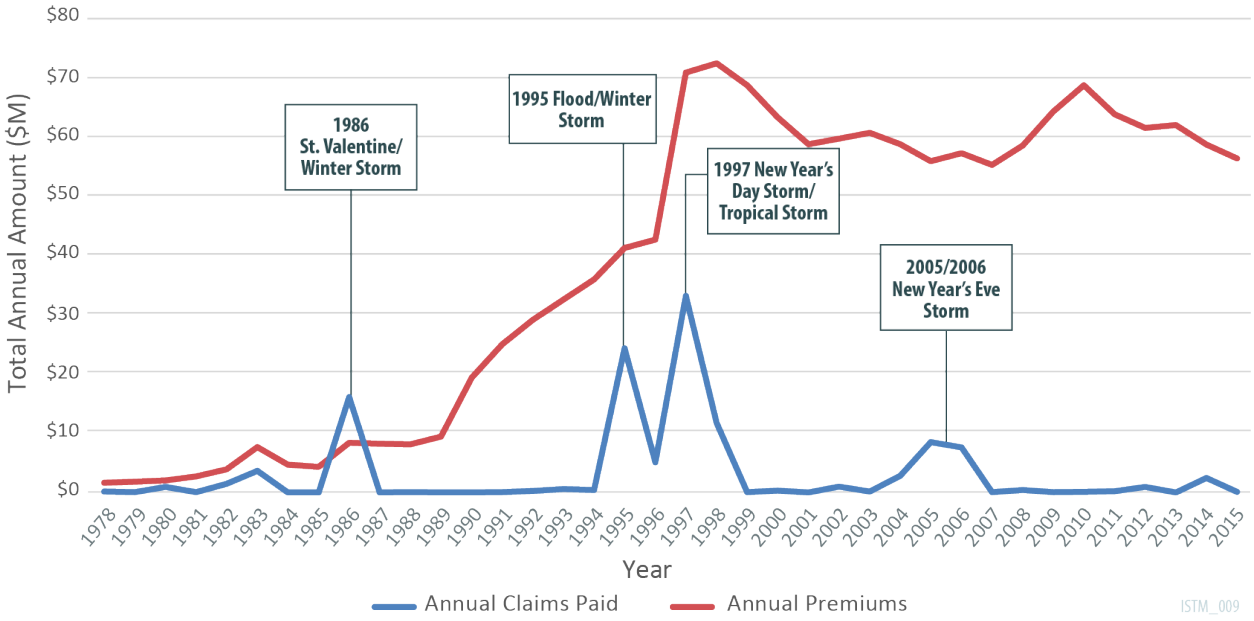
### 6.1.4 State Flood Insurance Program

Many states have explored implementing a statewide flood insurance program; however, no states have implemented a replacement program that would enable the state to opt out of the NFIP. Implementing a California State flood insurance program could enable California to receive a better return on its premiums currently paid into the NFIP. Californians have contributed more than five times in NFIP flood insurance premiums than claim payments received between 1978 and 2008 (Wharton Center for Risk Management and Decision Processes [WCRMDP], 2011).

California could establish a State program that allows the State to use a portion of the funds from insurance premiums to purchase private insurance and another portion of the funds to implement risk reduction measures. Implementing such a program would require the State to assume significant risk because more than 7 million Californians live in floodplains and more than $580 billion in assets are located in floodplains and would also require congressional action. For a complete analysis and discussion on a State flood insurance program, see Appendix C.

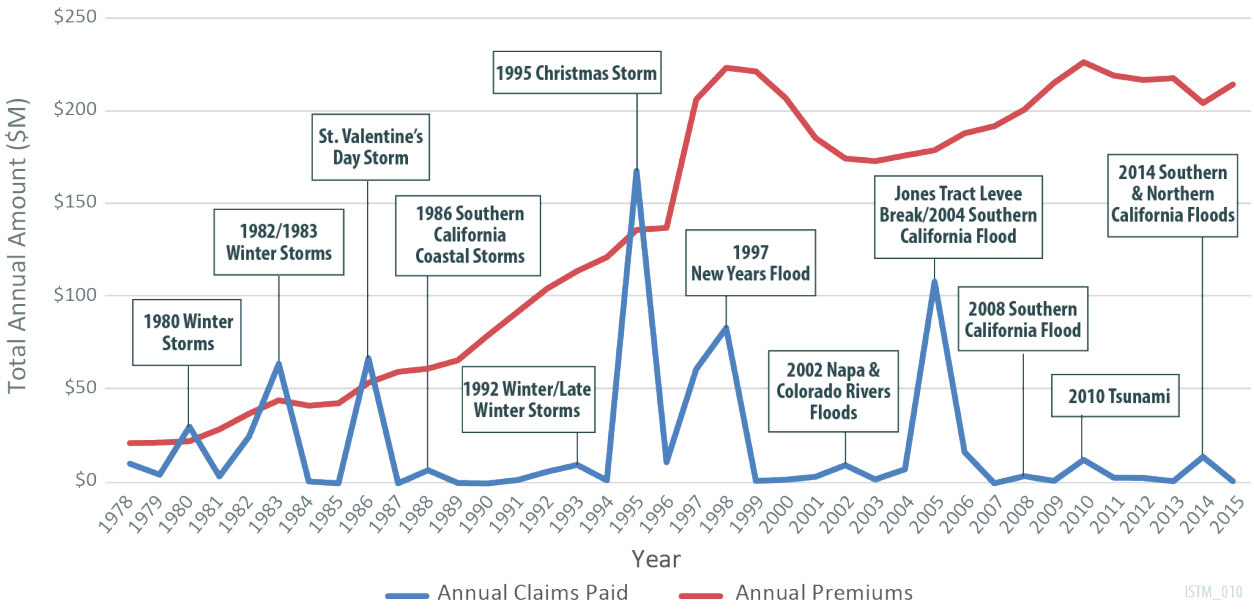
As shown in Figure 6-3, NFIP policy holders in the SPFC Planning Area have historically paid more into the system than they have received as payouts. This is also true at the state level, as described in Appendix C. On average, NFIP policy holders in the SPFC Planning Area have paid about $35 million per year (in 2015 dollars, the basis for all values in this discussion) more into the NFIP since 1978 than they have received as payouts. At the state level, NFIP policy holders have paid about $116 million per year more into the program since 1978 than they have received as payouts, see Figure 6-4. Over the last 10 years (2006 to 2015), the difference between premiums and claims (payouts) in the SPFC Planning Area has increased to about $60 million, and at the State level it has increased to about $206 million. Average annual total premiums paid by policy holders in the SPFC Planning Area during the last 10-year period were about $59 million. Statewide, the average annual total premiums paid were $212 million.

Figure 6-3. Annual NFIP Premiums and Claims, SPFC Planning Area, 1978 to 2015 (2015 $)




*Source: NFIP, 2016*

Figure 6-4. Annual NFIP Premiums and Claims, State of California, 1978 to 2015 (2015 $)




*Source: NFIP, 2016*

Flood insurance through the NFIP is available to homeowners, renters, condominium owners and renters, and commercial owners and renters. Flood insurance is specifically required for all buildings in mapped Special Flood Hazard Areas (SFHAs) shown on FEMA's maps if they are financed by federally backed loans or mortgages (FEMA, 2015). Nationally, as of April 2016, the maximum annual premium (including basement/enclosure) is $474 under the residential Preferred Risk Policy (PRP). Based on the 1978 through 2015 NFIP premiums, the average flood insurance in California was about $500. These figures include both PRP and non-PRP rates. The average flood insurance in the SPFC Planning Area during this period was about $280 per year (in 2015 dollars).

Currently, NFIP flood insurance rates for properties on agricultural lands are the same as those for commercial properties. This rate assumes that floodplains and the associated flood risk in these floodplains are the same across the country. It also assumes that farming practices are the similar across the country. But, there are major differences in the type of floodplain and types of farming practices on floodplains in California and particularly within the Central Valley. Whereas the designation of land as a SFHA would typically render such land as inappropriate for agriculture in other parts of the country, in California, the deeper floodplains are particularly suited for agriculture. FEMA's proposed updates to the NFIP floodplain maps in the Central Valley have resulted in agricultural lands inside the newly designated SFHAs. Once in the SFHA, all agricultural property is subject to NFIP flood insurance requirements, especially if the property is financed with a federally backed loans or mortgages. Because this flood insurance requirement has the potential to affect the sustainability of agriculture in the Sacramento Valley, the State convened the Agricultural Floodplain Ordinance Task Force (AFOTF) in 2015 to identify and recommend changes that FEMA could administratively implement. The AFOTF developed a number of recommendations that would modify FEMA's rules on elevation and floodproofing (either reducing them or removing them) and reduce the cost of flood insurance for agricultural structures (AFOTF, 2016).

#### *Applicability*

Flood insurance typically compensates for damage rather than reduces risk. However, activities that reduce flood risk could be funded by potential savings from a State flood insurance program. This applies to almost all management action categories in the 2017 refined SSIA portfolio.

#### *Interannual Reliability*

If implemented, a State flood insurance program would provide a steady income stream from premiums. A portion could be available for flood risk reduction.

#### *Political Viability*

The political viability of a State flood insurance program is uncertain at this time. The NFIP has access to funds from the U.S. Treasury during years when it takes in less in premiums than it pays out in claims. A state flood insurance program must also have a source of funding to respond to claims that exceed annual premium revenue plus any accumulated fund. If premiums are not able to sustain a financially sound program, the state taxpayers would bear the burden. Opting out of the NFIP may mean that California loses access to other funds available from FEMA, especially funding typically made available upon a Presidential declaration of emergency, which might be necessary if climate change intensifies storm events more frequently. While Californians currently pays more in premiums than the State receives in claims from

NFIP, it is possible that one or two severe and widespread floods could change that. Implementing this type of program at the State level would shift the risk of disaster payments to the State. This increase in risk for the State might make passage and approval of legislation to set up a State flood insurance program somewhat difficult. However, the State could mitigate the risk by purchasing reinsurance on the private market. Another way to shift some of this risk is to couple a State flood insurance program with private investments in the form of resilience bonds. Resilience bonds are a type of catastrophe (Cat) bond that account for reductions in risk from project implementation and pay investors a portion of the insurance value created after the implementation of the risk reducing projects. These payments are in the form of rebates paid to the bond investors. For additional information on resilience bonds, see Appendix C.

### *Role in a Flood Management Investment Strategy*

A State flood insurance program would use a small share of premium dollars to invest in management actions that limit or reduce risk. This applies to almost all action categories within the 2017 refined SSIA portfolio. However, the legislative requirements of setting up a State flood insurance program make it unlikely that one would be implemented in time to fund Phase 1 investments. Therefore, any revenue from a State flood insurance program could likely support only Phases 2 and 3.

### *Revenue Generating Potential*

As is discussed above, the average annual premiums to the NFIP from Central Valley residents is about $60 million annually. A State program could increase this number if it made insurance mandatory for all properties within any designated flood zone, including properties protected by flood management facilities (but which are still potentially subject to flood if that infrastructure fails). While some floodplain properties do currently require proof of NFIP flood insurance at the time of purchase in order to qualify for a mortgage, this requirement is not enforced when homeowners eventually let their policies lapse, and the requirement does not exist for all flood zones. Some NFIP insurance holders drop their policies within a few years, and almost 80% of policy holders drop their insurance within 10 years (See Appendix C for details). If a State program could ensure that those policies continued, it should be able to at least double (or more) the annual premiums it receives relative to the current NFIP. This would translate to about $120 million per year in premiums from Central Valley residents. However, most of this money would need to be placed into a disaster fund to pay for flood damages if and when they occur. If only 10% of these premiums are then applied to risk-reducing or limiting activity, this translates to $12 million annually in revenue generation potential for this funding mechanism.

### *Steps Required to Implement*

The State legislature would have to pass a law creating a State flood insurance program. It must specify how the program would be implemented and what and how funding sources would be made available. As shown above, on average, NFIP policy holders in California have paid more in premiums into the NFIP than they have received as payouts. However, this has not been the case in every year. Following the 1980, 1983, 1985 and 1995 floods, California policy holders received more in payouts than they paid as premiums.

The NFIP has access to funds from the U.S. Treasury during years when it takes in less in premiums than it pays out in claims. A state flood insurance program must also have a source of funding to respond to claims that exceed annual premium revenue plus any accumulated fund. If premiums are not able to sustain a financially sound program, the state taxpayers would bear the burden. Opting out of the NFIP may mean that California loses access to other funds available from FEMA, especially funding typically made available upon a Presidential declaration of emergency, which might be necessary if climate change intensifies storm events more frequently.

### 6.1.5 General Obligation Bonds

State GO bonds are a financing mechanism, or a way to borrow from investors in order to fund longer-term investments. State GO bonds are backed by the full faith and credit of the State of California, and are usually repaid with California taxpayer dollars through the General Fund. GO bonds have become an important source of flood and water management funding. As shown on Figure 6-5, the State voters have approved GO bonds for water management efforts every few years.

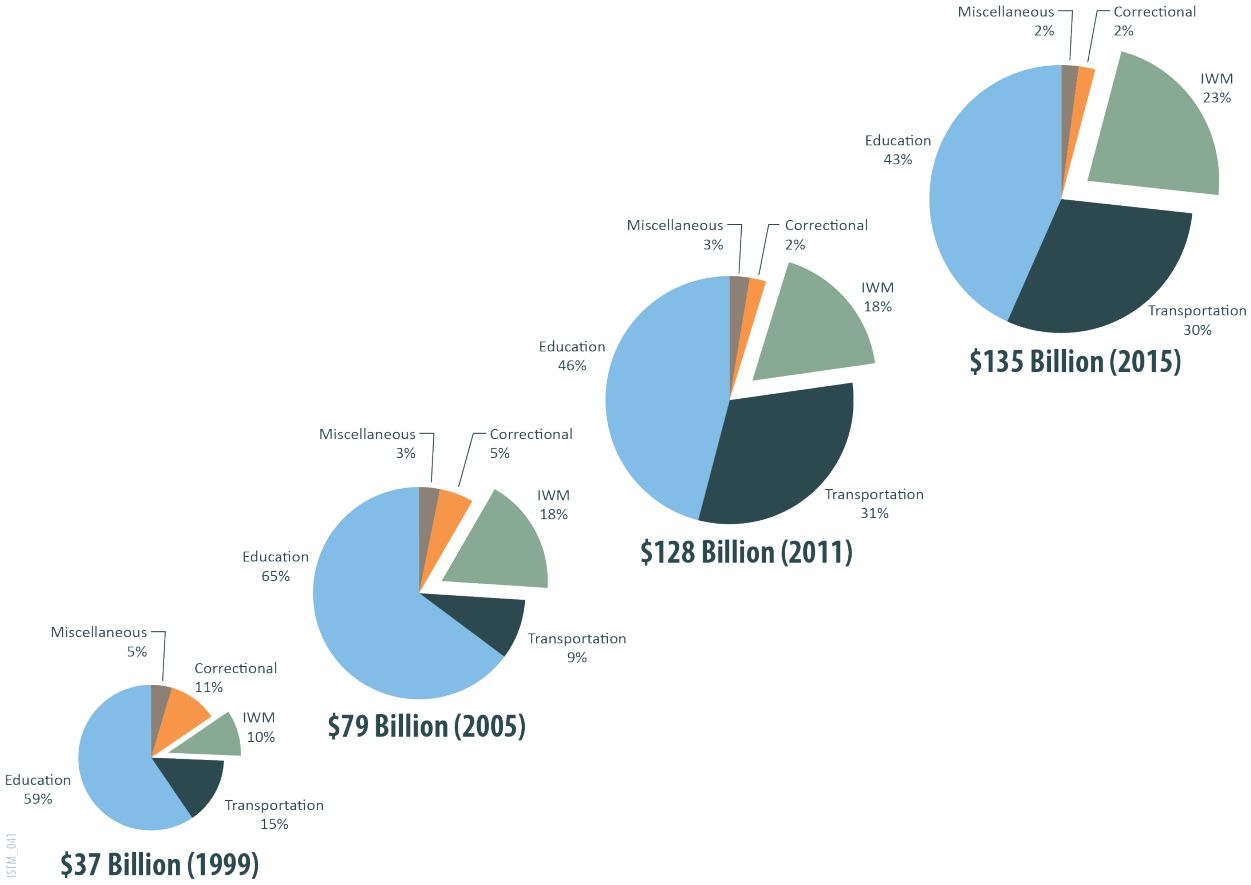
Although many GO bonds have been approved over the past few decades, few have had significant funding for flood management, with the exception of the 2006 Propositions 1E and 84 (which passed in the aftermath of the Hurricane Katrina disaster). In 1999, authorized bonds for water infrastructure totaled $3.8 billion, accounting for approximately 10% of total authorized State bonds. This increased to $22.9 billion by 2011, or 18% of total authorized bonds, largely due to Propositions 1E and 84 in 2006. With the passage of Proposition 1 in 2014, total GO water bonds increased by 33% (from the 2011 levels) to $30.5 billion in 2015. Water bonds accounted for about 23% of the total authorized State bonds in 2015.

#### GO Bonds vs. General Fund

General Obligation Bonds are typically repaid with general fund revenues. GO bonds should be considered as a subset of the general fund. The two mechanisms are separated for the following reasons:

- Funds are approved differently. GO Bonds require voter approval, whereas the State legislature approves the budget that describes the use of the general fund.
- GO Bonds are restricted to capital costs, whereas the general fund can pay for ongoing and capital costs.
- The general fund is subject to the vagaries of the annual budgeting process, whereas a GO Bond approved by the voters locks repayment into the budgeting process.
- GO Bonds are a way to fund a large block of capital investments.

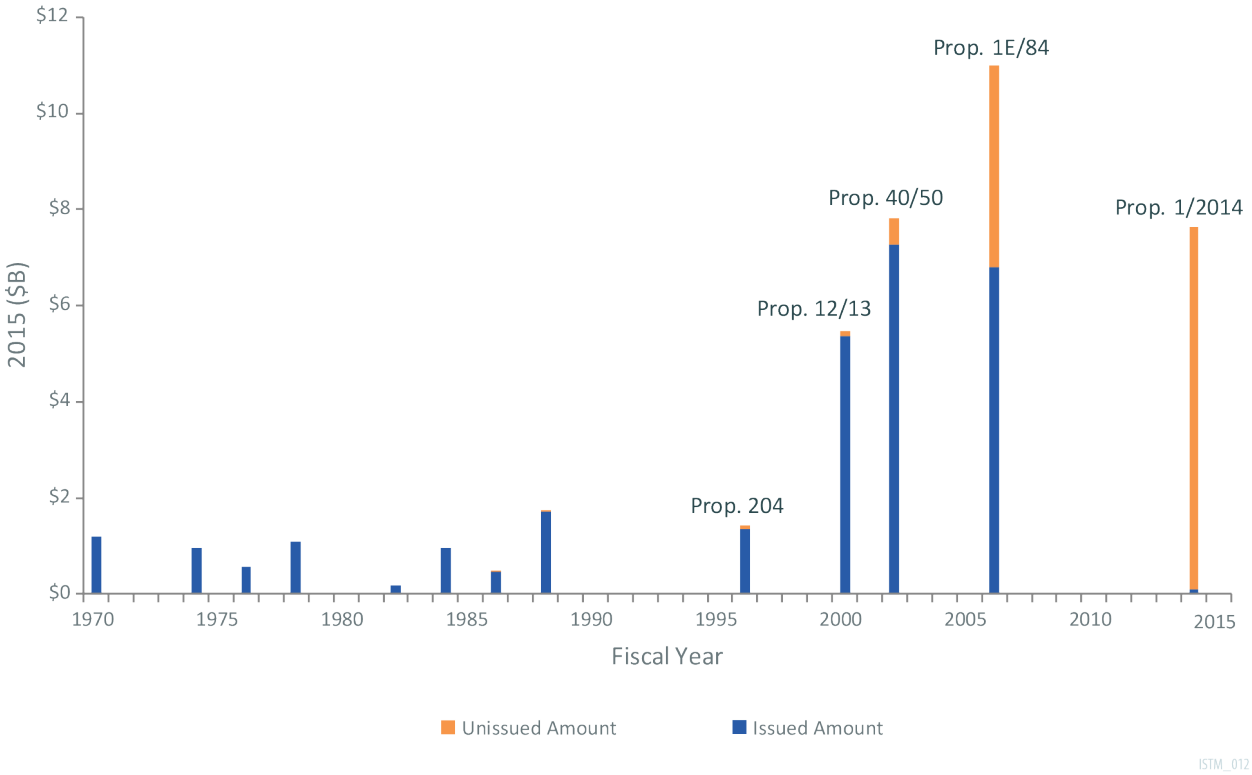
Figure 6-5. Total Authorized General Obligation Bond Debt of the State of California




*Sources: PPIC, 2011; State of California, 2015, 2016*

As shown in Figure 6-6, the State has issued GO bonds for water management efforts every few years. However, the portion designated for flood management has been relatively small, with the exception of Propositions 1E and 84 in 2006.

Figure 6-6. Total Authorized Integrated Water Management General Obligation Bond Debt of the State of California, 1970 to 2015




*Sources: PPIC, 2011; State of California, 2015, 2016*

### *Applicability*

GO bonds can be used for whatever purpose is proposed in the ballot measure. However, current state bond law (Government Code 16727) restricts their use to construction, acquisition of capital assets, costs of administering the bond program, or grant and loan programs that also meet these requirements with a few unique exceptions. Because state GO bonds are repaid from the general fund, and all state taxpayers contribute to the general fund, capital activities providing broad public benefit and management would have the strongest nexus for financing by GO bonds.

### *Interannual Reliability*

Once a GO bond is passed, the revenues from bond allocations are very reliable. However, current bond funds for flood management are expected to run out within the next few years.

Typically, new propositions are not put on the ballot unless proponents believe the likelihood of passage is high. This has caused some propositions to be delayed for a few years based on the political climate (see "political viability" discussion below). For these reasons, it is difficult to rely on the passage of new bonds at given intervals into the future. The passage and approval of new GO bonds tends to depend on voter awareness of the need for investment and the public benefit that investment might provide. Historical patterns show that for flood and water

management, that awareness usually does not exist without a recent crisis or other triggering news story that encourages public willingness to pay for related investments. Because new GO bonds require voter approval and general public awareness and concern about flood risk, interannual reliability over long time frames is relatively low.

### *Political Viability*

Water bonds have generally been successful and supported by voters, although their content is often shaped as a reaction to recent disasters or other news headlines. For example, flood management did not see substantial GO bond funding until after Hurricane Katrina, when many news headlines compared the Central Valley's aging flood infrastructure to that of failed New Orleans infrastructure. Future bonds will also be affected by the public's perception of the State's overall bonded indebtedness and competition from other infrastructure demands such as school construction and transportation. However, California voters have demonstrated a greater willingness to approve GO bonds over the last few decades (PPIC 2014) and do not tend to directly translate a "yes" vote into implications for their personal finances or taxes. Because of this, the political viability of this mechanism might be slightly higher than for new mechanisms that are more focused at the local or river basin scale, with more visible impacts on residents' tax burdens.

### *Role in a Flood Management Investment Strategy*

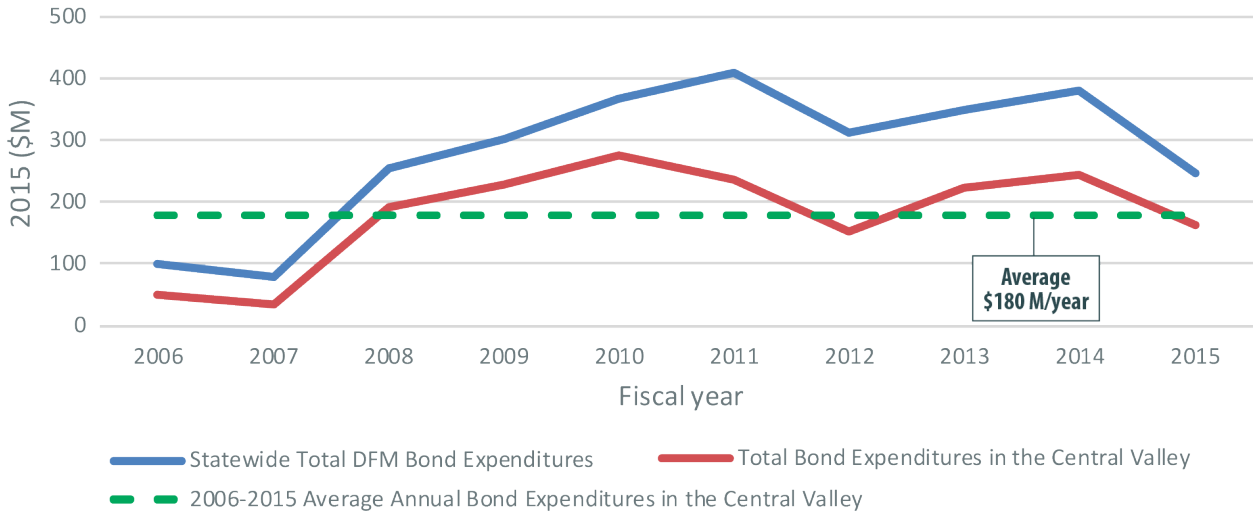
GO bonds play a key role in this flood management investment strategy as these can be used for many eligible capital expenditures, including easements and land acquisitions, levee or channel improvements, bypass expansions and modifications, storage (transitory, groundwater, or surface water), and setback levees. These are also an already established mechanism that can be readily used in all phases of implementation.

### *Revenue Generating Potential*

Figure 6-7 shows annual flood management expenditures funded through bonds between 2006 and 2015. The majority of the bond funding after FY 2007 were from Propositions 1E and 84. Proposition 84 (2006) has allocated 14.8%, or $800 million, for flood management, and Proposition 1E (2006) was almost entirely dedicated to flood management. Beginning in FY 2008, a large share of the bond funding supported flood management activities in the Central Valley, which accounted for an average of 75% of the DFM's general bond fund expenditures between FY 2008 and FY 2015. Average flood management bond expenditures in the Central Valley over the last 10 years (2006 to 2015) were about $180 million per year, or $1.8 billion per decade, but the average between 2008 and 2015 was higher at about $214 million per year. With the exception of the 2014 Proposition 1 bond funding, all current/existing GO water bonds will be fully allocated by 2018, and the remaining funds from Props 1E and 84 are expected to be depleted by FY 2019–2020.

If new GO bonds are approved over the next few decades with similar levels of investment for flood management to those seen in Propositions 1E and 84, then revenue generation potential would fall between $1.5 and $2.2 billion per decade. If public awareness of the need for Central Valley Flood Management increases over time, and the California economy is strong, revenue potential may even be slightly higher. For the purposes of this investment strategy, it was assumed that GO bond revenues could not exceed $3 billion over any 10-year period (a 40% increase over the level of investment observed since 2008).

Figure 6-7. DFM Annual Bond Fund Expenditures, FYs 2006 to 2015




*Source: DWR, 2016*

***Steps Required to Implement***

State GO bonds require 50% voter approval but only after approval by two-thirds of the legislature or through the initiative process.

### 6.1.6 Water Surcharge

In 2006, the Water Resources Investment Fund was proposed by the Secretary of California Natural Resources Agency, John Laird. This fund would have had the following attributes:

- The State would establish a fee to be collected from each retail water supplier in the state. The supplier would decide how to apportion the fee among its customers and would collect the fee.

- The collected fees would provide a stable funding source for clean, reliable, and safe water supplies. The funds would support water management activities described in the California Water Plan, including flood management activities. As originally proposed, a significant amount of the funds would pay for water quality improvements.

- Of the funds collected in each region, 50% would be returned to those respective regions to plan and carry out integrated regional water management. Additional funds would be reserved to match federal water quality grants, fund priority regional projects, and respond to water-related emergencies. More than two-thirds of all funds collected would be used to fund regional water management projects.

- A designated entity, such as the California Water Commission, would oversee management and recommend changes or improvements to the fund and fee structure. The funds available to implement water management projects would increase over time as new connections are added.

- Regions would prepare integrated regional water management plans consistent with the California Water Plan to meet their local needs and fund their projects from their regional accounts.

- Remaining funds would pay for programs of statewide significance, including funding for the general public benefits of new surface water storage projects such as ecosystem restoration and flood control.

In 2010, then State Senator Joe Simitian proposed a similar approach with SB 34, which was not passed into law, but would have created the California Water Resources Investment Program and a California Water Resources Investment Fund. The fund would have used urban and agricultural water user fees to support the following:

- Planning and managing the statewide water system
- Broadening access to necessary water services
- Improving the ecosystem
- Managing water-related risks and major public emergencies
- Changing the water system to improve recreation opportunities

Funds received would have gone into a State investment account and 11 regional investment accounts. DWR would have been responsible for distributing these funds among the regions.

#### *Applicability*

A statewide water use fee has a strong nexus with integrated resource management (of which flood management is a component), with clear ties to anything that is impacted by or impacts the management and movement of water supplies. There are very few flood management investments that can demonstrate such a clear tie. This mechanism would be limited to flood investments that benefit ecosystems impacted by water use, or otherwise impact water supply activities.

#### *Interannual Reliability*

A statewide water user fee would create a stable annual income stream.

#### *Political Viability*

Attempts to pass a statewide water user fee have failed in the past, but if public and legislative support is gained, this could be a funding mechanism with a good nexus with integrated resource management (of which flood management is a component).

#### *Role in a Flood Management Investment Strategy*

Because of its limited applicability to large portions of the 2017 refined SSIA portfolio, a statewide water user fee is not being considered for a significant role in the investment strategy.

#### *Revenue Generating Potential*

The potential revenue generated by a statewide water use fee depends on the magnitude of the fee. The portion of that revenue stream that would be allocated to flood management is variable and uncertain.

Unless further analysis suggests it should be included, the statewide water user fee is not recommended, has no assumed contribution to flood management actions.

#### *Steps Required to Implement*

A statewide water fee or surcharge could be used for a variety of purposes. Establishing this water fee would require legislation that stipulates the types of activities permitted under the fee. A water fee was proposed in the California legislature in 2006 and 2010, but failed to gain approval.

### 6.1.7 State Maintenance Area

The California Water Code Section 12878 gives the CVFPB the authority to form a maintenance area if the local agencies are unable to meet State and federal requirements. DWR will perform maintenance based on the actual costs of performing the maintenance. CVFPB has authority to assess property owners who receive benefits from the maintenance of the project. The CVFPB would approve a budget for DWR to perform the maintenance, and the county will levy an ad valorem assessment to pay the State. Property owners do not have a vote in maintenance area assessments.

#### *Applicability*

A maintenance area assessment would be limited to maintenance only. A maintenance area determination would need to be made for each underperforming local agency, which could limit its widespread use.

#### *Inter-Annual Reliability*

Once established, the maintenance area would provide a stable revenue source, with relatively small unexpected variation in assessments over time.

#### *Political Viability*

Since the CVFPB would have to determine if a local agency was underperforming, there would be the chance for push back from the local agency. There would likely be some concern that DWR could perform the maintenance more cost effectively than the local agency. The political viability might be improved if the maintenance area was designed to overlay the existing agency's assessment and DWR and the local agency shared maintenance activities.

#### *Role in a Flood Management Investment Strategy*

The maintenance area assessment could be used in the near term if the local agencies reject the other funding mechanisms. The advantage of the maintenance area assessment is it is already in the California Water Code, so could be put into action sooner than some new mechanisms.

#### *Revenue Generating Potential*

Revenue generation will be dependent on the maintenance costs to be recovered. However, because it doesn't require a vote it will be certain to cover the maintenance costs.

## 6.2 Potential Federal Funding Mechanisms

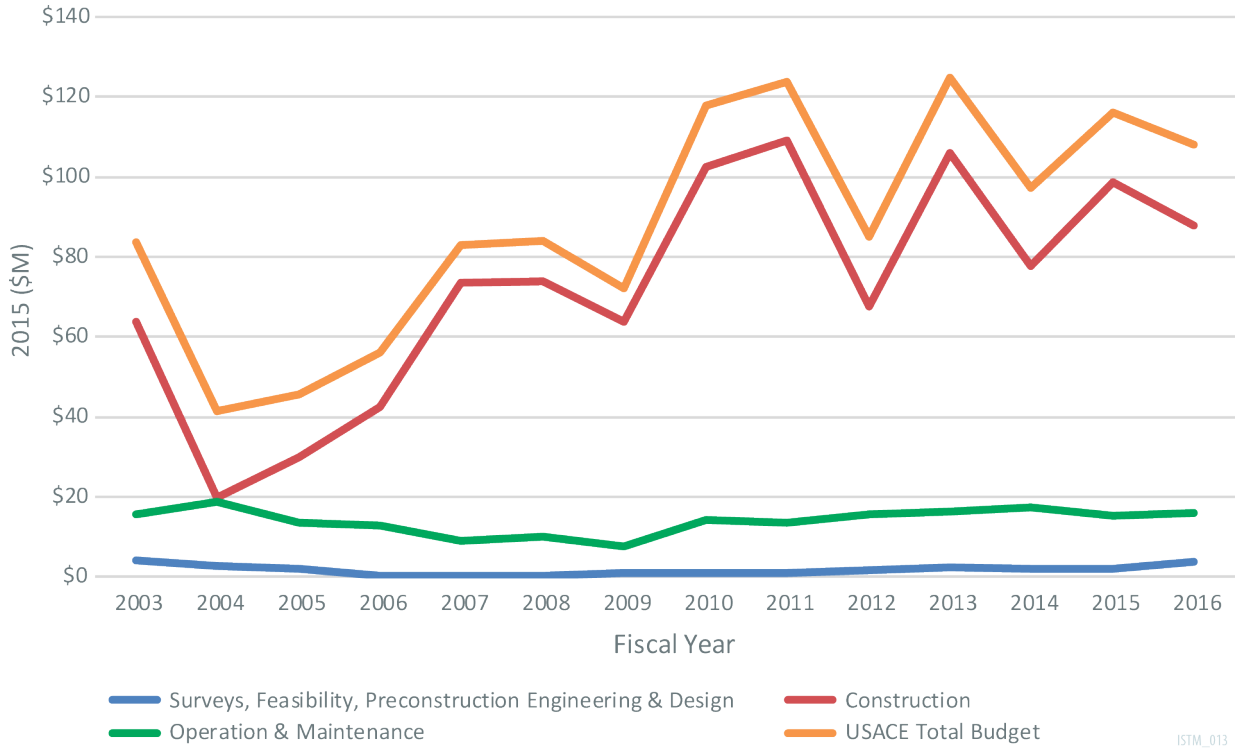
This section reviews each potential federal funding mechanism and evaluates it for applicability, interannual reliability, political viability, role in the CVFPP investment strategy, revenue-generating capacity, and other characteristics important to consider when applying it toward the CVFPP funding plan.

### 6.2.1 USACE Programs

The USACE plays a major role in funding and implementing flood management projects across California; most major projects implemented to date have involved USACE as a partner, and hundreds of projects have included cost-sharing with the USACE. Also, the State and the USACE have partnered with local agencies for improving portions of the SPFC in the Central Valley.

Figure 6-8 illustrates flood management funding by USACE and includes funds that USACE received for surveys, feasibility studies, and preconstruction engineering and design, construction, and O&M for flood management in the Central Valley for FY 2003 through 2016. USACE funding has ranged from approximately $40 million to approximately $120 million per year between 2003 and 2016 (all estimates are in 2015 dollars). These numbers represent funding for studies, construction, and O&M for flood management. Expenditures data for 2007 are work plan numbers, because Congress did not pass a federal budget, which would have included official budget numbers. The spike in USACE funding in FY 2010 is attributable to the passage of American Recovery and Reinvestment Act (ARRA) by Congress, which funded a number of projects in California. The majority of the expenditures shown for FY 2013 are associated with projects in the American River Watershed, such as the Common Features, Folsom Dam Modifications, and Folsom Dam Raise. Other USACE projects in the Central Valley are on the Yuba River (e.g., Yuba River Fish Passage), the Sacramento River (e.g., Sacramento River Bank Protection project), and in the Delta (the Sacramento–San Joaquin Delta Islands and Levees Project). These expenditures do not include project cost-shares paid by local and State agency cosponsors.

Figure 6-8. USACE Annual Budget for Flood Control by Category




*Source: USACE, 2015*

### *Applicability*

As was discussed in Section 4, a new, broader set of principles for making federal investment decisions appears to favor the multi-benefit, integrated approach for the CVFPP. Under the revised Principles, Requirements and Guidelines of 2013 and 2014, USACE funding is applicable to projects that assist in providing for safe and resilient communities and infrastructure, help facilitate commercial navigation in an environmentally and economically sustainable fashion, and restore degraded aquatic ecosystems and prevent future environmental losses. The USACE typically funds capital investments, but it also funds surveys, feasibility studies, and other ongoing management actions. USACE budgets by project and action are shown in Appendix A.

### *Interannual Reliability*

A significant amount of recent funding for flood management in the Central Valley comes from the USACE. Continued near-term USACE involvement in capital improvements for flood management has a high level of reliability. However, USACE participation in Central Valley flood management over long time periods is dependent on the priorities of ever-changing legislatures and presidential administrations. While it's likely that the USACE will continue to play a role in Central Valley flood management, the reliability of continued levels of investment over multiple decades can only be viewed as moderate.

### *Political Viability*

Historically, the political viability of USACE contributions to Central Valley flood management has been strong, especially for investments like urban levee improvements with clear economic benefits. Looking ahead, the viability of significant USACE participation in CVFPP implementation is less certain. As discussed above, the USACE and other federal agencies are evolving their decision-making processes to consider a broader set of criteria for investment that includes other benefits beyond economic returns, and the new administration (as of 2017) appears to support continued or increased federal infrastructure spending. At the same time, congressional leaders have expressed a goal of cutting federal spending. Because there are so many components of the refined SSIA, with a variety of potential outcomes, it is likely that at least some portions of the total investment will continue to be applicable for USACE funding, regardless of the political climate in Washington, D.C. However, the viability of broader USACE commitment to large-scale investments in the 2017 refined SSIA portfolio will depend on the direction provided by Congress and the administration.

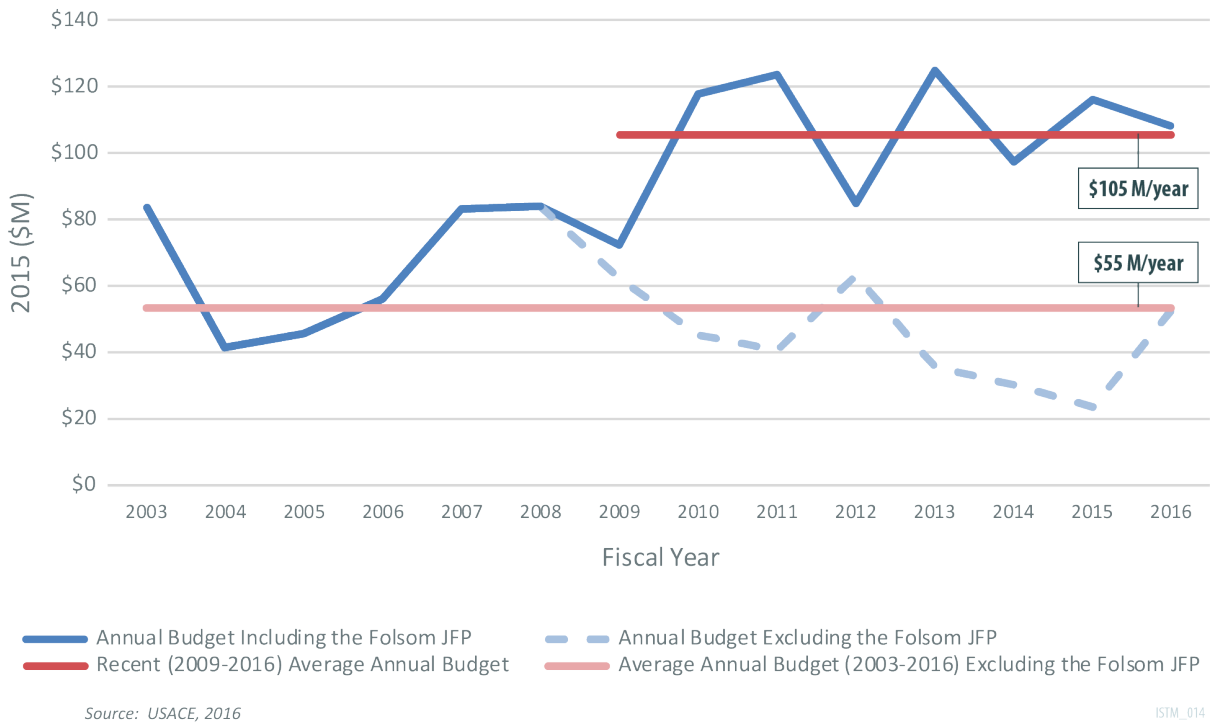
### *Role in a Flood Management Investment Strategy*

USACE funding is identified as the most likely source of federal funding support for a flood management investment strategy. For the purposes of this CVFPP investment strategy, the historical USACE involvement in the Central Valley is assumed to continue into the future. USACE funding is also considered for some action categories to which the agency is not currently contributing funds, but which might qualify for federal funds given the move toward more holistic evaluations of public benefit that stretch beyond cost benefit ratios. This translates into the USACE being considered as a potential source for all capital action categories, and for most ongoing action categories (with the exception of State planning, operations, maintenance, and performance tracking, and emergency management).

### *Revenue Generating Potential*

Figure 6-9 shows annual USACE spending in the Central Valley of California since 2003. Spending averaged $55 million per year from 2003 through 2016, not including Folsom JFP investments that began in 2009. During the construction years of the Folsom JFP (2009 through 2016), spending averaged $105 million, with a peak of $125 million in 2013. However, USACE spending on flood management in the Central Valley to date has focused mostly on levee and reservoir improvements, with a focus on economic outcomes. In contrast, the USACE has several other large-scale programs in other states that sometimes receive higher amounts of funding toward a broader variety of intended outcomes. For example, the Great Lakes Restoration Initiative was authorized for up to up to $475 million a year under the Department of the Interior, Environment, and Related Agencies Appropriations Act, 2010 (Public Law 111–88), and the House version of WRRDA 2016 includes authorizations for up to $300 million a year for the program from 2017 through 2021. Examples like these indicate a potential for the USACE to more than double its investment in the Central Valley if Congress would treat CVFPP implementation as a national priority. For the purposes of this investment strategy, it was assumed that the USACE could provide somewhere between current levels of investment and double the peak investment observed over the last 10 years, which translates to a range of $105 to $250 million annually.

Figure 6-9. USACE Budget for Flood Control Projects in the Central Valley With and Without the Folsom JFP Budget




*Source: USACE, 2015*

***Steps Required to Implement***

Involvement of USACE in new projects requires the support of the administration and congressional approval. WRDA 2014 created a new process calling for the Secretary of the Army to submit an annual report of potential authorizations for studies and projects to the congressional authorizing committees. Authorizations for the feasibility studies precede the authorizations for the subsequent construction projects. This annual report, along with the completed feasibility studies with favorable recommendations for construction authorizations by the Chief of Engineers, form the basis for discussion of subsequent authorization legislation. Only authorized studies and projects are considered for funding in the appropriations process.

### 6.2.2 FEMA Programs

The purpose of FEMA, created on April 1, 1979, is "to lead America to prepare for, prevent, respond to and recover from disasters with a vision of 'A Nation Prepared'." FEMA coordinates with states, territories, or federally recognized tribes to serve the agency's purpose. FEMA expenditures related to flood management fall under three categories: Hazard Mitigation Assistance (HMA), flood mapping, and the NFIP.

Three HMA grant programs available to fund flood management actions are the Flood Mitigation Assistance (FMA) Program, the Pre-Disaster Mitigation (PDM) Program, and the Hazard Mitigation Grant Program (HMGP). These programs share a common goal, which is to reduce the loss of life and property due to natural hazards. FMA funds are intended to reduce or eliminate flood damage to buildings insured under the NFIP. PDM funds are for protecting the population and structures from future hazards through hazard mitigation planning and projects. The intent for HMGP funds is for long-term planning following a major disaster declared by the President. The FMA and PDM programs are also intended to reduce reliance on federal funding in future disasters. For more information on the federal assistance expenditures by each of these programs for the Central Valley, see Appendix A.

FEMA conducts floodplain mapping throughout the United States and publishes the information free to the public. These maps are used by the NFIP to help assess the risk in different parts of a floodplain. Although most of the mapping is conducted by FEMA, state and local agencies participate in updating floodplain maps. In addition, grant programs support state and local floodplain mapping efforts through the Cooperating Technical Partners (CTP) Program and other grant programs.

#### *Applicability*

Activities eligible for funding include mitigation projects, hazard mitigation planning, technical assistance (eligible only through FMA), and management costs. The HMA guidance document provides a detailed description of eligible activities.

#### *Interannual Reliability*

HMA grants and floodplain mapping have been consistently funded in recent years. Of the HMA grants, Congress appropriates funding for PDM and FMA annually, whereas HMGP funding is only appropriated when the President declares a major disaster.

#### *Political Viability*

Continued FEMA HMA grant awards in California are likely. However, if the State develops its own insurance program, then it would become more difficult to convince the agency to continue to spend significant dollars in California on floodplain mapping or flood mitigation assistance programs. The case could be made that the federal government would still have an interest in funding floodplain and residual risk management through the HMA grant program because it would still play a role in disaster response and recovery in the case of a major flood. Significant federal dollars could be needed for emergency response, recovery of damaged Federal assets, infrastructure repairs, and other forms of assistance. The threat of these high costs might encourage continued federal participation on floodplain and residual risk management activities through these FEMA programs.

#### *Role in a Flood Management Investment Strategy*

FEMA HMA grant awards and floodplain mapping expenditures are considered in the CVFPP investment strategy as applicable funding mechanisms. Although these FEMA grant programs have smaller awards than USACE programs, the contribution is important. The FEMA programs provide a federal cost share under different guidelines than USACE programs. Therefore, they invest in flood management projects that may not otherwise have a federal cost-share partner. This flexibility supports a wider portfolio of management actions in the Central Valley.

The PDM and FMA programs have cost-share agreements that consider if the applicant is a small or disadvantaged community. Table 6-1 shows the potential cost shares across the three HMA programs. The HMA guidance document provides a detailed description of cost-share requirements and additional funding requirements. In the case of the State developing its own flood insurance program, it is assumed that the only FEMA dollars available are through HMA grants and not floodplain mapping.

Table 6-1. FEMA Program Cost Share Requirements

| Program | Subcategory (where applicable) | Mitigation Activity Award (Percent of Federal/Non-Federal Share) |
|---|---|---|
| HMGP | | 75/25 |
| PDM | | 75/25 |
| PDM | Sub recipient is small impoverished community | 90/10 |
| PDM | Federally recognized tribal Recipient is small impoverished community | 90/10 |
| FMA | Insured properties and planning grants | 75/25 |
| FMA | Repetitive loss property with repetitive loss strategy | 90/10 |
| FMA | Severe repetitive loss property with repetitive loss strategy | 100/0 |

*Source: The Hazard Mitigation Assistance Grant Programs Fact Sheet*

### *Revenue Generating Potential*

With the current data available, it is difficult to estimate FEMA revenue generation potential. FMA and PDM grant awards in California averaged $4.5M per year from 2001 to 2015. HMGP awards in California averaged $40M/year from 2001 to 2015, but include expenditures on hazards other than just floods. See Appendix A for details on these expenditures. Revenue generation for floodplain mapping in California is also difficult to estimate from the available data. Based on this information, it is assumed for purposes of this investment strategy that FEMA can contribute $5M to $15M/year toward CVFPP implementation. This assumption is similar in magnitude to the cost estimate of management actions that are applicable for FEMA funding. The estimate is adequate for the use in the funding plan because it is relatively small compared to the other funding mechanisms.

### *Steps Required to Implement*

The HMA grant programs and FEMA floodplain mapping efforts are already in place, so they do not require any new steps to implement. Agencies with projects eligible for HMA assistance must apply to FEMA.

### 6.2.3 Federal Ecosystem Programs

***North American Wildlife and Conservation Act Program***

The U.S. Fish and Wildlife Service (USFWS) administers the North American Wildlife and Conservation Act (NAWCA) program, which provides funding and administrative direction for the management of wetlands. The program provides matching grants to organizations and individuals who are engaged in wetland conservation projects in the United States, Canada, and Mexico for the benefit of wetlands-associated migratory birds and wildlife. The wetlands supported by the program also help in the control of flood waters and are therefore important to flood management.

**Applicability**

Several CVFPP multi-benefit management actions involve creation and management of wetlands, consistent with the CVFPP Conservation Strategy. This program would be helpful in providing supplemental funding to multi-benefit actions with clear benefits to wetlands ecosystems.

**Interannual Reliability**

Funds from these grant programs are not intended to be used programmatically, but are rather applied to specific projects that meet the program's funding criteria. Once a project is approved, reliability for funding is very high, but long-term interannual reliability is low in the sense that each individual project within the broader SSIA must apply for funding.

**Political Viability**

The use of the grant program would be universally supported but flood related spending may interfere with more traditional activities.

**Role in Flood Management Investment Strategy**

The mechanism should be used as a supplemental source of funding for any action categories with the potential to improve wetland ecosystems. These include many of the systemwide investments (like the Yolo Bypass multi-benefit improvements), as well as other capital investments that increase floodplain habitat (like some easements or land acquisitions, and small scale levee setbacks in rural areas).

**Revenue Generating Potential**

Over the past 25 years, the NAWCA program has funded over 2,000 projects totaling $1.4 billion in grants, and partners have contributed nearly $3 billion in matching funds to benefit more than 33 million acres of habitat (USFWS, 2017a). During FY 2015, the NAWCA program provided about $11.5 million in grant funding to 18 projects in California; six of these were in the Central Valley and received about $4.9 million in grant funding (USFWS, 2017b). It is assumed that similar levels of investment could continue, with a revenue generation potential of up to $5 million per year.

**Steps Required to Implement**

This is a competitive grant program, so it requires preparing a grant proposal. The program has two funding cycles per year.

### *Anadromous Fish Restoration Program*

The goal of the Anadromous Fish Restoration Program (AFRP), administered by the USFWS, is to expand the accessible range of habitat and improve the quality of fish habitat in the Central Valley in an effort to restore natural stocks of anadromous fish. The program brings together federal, State, and local agencies as well as non-profit organizations and private landowners on projects that increase available juvenile and adult salmon habitat (USFWS, 2017c). The final restoration plan for the AFRP explicitly calls for coordination with flood management activities to ensure the protection of fishery resources and riparian habitats as well as spawning grounds (USFWS, 2001).

**Applicability**

This program would only be applicable for CVFPP management actions that provide benefits consistent with the AFRP's goals; any qualifying project would have to provide the benefit of improving fish habitat.

**Interannual Reliability**

Inter-annual reliability would be very low, as the project would still need to be funded by USFWS.

**Political Viability**

Because funds are provided programmatically to the AFRP (independent from CVFPP implementation), the viability of this funding mechanism rests only on the ability of individual projects to meet the program's funding criteria. Because of this, the viability of this mechanism is high, but only for the small proportion of the 2017 refined SSIA portfolio that can clearly demonstrate benefits to anadromous fish habitat.

**Role in Flood Management Investment Strategy**

This program would have a limited role as part in CVFPP implementation, and could be used as a supplemental source of funding for any action categories with the potential to improve anadromous fish habitat. These include many of the systemwide investments (like the Yolo Bypass multi-benefit improvements), as well as other capital investments that increase floodplain habitat (such as some easements or land acquisitions, and small-scale levee setbacks in rural areas).

**Revenue Generating Potential**

This program anticipates having $11 million available for grants in FY 2017. However, this is for all flood, water, and land management activities in the Central Valley that impact anadromous fish habitat. Assuming that only about a quarter of these activities relate to flood management, the revenue generation potential of this mechanism for Central Valley flood management is not likely to exceed $3 million per year.

**Steps Required to Implement**

This program requires an application.

### *Endangered Species Act Section 6 Grant Program*

The Cooperative Endangered Species Conservation Fund Grants (Section 6 of ESA) is administered by USFWS and provides funding to states and territories for species and habitat conservation actions on non-Federal lands (USFWS, 2017d). The program's goal is to work cooperatively with landowners, communities, and tribes to foster voluntary stewardship efforts on private lands for the recovery of endangered species. The overall program has four specific grant programs: Conservation, Habitat Conservation Planning (HCP) Assistance, HCP Land Acquisition, and Recovery Land Acquisition.

**Applicability**

Because this program provides funding for land acquisition, it could be used to acquire lands in floodplains.

**Interannual Reliability**

This program provides low interannual reliability because it is set up to award one-time grants.

**Political Viability**

The use of this mechanism could be supported by landowners and communities.

**Role in Flood Management Investment Strategy**

This mechanism would have a very limited role, potentially providing supplemental funds targeted for land acquisitions.

**Revenue Generating Potential**

In FY 2016, the Yolo County HCP received $820,660 from the HCP Planning Assistance Grant Program.

**Steps Required to Implement**

This program requires an application to the USFWS.

### *U.S. Department of Agriculture, Natural Resource Conservation Service*

The NRCS has a history of providing funding for multi-benefit projects that impact agricultural lands. Programs that could potentially be used include the Environmental Quality Incentives Program and the Regional Conservation Partnership Program. The programs provide funding assistance to help manage natural resources in a sustainable manner.

**Applicability**

Some of the NRCS programs have provided funding for floodplain easements, and others will fund improving or restoring habitat.

**Inter-Annual Reliability**

These grant programs are typically a one-time occurrence.

**Political Viability**

The use of this mechanism could be supported by local entities.

**Role in Flood Management Investment Strategy**
These funds could be used for easements, improving habitat, and flood protection.

**Revenue Generating Potential**
A recent example of potential revenue is the Black Rascal Creek Project. NRCS is investing $10 million in this project proposed by the partnership of Merced County, Merced Irrigation District, and City of Merced. These funds were through the Regional Conservation Partnership Program. The project will provide flood protection to the communities of Merced and Franklin/Beachwood, as well as surrounding prime agricultural lands, in an area that has seen frequent and severe flooding. In addition to flood control, this multi-benefit project will address drought, water quality, soil quality, and inadequate wildlife habitat.

**Steps Required to Implement**
An application is required to be submitted for these competitive grants.

### 6.2.4 Other Potential Federal Mechanisms

***WaterSMART Program***
The Bureau of Reclamation (Reclamation) administers a grants program called WaterSMART that provides relatively small awards for state and local projects that improve water management. The program does not specifically target flood management, but it includes a broad range of water management activities, including Reclamation's Title 16 water recycling and reuse program. In addition, individual grant rounds have targeted water use efficiency, cooperative watershed management, water marketing, and system optimization. Typically, the grants require a 50% non-federal cost share.

***Land and Water Conservation Fund***
The National Park Service (NPS) administers the Land and Water Conservation Fund (LWCF). This fund is intended to create and maintain a nationwide legacy of high-quality recreation areas and facilities and to stimulate non-federal investments in the protection and maintenance of recreation resources across the United States. Initially authorized for a 25-year period, the LWCF was extended for another 25 years and expired September 30, 2015. The fund was temporarily extended for 3 years in the Consolidated Appropriations Act, 2016, and will expire September 30, 2018 (NPS, 2017a).

This program provides matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for conservation strategies). In most years, all states receive individual allocations of the LWCF grants based on a national formula (with state population being the most influential factor). The identification of which projects receive the grants is done at the local state level (NPS, 2017b). In FY 2016, California received about $8 million from the LWCF. Some of the lands developed using LWCF grants include the Millerton Lake State Recreation Area adjacent to Friant Dam (NPS, 2017c).

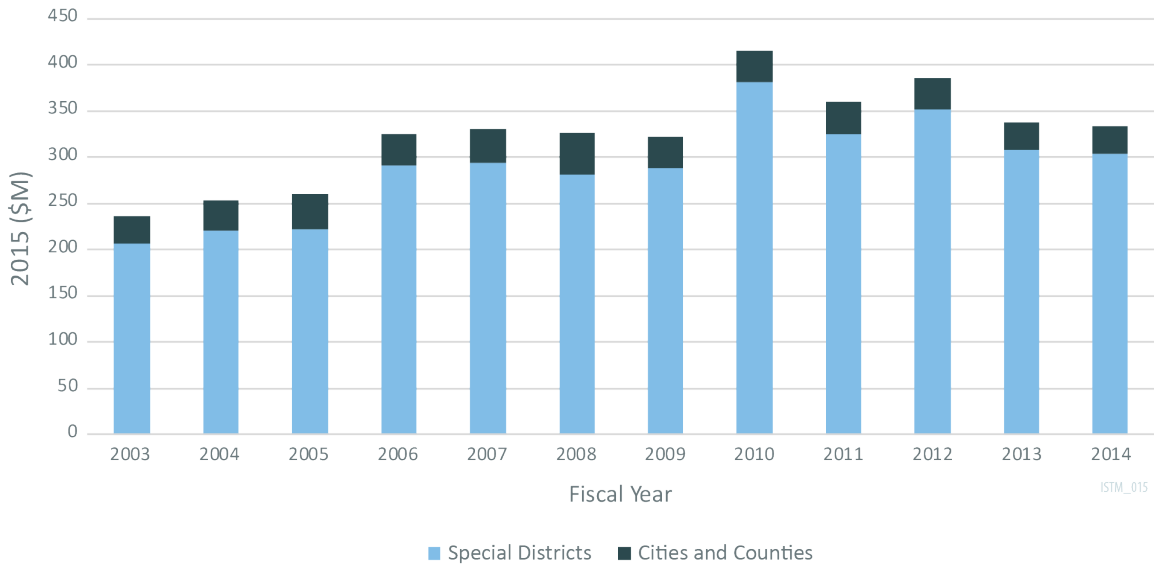
## 6.3 Potential Local Funding Mechanisms

These potential funding mechanisms include benefits assessment and special taxes, enhanced infrastructure financing districts, and developer fees.

### 6.3.1 Benefit Assessments and Special Taxes

Information for California city, county, and special district flood management expenditures were collected from the State Controller's Office (SCO 2016a, 2016c, 2016a). Figure 6-10 shows the annual local flood expenditures relevant to the SPFC Planning Area for FY 2003 through 2014.

Figure 6-10. Summary of Annual Local Expenditures, SPFC Planning Area, FY 2003 to 2014




*Sources: SCO, 2016a; 2016b; 2016c*

City expenditures for flood and stormwater management were estimated using the following categories identified in city expenditure reporting documents: water; sewers; streets, highways, and storm drains; and disaster preparedness. This estimate of flood management expenditures by city assumes that 5% of highway, streets, and storm drain expenditures and 12% of disaster preparedness expenditures are related to flood management activities. Appendix A presents the capital and O&M flood management expenditures by cities between FY 2003 and 2014 (in 2015 dollars) for all cities relevant to the SPFC Planning Area..

County expenditures on flood management, soil, and water conservation were used to calculate the county contribution. County expenditures averaged $2.5 million per year (in 2015 dollars) with a high of $3.3 million in FY 2008 and a low of $1.1 million per year in FY 2014. Appendix A presents a summary of total expenditures in flood management, soil, and water conservation across all counties relevant to the SPFC Planning Area between 2003 and 2014.

Special districts' expenditures on flood management include ongoing expenditures (labor and supplies), debt service, fixed assets, and other costs. Expenditures by special districts for flood management activities have been trending steadily higher since FY 2003, with a peak of more than $382 million (in 2015 dollars) in FY 2010. In addition, debt service is increasing as a proportion of total annual expenditures, while ongoing costs are relatively constant. Expenditures on fixed assets are correlated with increased need for local cost shares to match funding available at the State level. Special districts are financed by local fees and assessments, but cost sharing with the State increases capital expenditures in years when bond funding is available. Appendix A presents a summary of total expenditures by special districts across all counties relevant to the SPFC Planning Area between 2003 and 2014.

#### *Applicability*

Local assessments and taxes have a nexus to any CVFPP actions with clear local benefits. Because local benefits can be in the form of improved public safety, economic stability, ecosystem health, or enriching experiences, this nexus exists for almost any action category within the SSIA (both capital and ongoing).

#### *Interannual Reliability*

Many local agencies (such as counties, cities, and utility districts) fund all or a portion of their flood management and planning programs through their general fund budgets. Although general fund revenues are collected regularly and have virtually no restrictions on their use related to flood management and planning, most local agencies are financially challenged and cannot afford to take general fund monies away from other programs such as schools, police, and fire departments. As a result of this competition for limited funds, flood management can vary according to local economic conditions or unforeseen needs from other government departments.

#### *Political Viability*

Broad local support is necessary for any increase to local property assessments subject to Proposition 218 requirements. Local residents and businesses generally support spending for flood management when they can see local benefits. Support for more regional or systemwide investments can be more difficult to achieve. Local involvement in the planning process will help ensure political viability of the broad range of actions in the CVFPP.

#### *Role in a Flood Management Investment Strategy*

City, county, and special district contribution is a requirement of most capital and ongoing management actions.

#### *Revenue Generating Potential*

As was discussed in Section 5, local assessments and taxes already account for roughly $28 million dollars of spending towards RR&R in the Central Valley. This same level of investment in RR&R in the 2017 refined SSIA portfolio is assumed to continue. Some additional revenues may also be available to the extent that the Sacramento and San Joaquin Drainage District does not consume the remaining ability to pay in terms of local tax burdens. The total revenue generation capacity between these two mechanisms is not likely to exceed $50 million per year. Combined with the assumed continuation of $28 million of spending on RR&R, this translates to a total local burden that does not exceed about $80 million per year.

### 6.3.2 Enhanced Infrastructure Financing District

Approved by Governor Brown in September 2014, SB 628 authorizes the creation of enhanced infrastructure financing districts (EIFD) to finance public capital facilities or other specified projects of community-wide significance. Cities or counties may establish EIFDs by adopting a resolution of intention that defines the boundaries of the district, the type of public facilities and development proposed to be financed, the need for the district, and the goals the district proposes to achieve. Additionally, cities or counties may issue bonds with a 55% vote of the electorate. Cities or counties may set the boundaries of the district to include multiple jurisdictions, matching a tributary or watershed. An EIFD receives the incremental growth in property tax revenues, or tax increment, of taxing agencies (cities, counties, and special districts, but not schools) that consent.

Although tax increment would provide a dedicated source of funding, the amount of the funding may be small: Tax increment relies on new development for increased property tax revenues. Therefore, an EIFD may not be an appropriate financing mechanism for some areas not experiencing growth. In addition, only cities and counties are authorized to form an EIFD; however, because boundaries can include multiple jurisdictions, other agencies (such as flood control agencies) can contribute to the tax increment and receive funding for facilities.

#### *Applicability*

This mechanism is applicable for capital investments in areas experiencing growth. An EIFD may not be used to finance routine maintenance, repair work, or the costs of an ongoing operation or providing services of any kind.

#### *Interannual Reliability*

An annual assessment would have very good interannual reliability.

#### *Political Viability*

Political viability would depend on how the EIFD was formed.

#### *Role in Flood Management Investment Strategy*

The EIFD could potentially be used in an area experiencing growth.

#### *Revenue Generating Potential*

Revenue generation potential would be limited.

#### *Steps Required to Implement*

Cities or counties may establish EIFDs by adopting a resolution of intention that states the boundaries of the district, the type of public facilities and development proposed to be financed, the need for the district, and the goals the district proposes to achieve.

### 6.3.3 Developer Fees

Developer fees are monetary exactions (other than taxes or special assessments) charged by local agencies in conjunction with approval of a development project and are usually collected at the time building permits or occupancy permits are issued. Developer fees are levied to defray all or a portion of the costs incurred for any public facility, improvement, or amenity that benefits the development. However, they cannot be used to pay for public services. Most agencies currently impose developer fees for a broad range of public facilities.

AB 1600, which promulgated Section 66000 and other sections of the Government Code, was enacted in 1987 to regulate the imposition of developer fees in California. AB 1600 requires that all public agencies satisfy a number of requirements when establishing, increasing, or imposing a fee as a condition of approval for a development project. These requirements include identifying the facilities to which the collected fee would be applied and determining that there is a reasonable relationship among the facilities to be financed, the benefit received by the development paying the fees, and the amount of the fee imposed.

#### *Applicability*

This mechanism is applicable to, and could be useful in, new developments constructing flood management facilities.

#### *Interannual Reliability*

The developer fee is a one-time occurrence.

#### *Political Viability*

Developer fees are popular for infrastructure because they are constructed before the development occurs, and the ultimate payer of the fee does not yet reside there.

#### *Role in Flood Management Investment Strategy*

Developer fees could be used for some of the local share of a project.

#### *Revenue Generating Potential*

This is dependent on the developer fee, but because this mechanism applies to only growth areas, the revenue potential is low.

#### *Steps Required to Implement*

These requirements include identifying the facilities to which the collected fee would be applied and determining that there is a reasonable relationship among the facilities to be financed, the benefit received by the development paying the fees, and the amount of the fee imposed.

## 6.4 Other Potential Private Partnerships

Pay for success is an innovative approach toward contracting that links payments to outcomes. It can take many forms, but the main idea is to reduce the financial risk to the public by attracting private capital to fund environmental and/or social projects that are in the public interest. Pay for success contracts create opportunities for investors to finance projects with potential to achieve a return on investment if outcomes are cost-effectively produced. These mechanisms can also attract voluntary funds from NGOs such as Trout Unlimited, American Rivers, and The Nature Conservancy, as well as from private individuals, especially for projects that produce multiple benefits and that generate value that greatly exceeds the contributions by these groups.

- DC Water issued the nation's first environmental impact bond (EIB), a pay for success transaction, to fund the initial green infrastructure project in its DC Clean Rivers Project. The proceeds of the bond will be used to construct green infrastructure practices designed to mimic natural processes to absorb and slow surges of stormwater during periods of heavy rainfall, reducing the incidence and volume of combined sewer overflows (CSOs) that pollute the District's waterways (https://www.dcwater.com/site_archive/news/press_release783.cfm).

- Blueprints for similar environmental impact bonds are described by Encourage Capital and Squire Patton Boggs who received funding from the Walton Family Foundation to identify potential innovative financing mechanisms for private investors to finance water resource solutions and generate related environmental benefits, including flood mitigation (http://encouragecapital.com/wp-content/uploads/docs/water-in-the-west-full-report-final_web.pdf)

## 6.5 Summary of Potential Funding Mechanisms

Potential funding mechanisms for CVFPP investment are summarized in Table 6-2. The table briefly describes local, State, and federal funding mechanisms by providing a summary description of each mechanism, what management actions it best applies to, and the role the mechanism can play for investments in the Central Valley.

Table 6-2. Summary of Potential Funding and Financing Mechanisms by State, Federal, and Local Entities

| Mechanism | New Mechanism | Description | Applicable Management Actions | Level of Applicability | Inter-annual Reliability | Current Funding Level | Revenue General Potential for 2017 Refined SSIA Portfolio | Mechanism Included in Funding Plan | Recommendations for CVFPP Funding Plan |
|---|---|---|---|---|---|---|---|---|---|
| ***State*** | | | | | | | | | |
| Additional State General Fund | | The General Fund has traditionally funded some flood management. The CVFPP funding plan recommends increasing General Fund appropriations. | All capital and ongoing management actions | Applicability is high. There is a nexus between lowering the risk of flooding and benefits to the State economy. | Moderate | 2003–2015 annual average: $40M<br>2003–2015 maximum $64M (2008) | $60–$200M per year (up to $128/year in Phase 1) | ✓ | Key part of the near-term approach. |
| Sacramento and San Joaquin Drainage District | ✓ | Reutilize the function of the Sacramento and San Joaquin Drainage District to provide another source of funding. This would require new legislation to amend the Sacramento and San Joaquin Drainage District currently in the California Water Code. This mechanism would need to be coordinated with other potential assessments. | All capital and ongoing management actions | Applicability is high. There is a strong nexus between the assessments and benefits received in the drainage district. | High | N/A | $10–$50M per year<br>(upper bound assumes no increases in local property assessments or special taxes) | ✓ | A new funding source to pay local cost shares. |
| State River Basin Assessment | ✓ | A river basin assessment would be a tool for integrated water management. Assessment revenue would be returned to the watershed to be shared across the integrated water management activities. This assessment would cover the whole watershed and be shared by water agencies within the watershed. | All capital and ongoing management actions | Applicability is low (if implemented, assessment revenue would be spread across other water activities in the basin with likely no more than $5 to $10M/year for flood management). Nexus is good between the assessment and the benefits received in the watershed. | High | N/A | $25M per year | ✓ | A new funding source that could fund some projects in the longer term, but a minor role in the CVFPP funding plan. |
| State Flood Insurance Program | ✓ | The State would augment/replace the NFIP program with a State-led program. Beyond providing risk coverage, the program would be set up to invest in infrastructure and other floodplain management activities that reduce flood risk. Another version of this could be a local basin-wide insurance program. A local basin-wide insurance program could potentially be a companion program with the Statewide Flood Insurance Program. Any new program could also consider insurance for agricultural properties. | Levee improvements, small-scale levee setbacks and floodplain storage, land acquisitions and easements | Applicability is high (anticipated to generate $5 to $20M/yr.; however, this would require significant effort to determine feasibility).<br>There is a strong nexus insurance and the benefits received as rates could fluctuate depending on benefit level. | High | N/A | $12M per year | ✓ | A new funding source that could fund projects in the longer term. |
| GO Bonds | | Issuance of new State general obligation bonds would require a statewide vote. This mechanism would require time to prepare language for the bond measure for the statewide vote, as well as a 2-year lag before funds would be available after passage. | Systemwide capital actions, levee improvements, small-scale levee setbacks and floodplain storage, land acquisitions and easements, habitat restoration/ reconnection | Applicability is high. The benefits of reducing the flood risk and benefits to the State economy create a nexus with this mechanism. | High for bonds that have passed, low over the long term | 2003–2015 annual average: $180M<br>2003–2015 maximum $275M (2010) | $1.5–$3B per decade | ✓ | Could continue to play a significant role in capital investments. |
| Water Surcharge | | An option that has been discussed for several years, a water surcharge on retail water sales would generate revenue for water projects. There would likely be a nexus to ecosystem projects. | habitat restoration/ reconnection, small-scale levee setbacks | Applicability and nexus is low (except for projects w/ ecosystem benefits). | High | | Not used in the Plan | | Not used for CVFPP recommended funding plan – Could be used as long term source of funding for ecosystem efforts, but a minor role in the funding plan. |

Table 6-2. Summary of Potential Funding and Financing Mechanisms by State, Federal, and Local Entities

| Mechanism | New Mechanism | Description | Applicable Management Actions | Level of Applicability | Inter-annual Reliability | Current Funding Level | Revenue General Potential for 2017 Refined SSIA Portfolio | Mechanism Included in Funding Plan | Recommendations for CVFPP Funding Plan |
|---|---|---|---|---|---|---|---|---|---|
| *Federal* | | | | | | | | | |
| USACE | | The WRDA authorizes the Secretary of the Army to study and/or implement various projects and programs for improvements and other purposes to rivers and harbors of the United States. Federal authorized funds would require appropriation by Congress. | Systemwide capital actions; urban levee improvements; small-scale levee setbacks and floodplain storage; rural land acquisitions and easements; habitat restoration/ reconnection; risk awareness, floodproofing, and land use planning; urban and small community studies and analysis | Applicability is high. Projects qualifying for USACE funding have to demonstrate that they provide national benefits to receive funding. | Moderate | 2003–2016 annual average: $55M (excluding Folsom JFP)<br>2009–2016 annual average: $105M (including Folsom JFP)<br>2003–2016 maximum $125M (2013) | $100–$250M Per year | ✓ | A key part of the federal contribution. |
| FEMA | | FEMA is the disaster response agency of the federal government. FEMA provides State and local governments with funding for emergency preparedness programs in the form of non-disaster grants. | Risk awareness, floodproofing, and land use planning; rural and small community studies and analysis | Applicability is high (expected to generate no more than $10M/yr.) The limited uses of the funds maintain the nexus between the funds and benefits received. | High | 2001–2015 annual average: $4.5M<br>2001–2015 maximum $18.5M (2009) | $5–$15M per year | ✓ | Part of the CVFPP funding plan, but provides smaller percentage of overall CVFPP funds. |
| Ecosystem Programs | | Several federal programs provide grants for ecosystem purposes. For example, voluntary Farm Bill conservation programs are offered through the NRCS. | Habitat restoration/reconnection, rural land acquisitions and easements | Applicability is high. The application process for these funds would require a nexus to be shown. | Moderate | | $10M per year | ✓ | Programs should be explored to augment funding. |
| *Local* | | | | | | | | | |
| Benefit Assessments and Special Taxes | | The typical mechanism for funding local activities. Increases to benefit assessments and special taxes would require a property owner or a registered voter vote (depending upon specific circumstances). Benefit assessments would be limited and not able to fund general benefits such as habitat restoration. | All capital and ongoing management actions other than habitat restoration/reconnection | Applicability is high. Benefit assessments by definition would have a good nexus. | High | 2003–2014 annual average: $28M | $28–$78M per year<br>(upper bound assumes that the Sacramento and San Joaquin Drainage District does not pass) | ✓ | Could continue to play a major role in local funding. |
| Enhanced Infrastructure Financing Districts | | EIFDs were established in 2014 and enable the establishment of one or more EIFDs within a county to assist with financing construction or rehabilitation of a wide variety of public infrastructure and private facilities. | Systemwide routine maintenance, emergency management, levee improvements, floodplain storage (transitory, groundwater, and/or surface), Small-Scale Levee Setbacks | Applicability is moderate. Nexus would be dependent on how the EIFD was established. | Moderate | | Would be just another form of assessment district | | Not used for CVFPP recommended funding plan – Could be used as another approach for local funding. More applicable to new development. |
| Developer Fees | | A system development charge for new improvements. | Levee Improvements, Floodplain Storage (transitory, groundwater, and/or surface), Small-Scale Levee Setbacks | Applicability is high. The developer fee would have to show a nexus in the calculation of the fee. | Low, depends on development | | Not assumed to be used in the Plan | | Not used for CVFPP recommended funding plan. Could be used as a source for one-time management actions. |

Notes:
1. A requested change for the USACE project approval methodology.
2. Numbers based on an unconstrained State funding scenario, for demonstration only.
3. State GO Bond revenue generation potential is reported on a per decade basis because the CVFPP Funding Plan assumes a GO bond will be passed every decade.

LPA = local property assessment
State GF = CA State General Fund

Tables 6-3 and 6-4 focus on a subset of funding mechanisms that are likely to represent the majority of contribution to the CVFPP Funding Plan, some of which are a broader grouping of some of the more detailed mechanisms discussed above. During funding plan development, each of the management actions by area of interest were aligned with the applicable funding mechanism.

Table 6-3. Applicable Funding Mechanisms for Capital Investments

| Management Action Category and Area of Interest | Applicable Funding Mechanisms (Local, State, and/or Federal) |
|---|---|
| Systemwide | |
| Yolo Bypass multi-benefit improvements | State General Fund, GO bond, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Feather River–Sutter Bypass multi-benefit improvements | State General Fund, GO bond, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Paradise Cut multi-benefit improvements | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Reservoir and floodplain storage | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Urban | |
| Levee improvements | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Other infrastructure and multi-benefit improvements | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Rural | |
| Levee repair and infrastructure improvements | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Small-scale levee setbacks and floodplain storage | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Land acquisitions and easements | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Habitat restoration and reconnection | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Small Community | |
| Levee repair and infrastructure improvements | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |
| Levee setbacks, land acquisitions, and habitat restoration | State General Fund, GO bond, State River Basin Assessment, State Flood Insurance Program, USACE, LPA, Sacramento and San Joaquin Drainage District |

Table 6-4. Applicable Funding Mechanisms for Ongoing Investments

| Management Action Category and Area of Interest | Applicable Funding Mechanisms (Local, State, and/or Federal) |
|---|---|
| Systemwide | |
| State operations, planning and performance tracking | State General Fund, State Flood Insurance Program |
| Emergency management | State General Fund, LPA |
| Reservoir operations | State General Fund, LPA |
| Routine maintenance | State General Fund, LPA |
| Urban | |
| Risk awareness, floodproofing, and land use planning | State General Fund, Sacramento and San Joaquin Drainage District, LPA, FEMA, USACE |
| Studies and analysis | State General Fund, Sacramento and San Joaquin Drainage District, LPA, USACE |
| Rural | |
| Risk awareness, floodproofing, and land use planning | LPA, FEMA, USACE |
| Studies and analysis | State General Fund, Sacramento and San Joaquin Drainage District, LPA, FEMA |
| Small Community | |
| Risk awareness, floodproofing, and land use planning | LPA, FEMA |
| Studies and analysis | State General Fund, Sacramento and San Joaquin Drainage District, LPA, FEMA, USACE |

# 7.0 Assessment of Funding Scenarios

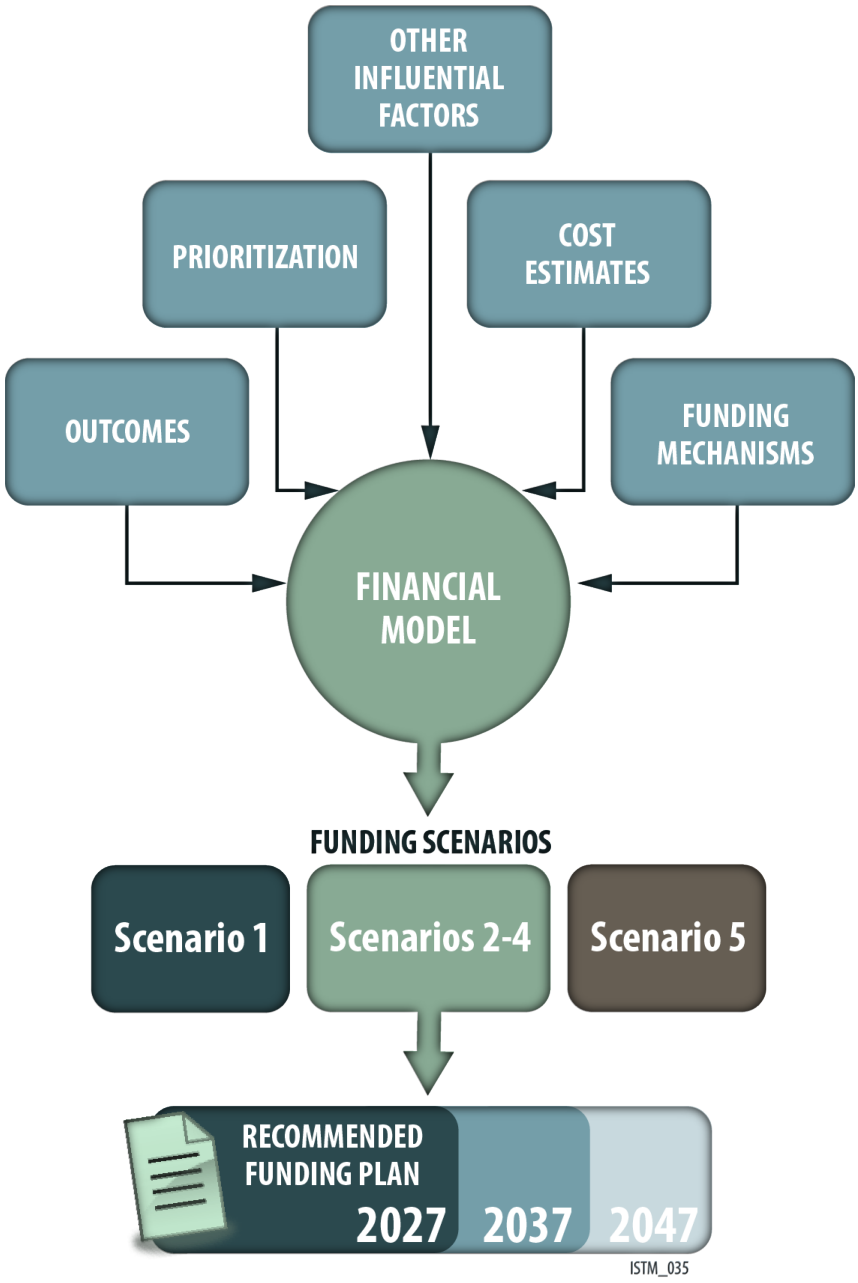
## Section 7 Highlights

- Section Outline:
  - Financial Model
  - State, Local and Federal Contributions to CVFPP and Central Valley Flood Management
  - Overview of Scenarios
  - Scenario 1: Continuation of Current Levels of Investment
  - Scenarios 2–4: Increased Investment in Central Valley Flood Management
  - Scenario 5: Decreased Investment in Central Valley Flood Management
  - Scenario Conclusions
- Key Section Takeaways:
  - A financial model was applied to analyze five funding scenarios for the CVFPP and considered State, local, and federal contributions.
  - The recommended funding plan is guided by lessons learned from the results of five scenarios.

Many uncertainties affect future flood management investments; the financial analysis builds these uncertainties in as prescribed constraints. Financial analysis of the 2017 refined SSIA portfolio explores various ways to fund proposed CVFPP investments with varied assumptions about the following factors: prioritized management types, existing and new funding mechanisms, and influential factors such as ability to pay or cost share agreements. In order to inform the financial analysis, the 2017 refined SSIA portfolio was organized by area of interest and by prioritized management action type as described in Section 3. The management action types were matched with the DWR flood management programs for delivery. Then, the management action types were matched to existing and new funding mechanisms. The multiple scenarios vary the capacity of existing and new funding mechanisms, along with other constraints. The recommended funding plan is guided by lessons learned from the results of these scenarios.

Section 6 of this TM described the many different funding mechanisms that might be used to pay for Phases 1, 2 and 3 of recommended CVFPP investment, along with their advantages and shortcomings. A financial model was developed to help identify the most viable, reliable, and applicable uses of those mechanisms for funding CVFPP investment, based on varying sets of assumptions. Figure 7-1 presents the overall process for development of the CVFPP funding plan. The next section provides a technical description of the model. The Financial Model evaluated the following scenarios that compare potential funding strategies and vary limitations and opportunities over the next 30 years.

Figure 7-1. Development of a Funding Plan



## 7.1 Financial Model

The CVFPP Financial Model was developed in Microsoft Excel to optimize the funding of management actions in each phase and over the 30-year implementation timeframe, given a set of limitations. These limitations include the capacity of each funding source by phase, applicability of funds (good, moderate, poor, not applicable), and the cost share percentages for each partner (State, federal, local).

The Financial Model solves for the optimal contribution of each funding source to management actions in a phase. The objective function is to maximize the overall phase funding score subject to the constraints set for that scenario. The funding score is calculated from the level of applicability of each funding source that is applied to each management action, with applicability based on a variety of considerations, including nexus, inter-annual reliability (for ongoing actions), scale of benefit, and political viability. Higher scores are achieved when management actions are funded by sources with "Good Applicability." The available capacity for each phase and cost shares limit the amount a funding source can contribute to a management action. The overall phase funding score is the sum of each individual management action funding score. The model maximizes this score for each phase; therefore, providing the optimal funding of management actions over the 30-year timeline.

The Financial Model input sheet contains the 2017 refined SSIA portfolio management actions, level of investment by phase, fund applicability, and cost share limits. The optimization mechanics of each phase are contained in a unique sheet of the Financial Model. In these phase sheets, the funding applicability for each management action is assigned a value, where: "Good Applicability" sources are assigned a value of five, "Moderate Applicability" sources are assigned a three, "Poor Applicability" sources a one, and "Not Applicable" sources a zero.

The contribution of each funding sources can be constrained by available capacity in each phase or by cost share. Each source is identified as a State, federal, or local mechanism and are subject to the respective cost share limit toward each management action. Funding source capacity constraints by phase are set on Dashboard Sheet. All capacities are set as an annual amount, except for State GO bonds, which are a total phase amount. Additional constraints include limits on overall partner contribution by phase or over the entire 30-year timeline, overall combined investment limit, and escalation rate of costs over time.

The solver maximizes the sum of all the individual management actions funding scores. The individual management action scores are the weighted average of the achieved applicability scores and their respective percentage contribution toward the total management action cost. An example of this can be found below:

Management action 1 has an investment of $100M in Phase 1, fund 1 is a "good applicability" source with a 50% cost share limit, fund 2 is a "moderate applicability" source with a 30% cost share limit, and fund 3 is "poor applicability" source with a 50% cost share limit. Solver has allocated $50M in fund 1, $30M in fund 2 and the remainder into fund 3. The individual management action score for Phase 1 is (50% × 5) + (30% × 3) + (20% × 1) = 3.6. The optimization maximized the contribution from fund 1 because of the greater applicability score. This solution requires that this funding source has the available capacity to make this

contribution. If fund 1 has a capacity constraint that prevents this investment, and fund 3 does not, the resulting management action score for this phase will be less than the optimal.

The Financial Model optimizes Phase 1 before optimizing Phase 2 and Phase 3. Any capital management actions not fully funded in Phase 1 either through a lack of funds or a violation of a constraint are added to the next phase. The same process for Phase 1 is repeated for Phase 2 and Phase 3. The total amount of unfunded management actions for each phase are identified on the Dashboard Sheet. If the target level of an ongoing management action investment is not funded in the phase, any remaining investment is not moved onto the next phase.

## 7.2 State, Local and Federal Contributions to CVFPP and Central Valley Flood Management

In order to compare the implications of various scenarios on different funding sources, it's important to first have an understanding of how CVFPP Investments relate to overall investment in Central Valley flood management by State, local and federal entities. Throughout the following scenarios discussion, State, local and federal cost share is reported from two different perspectives:

1. **CVFPP Cost Shares** – These numbers include only the contributions that these sources could make to investments within the 2017 refined SSIA portfolio. These numbers come directly out of the financial model results, and represent the amount that each source puts forth toward CVFPP implementation.

2. **Central Valley Flood Management "Cost Shares"** – These numbers include the total amount of investment that each source could make in flood management in the Central Valley. This total always includes the CVFPP totals described above, but may also include additional expenditures outside of those captured within the 2017 refined SSIA portfolio. Figure 7-2 shows a conceptual pie chart representing these cost share perspectives. The 2017 refined SSIA portfolio accounts for all State expenditures in Central Valley flood management, including routine operations and maintenance. Therefore, there is no significant difference between the *dollar* values of State contribution to the 2017 refined SSIA portfolio versus State contribution to Central Valley flood management.

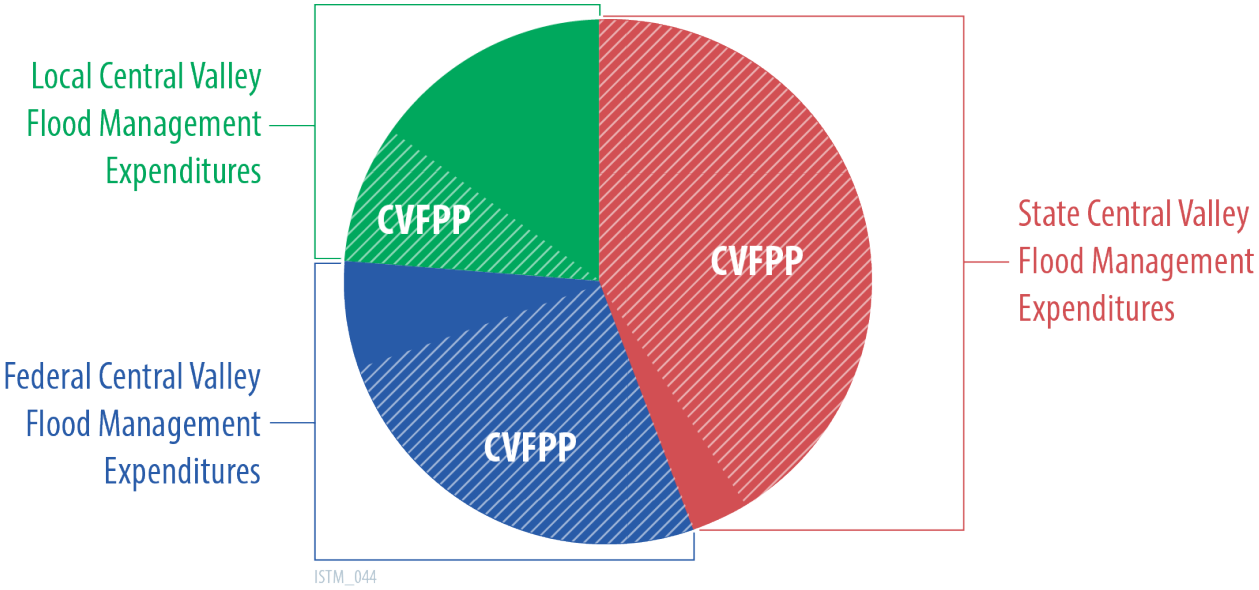
However, the same is not true for local or federal entities, and therefore the State's cost share differs in each calculation. The 2017 refined SSIA portfolio does not include things like administrative or operating costs for local or federal agencies, or any local or federal expenditures outside of the SPFC.

The average annual future contribution of local and federal agencies to Central Valley flood management is calculated as a combination of two types of expenses:

1. Average annual CVFPP contributions (CVFPP-related expenses), plus

2. Average annual contributions to activities not captured within the 2017 refined SSIA portfolio (non-CVFPP expenses).

Figure 7-2. State, Federal, and Local Contributions to Central Valley and CVFPP Expenditures




The assumed annual local contributions not captured within the 2017 refined SSIA portfolio are administrative and operating costs. However, routine operation and maintenance, repair, rehabilitation and replacement (OMRR&R) contributions are included in the 2017 refined SSIA portfolio. Table 7-1 displays annual data for State, federal and local expenditures in the Central Valley for years 2003 through 2015. It is assumed that locals spend an average of approximately $22M annually on OMRR&R. The local average annual non-CVFPP expenses are calculated as approximately $216 M – $22M = $194M/year.

The assumed annual federal contributions not captured within the 2017 refined SSIA portfolio are operations and improvements to reservoirs outside the SPFC (e.g., Black Butte Lake, Buchanan Dam, Farmington Dam, Hidden Dam, Pine Flat Lake etc.). However, feasibility studies and construction costs associated with key projects within the SPFC Planning Area (e.g., American River Watershed, Merced County Streams, Yuba and Marysville Improvements, etc.) are included in the 2017 refined SSIA portfolio. It is assumed that a percentage of these expenditures will contribute to the 2017 refined SSIA portfolio, approximately $50M annually, see Appendix A for reference. The average annual non-CVFPP federal expenses, within the Central Valley, are calculated as approximately $108M - $50M = $58M/year.

Table 7-1. Historical Contributions to Central Valley Flood Management

| Background Data that Supports Historical to Future Contributions in the Central Valley | | | |
|---|---|---|---|
| Year | Historical State Total[1] | Historical Federal Total[2] | Historical Local Total[3] |
| 2003 | $75,239,416 | $64,283,000 | $234,983,102 |
| 2004 | $229,283,352 | $30,908,000 | $211,902,795 |
| 2005 | $247,712,714 | $38,252,000 | $218,377,953 |
| 2006 | $62,645,542 | $48,311,000 | $225,795,315 |
| 2007 | $75,239,416 | $73,544,038 | $215,082,694 |
| 2008 | $229,283,352 | $75,972,063 | $210,599,527 |
| 2009 | $247,712,714 | $65,676,515 | $234,661,799 |
| 2010 | $286,576,154 | $108,355,000 | $194,177,729 |
| 2011 | $256,802,903 | $116,211,000 | $209,415,598 |
| 2012 | $182,626,268 | $81,356,000 | $220,374,279 |
| 2013 | $249,347,122 | $121,294,000 | $207,763,978 |
| 2014 | $277,585,245 | $96,210,000 | $207,451,970 |
| 2015 | $200,312,971 | $116,148,000 | $215,882,228 |
| Average | **$201,566,705** | **$108,202,000** | **$215,882,228** |

Notes:
1. State contribution includes General Fund, GO Bond expenditures in the Central Valley
2. Federal contribution includes only USACE budgets in the Central Valley and not FEMA. FEMA expenditures specific to the Central Valley is not available at this time. Statewide FEMA expenditures on grant programs averaged $4.5M in this time period. For a list of USACE projects included in the historical calculations see Appendix A.
3. Historical Local Expenditures includes city and county expenditures and special district revenues

## 7.3 Overview of Funding Scenarios

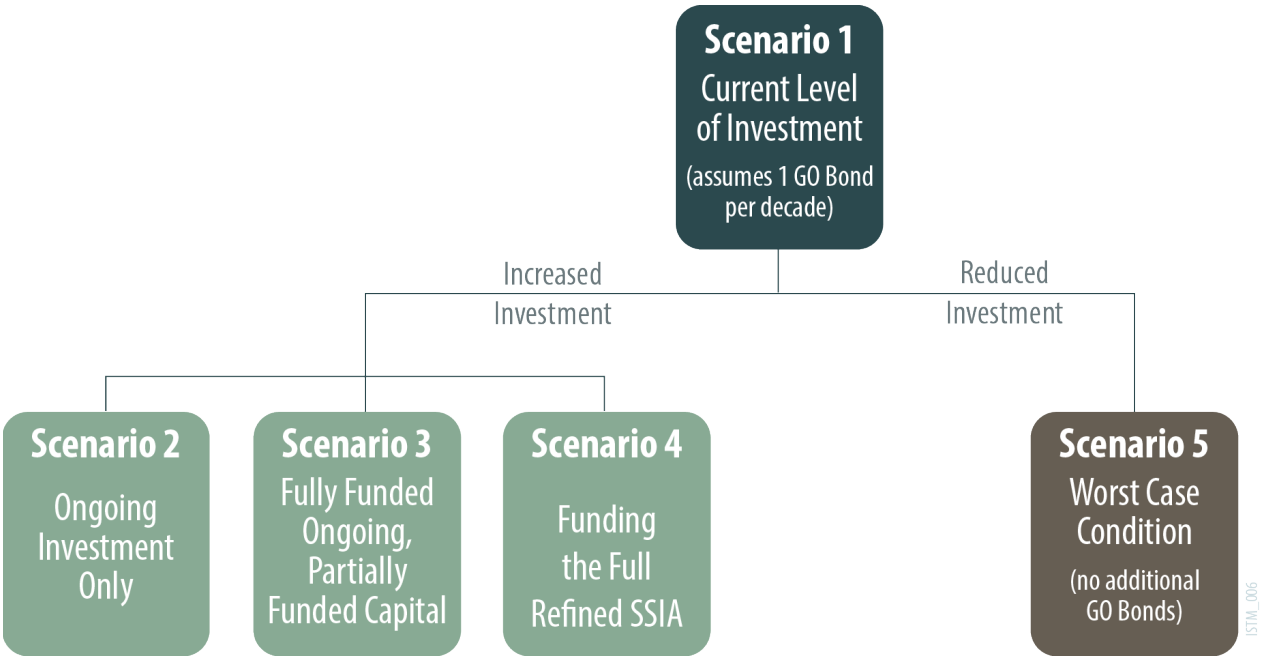
The following analysis and scenarios comparison is intended to help guide State, federal, and Local funding strategies for the 2017 refined SSIA portfolio. The scenarios explore the implications of various constraints on funding mechanisms and sources, and of some of the cost share and ability to pay realities discussed in Section 4. This comparison serves to highlight some of the following key relationships:

- The shifting burdens on local, State, and federal sources if one or more of those sources is significantly constrained or does not have the requisite ability to pay.
- The tradeoffs between ability to pay and funding mechanism applicability
- The degree to which various management action types are funded given differing levels of contribution from local/State/federal sources, and how the mix of sources impacts the focus of investment
- The tradeoffs between short-term political viability and long-term funding reliability

Each scenario was based on a different set of assumptions, from a continuation of historical trends to a more optimistic future. They start with two basic paths – one of increased investment, or one of reduced investment. The reduced investment scenario would occur if no additional bonds or assessments are passed, and the only means of funding the 2017 refined SSIA portfolio are existing federal and local sources, and State General Fund contributions. The increased investment scenarios take a variety of forms, looking first at what is needed to fund all of the ongoing management activities within the 2017 refined SSIA portfolio, and building up to various ways of funding the entire portfolio (capital and ongoing included).

This comparison of decreased investment to a build-up toward funding the full 2017 refined SSIA portfolio is split into five main scenarios shown in Figure 7-3. A few of the main scenarios consist of several sub-scenarios to account for potential smaller-scale nuances in funding approach or funding constraints. The following descriptions provide an overview of Scenarios 1 through 5, followed by a more detailed look at the results of each one.

Figure 7-3. Funding Scenarios Compare Various Degrees of Investment Toward the 2017 Refined SSIA Portfolio




***Scenario 1: Continuation of Current Levels of Investment***

This scenario identifies the percentage and components of the 2017 refined SSIA portfolio that could be implemented over the next 30 years if investment levels in the coming decades match those of the last decade. This scenario does not apply any new funding mechanisms, but it does assume the continued passage of GO Bonds (one per decade) with significant funds for flood management.

### *Scenarios 2–4: Increased Investment in Central Valley Flood Management*

Scenarios 2 through 4 all explore various forms of increased investment in Central Valley flood management, whether in terms of increased use of particular funding mechanisms, or in terms of increases in the overall level of investment in Central Valley flood management.

- **Scenario 2 – Funding Ongoing Investments Only:** Investment in ongoing management actions is critical to maintain an effective system and proactively managing risk intensification and residual risk on floodplains. Scenario 2a demonstrates how existing mechanisms can be used to fund this baseline need, without yet looking at additional needs for capital investment. Scenario 2b explores how new funding mechanisms might help to fund this baseline need. While scenarios 2a and 2b don't necessarily represent a large increase in overall level of investment in Central Valley Flood Management, they both require significant increases in revenue from select funding mechanisms, like the General Fund.

- **Scenario 3 – Fully Funded Ongoing Investments, Partially Funded Capital Investments:** Scenario 3 consists of 3 sub-scenarios, each of which builds off of Scenario 2 and each other, progressively investing in more of the Capital portion of the 2017 refined SSIA portfolio (in addition to fully funding all ongoing activities). This build-up is based on increasingly optimistic assumptions about the availability of additional local, State and federal funding sources.

- **Scenario 4 – Funding the Full 2017 Refined SSIA Portfolio:** Significant State, federal, and local participation is necessary for full implementation of the 2017 refined SSIA portfolio. Scenario 4 explores the various ways that funding mechanisms from each of these sources might be combined to fully fund and implement the 2017 refined SSIA portfolio over the next three decades.

### *Scenario 5: Decreased Investment in Central Valley Flood Management*

This scenario provides the other bookend to this analysis, for a point of comparison. It explores the implications of continued current levels of investment from the general fund, local and federal sources, but without any further GO Bonds passed in the next decades. This represents a significant hurdle to all of the proposed capital actions within the 2017 refined SSIA portfolio, and does not allow for much of an increase in spending on ongoing activities.

## 7.4 Scenario 1: Continuation of Current Levels of Investment

Table 7-2 shows the maximum funding levels for State, federal and local participation in CVFPP-related Central Valley Flood Management from 2003 through 2016. Scenario 1 assumes that the average annual contributions from each of these sources will not exceed this historical maximum in Phases 1 or 2, although a modest increase is allowed in Phase 3.

Table 7-2. Maximum CVFPP-related Annual Expenditures for Years 2003 - 2016

| State ($) | Federal($M) | Local($M) |
|---|---|---|
| $287 | $90 | $48 |

Notes:
1. Federal expenditures include the Joint Federal Project (JFP) at Folsom Dam.
2. Expenditures are based on the maximum average annual expenditure.

Tables 7-3 and 7-4 show the extent to which the capital and ongoing portfolios can be funded with a continuation of current funding trends. Only about half of the full refined 2017 SSIA portfolio is funded, with some capital investments delayed – for example the Yolo Bypass and urban levee improvements are stretched across all 30 years, as opposed to being mostly completed within Phases 1 and 2, as called for in Section 5.

Table 7-3. Capital Investment Over Time with Current Funding Levels

| Management Action Category and Area of Interest | Phase 1 | Phase 2 | Phase 3 | % Funded |
|---|---|---|---|---|
| Systemwide | | | | |
| Yolo Bypass Multi-Benefit Improvements | $597 | $607 | $614 | 80% |
| Feather River-Sutter Bypass Multi-Benefit Improvements | $0 | $0 | $0 | 0% |
| Paradise Cut Multi-Benefit Improvements | $31 | $139 | $139 | 100% |
| Reservoir and Floodplain Storage | $165 | $165 | $165 | 60% |
| Urban | | | | |
| Levee Improvements | $877 | $889 | $889 | 58% |
| Other Infrastructure and Multi-Benefit Improvements | $87 | $87 | $87 | 57% |
| Rural | | | | |
| Levee Repair and Infrastructure Improvements | $136 | $163 | $194 | 26% |
| Small Scale Levee Setbacks and Floodplain Storage | $51 | $68 | $68 | 96% |
| Land Acquisitions and Easements | $155 | $169 | $192 | 61% |
| Habitat Restoration/Reconnection | $71 | $71 | $71 | 75% |
| Small Community | | | | |
| Levee Repair and Infrastructure improvements | $214 | $214 | $214 | 62% |
| Setbacks, Land Acquisitions and Habitat Restoration | $84 | $92 | $110 | 41% |
| **Total** | **$2,467** | **$2,664** | **$2,743** | **50%** |

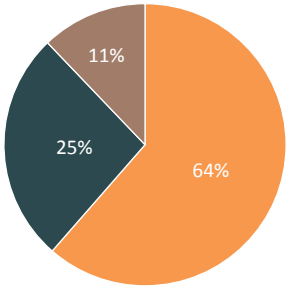
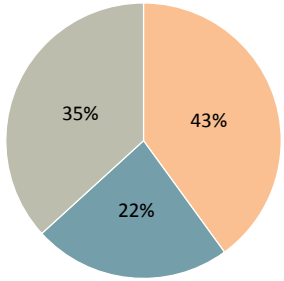
A continuation of current funding levels would also imply that ongoing management actions are never funded at optimal levels, instead only reaching less than half of that total need by the end of the 30-year timeline see Table 7-4.

Table 7-4. Phase 3 Investment in Ongoing Action Types, Full Refined SSIA Portfolio vs. Scenario 1, Average Annual Investment

| Management Action Category and Area of Interest | Full Refined SSIA Portfolio | Scenario 1 |
|---|---|---|
| Systemwide | | |
| State operations, planning and performance tracking | $45.6 | $19.3 |
| Emergency management | $36.2 | $23.0 |
| Reservoir operations | $14.3 | $5.7 |
| Routine maintenance | $110.2 | $35.3 |
| Urban | | |
| Risk awareness, floodproofing and land use planning | $12.8 | $10.2 |
| Studies and analysis | $2.2 | $0.6 |
| Rural | | |
| Risk awareness, floodproofing and land use planning | $4.9 | $3.3 |
| Studies and analysis | $1.1 | $0.2 |
| Small Community | | |
| Risk awareness, floodproofing and land use planning | $11.4 | $8.4 |
| Studies and analysis | $10.6 | $3.7 |
| **Total** | **$249** | **$109.8** |

Table 7-5 shows average annual contributions from each source to CVFPP implementation, and then more broadly to flood management in the Central Valley. A continuation of current funding trends with partial CVFPP implementation would imply an almost even split between State and local entities in terms of overall contributions toward flood management in the Central Valley, with federal contributions lagging slightly behind at 22% of total investment. However, because local entities spend so much on activities not captured within the 2017 refined SSIA portfolio, this requires the State to cover the majority of CVFPP-related implementation costs, representing 64% of total contributions toward those activities.

Table 7-5. CVFPP and broader Central Valley Flood Management Cost Shares with Continuation of Current Investment Levels from State, Federal and Local Sources

| % of Full 2017 Refined SSIA Portfolio | Average Annual 2017 Refined SSIA Portfolio Investment ($M) | | | | Average Annual Contributions Toward Central Valley Flood Management ($M) | | | |
|---|---|---|---|---|---|---|---|---|
| | Cost Share | State | Federal | Local | Cost Share | State | Federal | Local |
| 50% |  | $235 | $92 | $42 |  | $235 | $123 | $194 |

Noticeably, average federal and local contributions applied in this scenario are maxed out (almost equal to the constraints presented in Table 7-2), but the amount of State funds applied to CVFPP implementation in this scenario is slightly lower than the constraint shown in Table 7-2. This has to do with target cost share ranges and funding mechanism applicability assumptions for various action types as described in Sections 4 and 6 and implies that State cost share for the CVFPP won't likely exceed 64%, unless exceptions are made to the Target Cost Share ranges portrayed in Section 4. However, this may change with full implementation of the 2017 refined SSIA portfolio, described for Scenario 4.

## 7.5 Scenarios 2 – 4: Increased Investment in Central Valley Flood Management

### 7.5.1 Scenario 2: Funding Ongoing Investments Only

One of the CVFPP investment strategy guidelines is to secure reliable and continuous funding for ongoing management activities that serve to maintain the system, encourage wise use of floodplains, and manage residual risk. With Scenario 2, the goal is to demonstrate various methods with which these ongoing management actions can be funded as shown in Figure 7-4. The level of contribution to ongoing management actions will have to ramp up over time, as capacity is added to relevant agencies and new funding mechanisms are developed as described in Section 5. This ramping process starts with an average of $154 million/year throughout Phase 1 to an average of $250 million/year throughout Phase 3. Figure 7-5 compares current to Phase 3 levels of investment by management action. This helps to illustrate the large gap that currently exists in funding system maintenance, ongoing operations, and floodplain and residual risk management at levels needed to proactively and effectively manage flood risk in the Central Valley.

Figure 7-4. Scenario 2: Funding Ongoing Investments Only

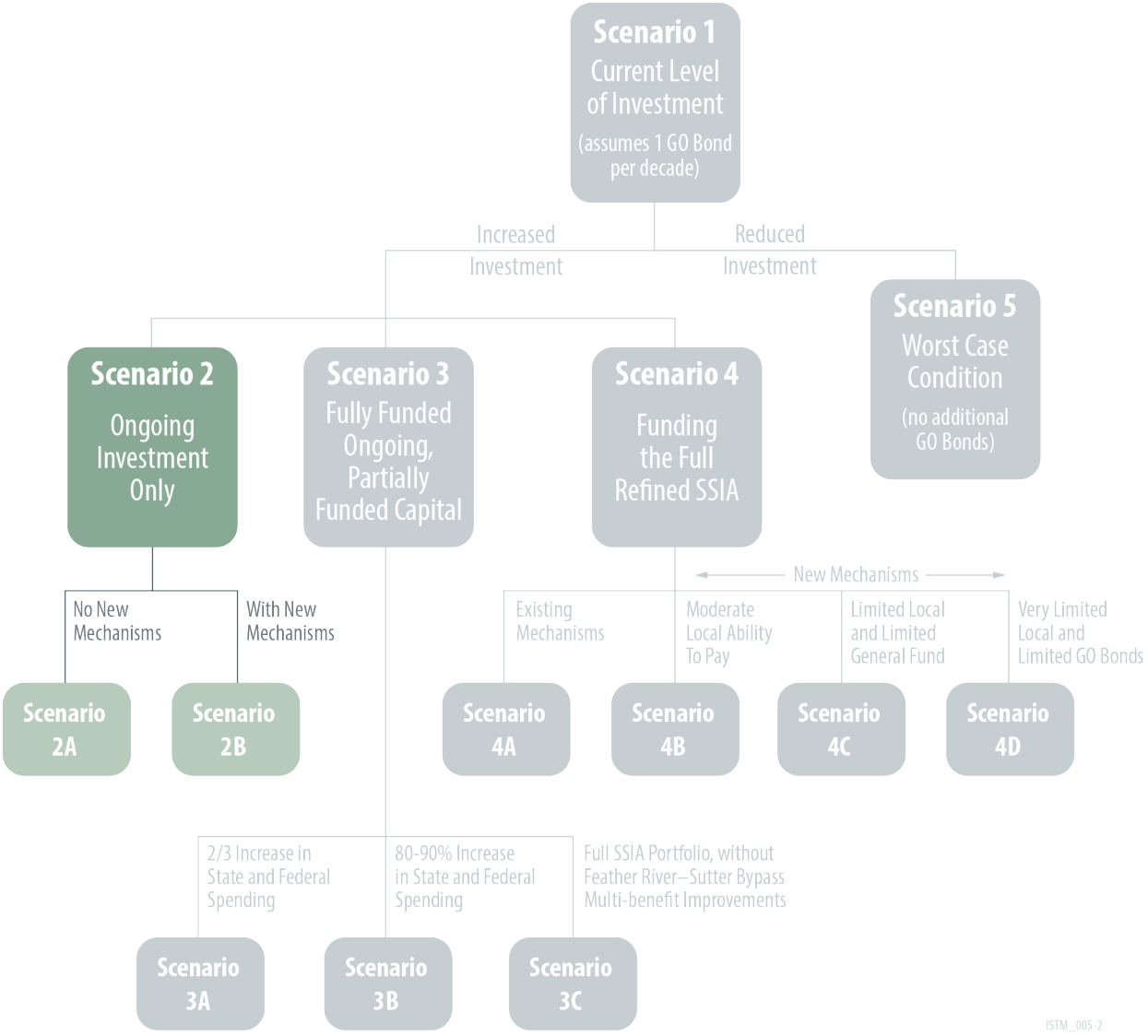
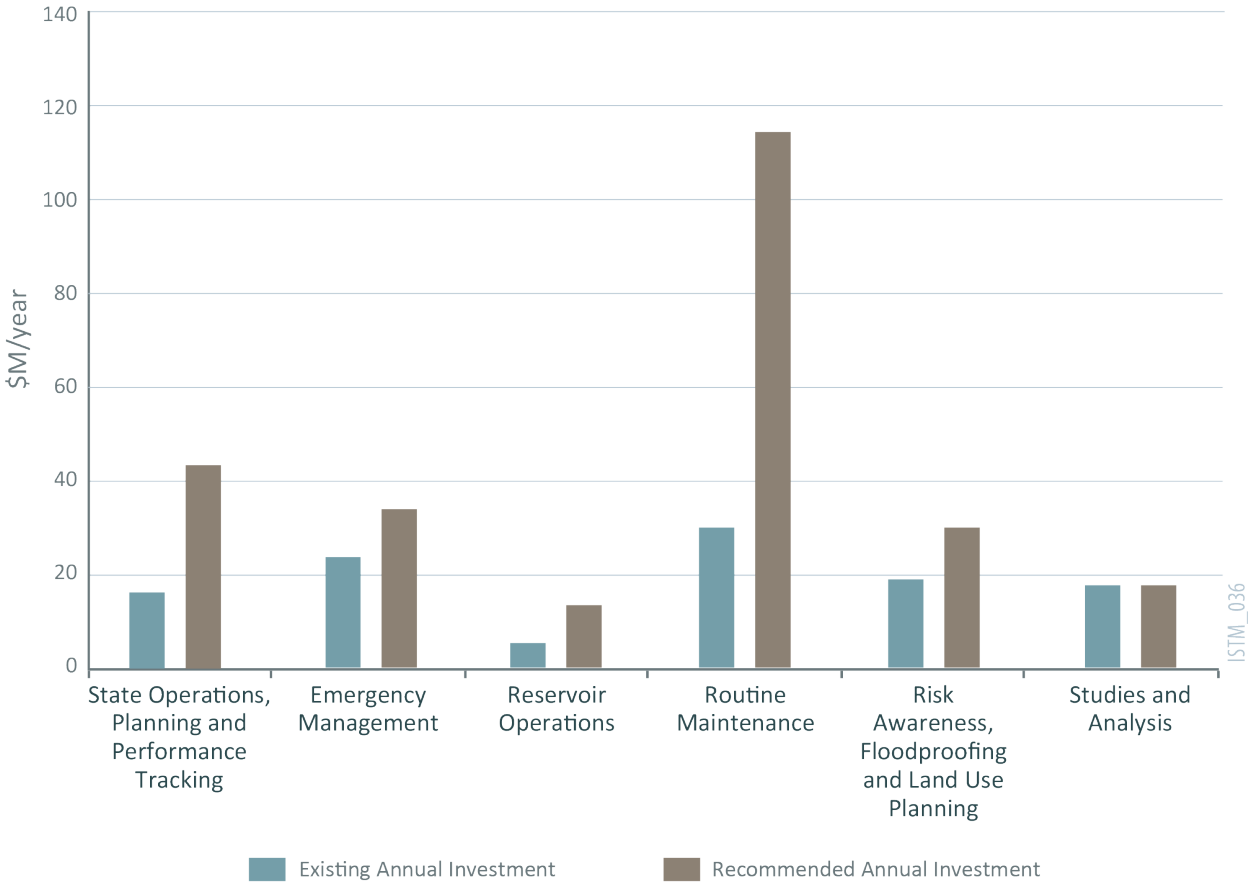


Figure 7-5. Comparison of Current to Needed Annual Levels of Investment in Ongoing System Maintenance and Risk Management Activities




Note:
1. Existing annual investments are an average of 2003-2016.

The following scenarios explore ways to fill the gaps of existing annual investments and the recommended annual investment amounts in the 2017 refined SSIA portfolio.

***Scenario 2a: Maintaining the System with Existing Mechanisms***

Scenario 2a funds the full ongoing management action need with existing State, federal, and local mechanisms. Table 7-6 shows the average annual investment needed from each mechanism, and Table 7-7 shows the extent to which State, federal and local sources contribute to each management action type.

Table 7-6. Average Annual Contribution Needed from Existing Funding Mechanisms (by Phase) to Fund Ongoing Action Types According to the Recommended Ramping Scheme, Scenario 2a

| | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| State GF | $90 | $150 | $175 |
| USACE | $7 | $9 | $12.6 |
| FEMA | $4 | $7 | $8.7 |
| Local | $53 | $53 | $53 |
| **Total** | **$154** | **$219** | **$249** |

Table 7-7. Federal, Local and State Cost Shares by Management Action Type, Scenario 2a

| Management Action Category and Area of Interest | State | Federal | Local |
|---|---|---|---|
| Systemwide | | | |
| State operations, planning and performance tracking | 100% | 0% | 0% |
| Emergency management | 80% | 0% | 20% |
| Reservoir operations | 70% | 10% | 20% |
| Routine maintenance | 66% | 0% | 34% |
| Urban | | | |
| Risk awareness, floodproofing and land use planning | 0% | 33% | 67% |
| Studies and analysis | 0% | 50% | 50% |
| Rural | | | |
| Risk awareness, floodproofing and land use planning | 18% | 50% | 32% |
| Studies and analysis | 17% | 50% | 33% |
| Small Community | | | |
| Risk awareness, floodproofing and land use planning | 25% | 50% | 25% |
| Studies and analysis | 22% | 50% | 28% |
| **Scenario 2a Ongoing Cost Share Total** | **66%** | **8%** | **26%** |

### *Scenario 2b: Maintaining the System with New and Existing Mechanisms*

Scenario 2b funds the full ongoing management action need with new and existing State, federal, and local mechanisms. Realistic constraints are placed on the new funding mechanisms based on revenue generation capacity as discussed in Section 6 and new mechanism development timelines. Table 7-8 and Table 7-9 present the results of Scenario 2b.

Table 7-8. Average Annual Contribution Needed from Existing Funding Mechanisms (by Phase) to Fund Ongoing Action Types According to the Recommended Ramping Scheme, Scenario 2b

| Average Annual Contribution per Mechanism | | | |
|---|---|---|---|
| | Phase 1 | Phase 2 | Phase 3 |
| State GF | $90 | $135 | $160 |
| SFIP | $0.0 | $6 | $6 |
| State River Basin Assess. | $0.0 | $25 | $25 |
| USACE | $7 | $8 | $12.8 |
| FEMA | $4 | $6 | $8.3 |
| Local | $38 | $16 | $14.8 |
| Sac/SJ Drainage Dist. | $15 | $22 | $22.3 |
| **Total** | **$154** | **$219** | **$249** |

Table 7-9. Federal, Local and State Cost Shares by Management Action Type, Scenario 2b

| Management Action Category and Area of Interest | State | Federal | Local |
|---|---|---|---|
| Systemwide | | | |
| State operations, planning and performance tracking | 100% | 0% | 0% |
| Emergency management | 80% | 0% | 20% |
| Reservoir operations | 92% | 3% | 5% |
| Routine maintenance | 73% | 0% | 27% |
| Urban | | | |
| Risk awareness, floodproofing and land use planning | 0% | 38% | 62% |
| Studies and analysis | 0% | 50% | 50% |
| Rural | | | |
| Risk awareness, floodproofing and land use planning | 42% | 44% | 14% |
| Studies and analysis | 39% | 50% | 11% |
| Small Community | | | |
| Risk awareness, floodproofing and land use planning | 44% | 50% | 6% |
| Studies and analysis | 39% | 50% | 11% |
| **Scenario 2b Ongoing Cost Share Total** | **72.3%** | **7.4%** | **20.3%** |

***Comparing Results from Scenarios 2a and 2b***

Results from Scenario 2a and Scenario 2b contrast the demand from existing sources with and without the use of new funding mechanisms. With the use of new funding mechanisms, such as the State flood insurance program and river basin assessment, the average annual burden on the general fund decreases from $147 to $135 in Phase 2, and from $175 to $160 in Phase 3. Federal sources (USACE, FEMA) do not change significantly with the use of new State and local funding mechanisms. Local property assessment contributions decrease with the implementation of the new drainage district and new State funding mechanisms, and the overall local contribution falls from 26% to 20% of the total cost share. Reducing the burden on the general fund and on local property assessments is important because both of these current mechanisms suffer from political challenges – competing demands on the State's general fund, and Proposition 218 challenges for local property assessments. Section 6 discussed revenue generating capacity for each funding mechanism. The development of new mechanisms keeps the use of State general fund dollars and local property assessments to within their revenue generating capacity at least for the first 20 years of CVFPP implementation. The development of new funding mechanisms is therefore especially important for the viability of ongoing system maintenance, operations, planning and residual risk management.

### 7.5.2 Scenario 3: Fully Funded Ongoing Investments, Partially Funded Capital Investments

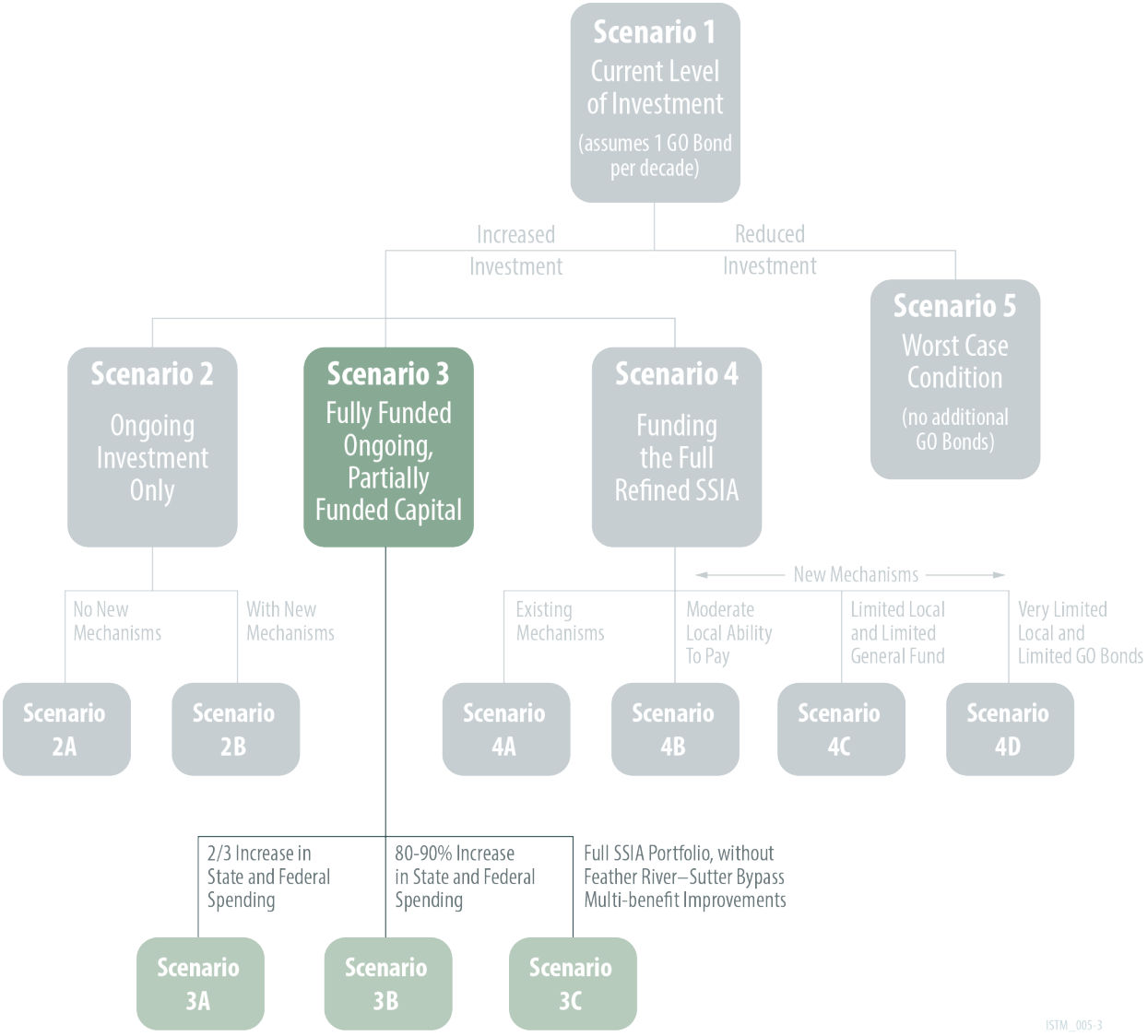
Scenarios 3a, 3b and 3c all build upon Scenario 2, funding progressively larger portions of the capital portion of the 2017 refined SSIA portfolio. New funding mechanisms are assumed available in all three scenarios, with the same constraints placed on them as for Scenario 2. Scenario 3a assumes an approximately 2/3 increase from historical annual averages for State and federal sources, and a 1/3 percent increase from the historical average from local sources. The analysis builds up to near full implementation in Scenario 3c.

- **Scenario 3a: 2/3 Increase in State and Federal Funding, 30% Increase in Local.** This scenario explores the implications of only a 2/3 increase (on average) from historical State and federal spending, and a 1/3 increase in local spending.

- **Scenario 3b: 80 - 90% Increase in State and Federal Funding, 30% Increase in Local, No Bonds Until Phase 2.** This scenario builds up from Scenario 3a, applying an 80 – 90% increase from historical averages from State and federal sources, while keeping local contributions the same as in Scenario 3a. However, it adds another dimension, looking also at the implication of no GO Bonds being passed until Phase 2.

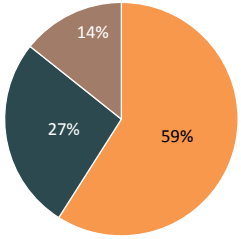
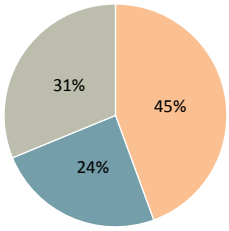
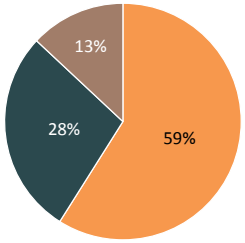
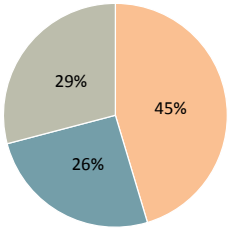
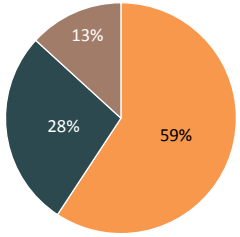
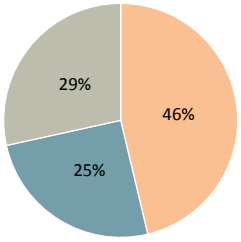
- **Scenario 3c: Full 2017 Refined SSIA Portfolio without Feather River-Sutter Bypass multi-benefit improvements.** Scenario 3c removes the $2.3B Feather River- Sutter Bypass multi-benefit improvement planned for Phase 3, but otherwise funds the full 2017 refined SSIA portfolio with local contributions capped at an average of $87 million annually (slightly higher than Scenarios 3a and 3b), and moderate constraints also placed on use of the State's General Fund.

Figure 7-6. Scenario 3: Fully Funded Ongoing Investments, Partially Funded Capital Investments




To better understand the dollar value implications of these scenarios for local, State and federal sources, Table 7-10 compares cost shares and average annual contributions from each source, and shows the percent of the full amount that could be funded given those contribution levels. It also shows how future annual contributions to Central Valley Flood Management in each scenario deviate from the historical averages presented earlier in this section. Even as overall CVFPP investment increases, the cost shares are relatively unchanged, with State participation at 59%, federal between 27 and 28%, and local between 13 and 14%. However, this is largely due to the way these scenarios were set up – with constraints on State and federal sources that forced near equal increases from historical averages for those two sources.

Table 7-10. Cost Share and Deviation from Historical Averages for Scenarios 3a through 3d

| Scenario | % of Full 2017 Refined SSIA Portfolio Funded | % Increase from Average Historical Expenditures (2003 - 2016) | | | Average Annual CVFPP Investment ($Mil) | | | | Average Annual Contributions toward Central Valley Flood Management ($Mil) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | State | Federal | Local | Cost Share | State | Federal | Local | Cost Share | State | Federal | Local |
| 3a | 76% | 64% | 67% | 30% |  | $330 | $149 | $80 |  | $330 | $181 | $232 |
| 3b | 84% | 80% | 88% | 30% |  | $362 | $172 | $80 |  | $362 | $204 | $232 |
| 3c | 90% | 93% | 96% | 34% |  | $389 | $180 | $87 |  | $389 | $212 | $239 |

### *Scenario 3a: 2/3 Increase from Historical Average for State and Federal Sources, 30% Increase for Local Sources*

Table 7-11 shows capital investment for Phases 1 through 3 for Scenario 3a, and the extent to which each capital action type within the 2017 refined SSIA portfolio is funded. All ongoing activities are fully funded as they were in Scenario 2, so those tables and graphics are not repeated here. In Scenarios 3a through 3c, most capital items are funded according to their assigned phase, and the model funds all ongoing actions according to the same ramping scheme applied in Scenario 2. Some exceptions to this rule are made for capital investments that were placed in later phases because of reasons other than priority or effectiveness, as described in Section 5. For example, all Yolo Bypass multi-benefit improvements would have been placed in Phase 1 per scoring results described in Section 3, but are spread between phases based on chronological dependencies and large total investment needed. As another example, some small community land acquisitions were moved to later phases because of a lack of near-term political viability. In cases like these, inputs for each partial funding scenario were modified such that higher portions of the later phase costs for those investments would still be funded when possible.

Table 7-11. Capital Investment by Phase, Scenario 3a

| Management Action Category and Area of Interest | Years 1-10 | Years 11 - 20 | Years 21-30 | % Funded |
|---|---|---|---|---|
| Systemwide | | | | |
| Yolo Bypass Multi-Benefit Improvements | $1,023 | $1,023 | $227 | 100% |
| Feather River-Sutter Bypass Multi-Benefit Improvements | $0 | $0 | $0 | 0% |
| Paradise Cut Multi-Benefit Improvements | $31 | $278 | $0 | 100% |
| Reservoir and Floodplain Storage | $183 | $183 | $183 | 67% |
| Urban | | | | |
| Levee Improvements | $1,227 | $1,227 | $1,227 | 80% |
| Other Infrastructure and Multi-Benefit Improvements | $120 | $119 | $119 | 78% |
| Rural | | | | |
| Levee Repair and Infrastructure Improvements | $415 | $415 | $415 | 65% |
| Small Scale Levee Setbacks and Floodplain Storage | $59 | $59 | $59 | 91% |
| Land Acquisitions and Easements | $199 | $199 | $199 | 70% |
| Habitat Restoration/Reconnection | $70 | $70 | $70 | 75% |
| Small Community | | | | |
| Levee Repair and Infrastructure improvements | $155 | $266 | $266 | 66% |
| Setbacks, Land Acquisitions and Habitat Restoration | $46 | $115 | $330 | 70% |
| **Total Capital Investment** | **$3,528** | **$3,954** | **$3,095** | **67%** |

In Scenario 3a, only the Yolo Bypass and Paradise Cut multi-benefit improvements are fully funded, and the 80% of urban levee improvements that are funded are spread more evenly across the 30-year planning horizon, rather than being mostly concentrated in the first 20 years. Available funds in this scenario are not enough to pay for any of the Phase 3 investments as called for in Section 5, therefore the Feather River-Sutter Bypass multi benefit improvements would not be funded. Otherwise, all other capital action types would be funded at least to 65% of their total cost estimate.

Table 7-12 shows average annual use of funding mechanisms, by decade, for Scenario 3a. The General Fund would build from an average of $120 million annually, to $165 million annually by Phase 3. Use of GO Bond dollars would range from an average of $129 to $199 million per year, with the greatest dependence on GO Bonds occurring in the second ten years of implementation. The use of traditional local funds would drop off as the Sac/SJ Drainage district is developed, but total local contributions limited to an average of $85 million per year.

Table 7-12. Average Annual Funding Mechanism Contributions, by Decade, Scenario 3a

| | State GF | State GO Bonds | State River Basin Assess | State Flood Insurance Program | Sac/SJ Drainage District | Local | FEMA | USACE |
|---|---|---|---|---|---|---|---|---|
| Years 1 - 10 | $120 | $168 | $ - | $ - | $20 | $55 | $14 | $130 |
| Years 11 - 20 | $145 | $199 | $15 | $15 | $28 | $52 | $20 | $140 |
| Years 21 - 30 | $165 | $129 | $20 | $7 | $30 | $55 | $13 | $140 |

***Scenario 3b: 80 to 90% Increase in State and Federal Funding, 30% Increase in Local, No Bonds Until Phase 2***

Scenario 3b adds to the total amount of funds available from State and federal sources, but also explores the implication of a failed bond in Phase 1. Table 7-13 shows capital investments, with distinctions made for funding by phase. As expected, significant portions of high priority investments (e.g., Yolo Bypass multi-benefit improvements, urban levee improvements, etc.) would be delayed until Phases 2 and 3. Also, very few rural capital investments would be made in the first decade, since these investments all require significant State cost share to move forward. However, compared to Scenario 3a, the increase in overall investment from State and federal sources in Scenario 3b allows for more complete investment in certain action categories. All systemwide actions would be fully funded, with the exception of the Feather River – Sutter Bypass Multi Benefit Improvements. All urban levee improvements would be fully funded. All other capital action categories are funded up to at least 70%.

Table 7-13. Capital Investment by Phase, Scenario 3b

| Management Action Category and Area of Interest | Years 1 - 10 | Years 11 - 20 | Years 21-30 | % Funded |
|---|---|---|---|---|
| Systemwide | | | | |
| Yolo Bypass Multi-Benefit Improvements | $563 | $1,483 | $227 | 100% |
| Feather River-Sutter Bypass Multi-Benefit Improvements | $0 | $0 | $0 | 0% |
| Paradise Cut Multi-Benefit Improvements | $103 | $103 | $103 | 100% |
| Reservoir and Floodplain Storage | $228 | $322 | $275 | 100% |
| Urban | | | | |
| Levee Improvements | $1,381 | $1,790 | $1,429 | 100% |
| Other Infrastructure and Multi-Benefit Improvements | $93 | $128 | $145 | 80% |
| Rural | | | | |
| Levee Repair and Infrastructure Improvements | $26 | $436 | $943 | 73% |
| Small Scale Levee Setbacks and Floodplain Storage | $14 | $99 | $65 | 92% |
| Land Acquisitions and Easements | $7 | $220 | $454 | 80% |
| Habitat Restoration/Reconnection | $7 | $124 | $85 | 77% |
| Small Community | | | | |
| Levee Repair and Infrastructure improvements | $201 | $257 | $407 | 83% |
| Setbacks, Land Acquisitions and Habitat Restoration | $92 | $92 | $307 | 70% |
| **Total Capital Investment** | **$2,714** | **$5,055** | **$4,440** | **77%** |

Table 7-14 shows how various funding mechanisms were used over the 30 year planning horizon to fund the above capital investments, and the fully ongoing investment portfolio. Lack of GO Bonds in the first decade would greatly increase the burden on the General Fund and USACE for those early years of implementation. The GO Bonds needed in the second two decades are also much larger in terms of cost per decade – a total of $2.9 billion in years 11 – 20, and $2.5 billion in years 21 – 30.

Table 7-14. Average Annual Funding Mechanism Contributions, by Decade, Scenario 3b

| | State GF | State GO Bonds | State River Basin Assess | State Flood Insurance Program | Sac/SJ Drainage District | Local | FEMA | USACE |
|---|---|---|---|---|---|---|---|---|
| **Years 1 - 10** | $150 | $ - | | | $15 | $55 | $10 | $195 |
| **Years 11 - 20** | $161 | $293 | $15 | $15 | $30 | $55 | $15 | $140 |
| **Years 21 - 30** | $170 | $254 | $20 | $8 | $30 | $55 | $17 | $139 |

***Scenario 3c: Full 2017 Refined SSIA Portfolio without Feather River-Sutter Bypass Multi-benefit Improvements***

Implementing the full 2017 refined SSIA portfolio without the Feather River-Sutter Bypass multi-benefit improvements requires a near doubling of State and federal contributions to Central Valley Flood Management as discussed earlier in this section. However the focus of that investment changes over time. Figure 7-7 shows how investment shifts from mostly capital activities in Phase 1, to a more balanced investment that includes a large portion of more proactive, ongoing management activities in Phase 3. The total cost of flood management also significantly decreases in Phase 3. This reflects the fact that Phase 1 implementation is primarily focused on mitigating unacceptably high levels of risk, whereas lower-cost, ongoing investments in floodplain and residual risk management throughout all three Phases should eventually decrease the need for those mitigating investments in the future. This scenario therefore previews where investment in Central Valley Flood Management is eventually headed, toward a more proactive and cost effective set of ongoing investments that adaptively manage risk and maintain the system's ability to produce multiple outcomes of value to society, with decreasing need for large capital investment every decade.

Figure 7-7. Trends in Capital vs. Ongoing Investment Over Time, Scenario 3d

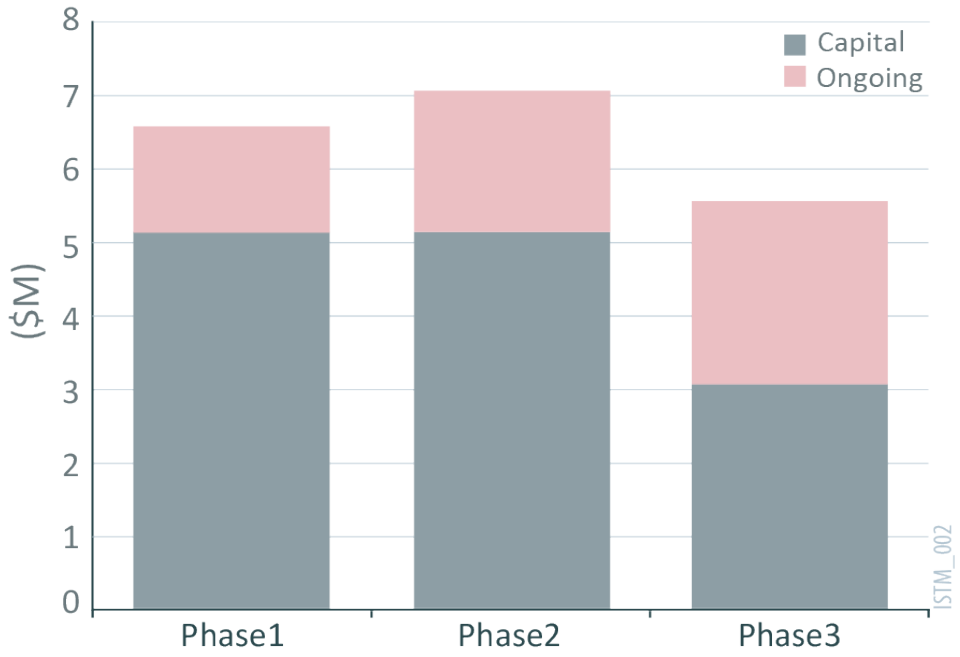


Table 7-15 shows how various funding mechanisms are applied to fund the 2017 refined SSIA portfolio through time. As with all scenarios so far, General Fund usage increases from the first decade to the third. In this scenario, it starts at an average of $124 million annually and rises to $169 million annually. This is similar to what was applied in Scenario 3a, reflecting the fact that General Fund dollars are not a primary source for most capital action categories (and thus its usage stays fairly static between Scenario 3a and 3c). However, in contrast to Scenario 3a, two rather large GO Bonds are needed in the first two decades ($2.3 billion in years 1 – 10 and $2.9 billion in years 11 – 20), and a smaller GO bond is required in years 21 – 30 ($1.6 billion) to fund the additional investments in Scenario 3c. Local property assessments also increase – they contribute $5 – $10 million more per year in this scenario to help pay for the additional capital investments.

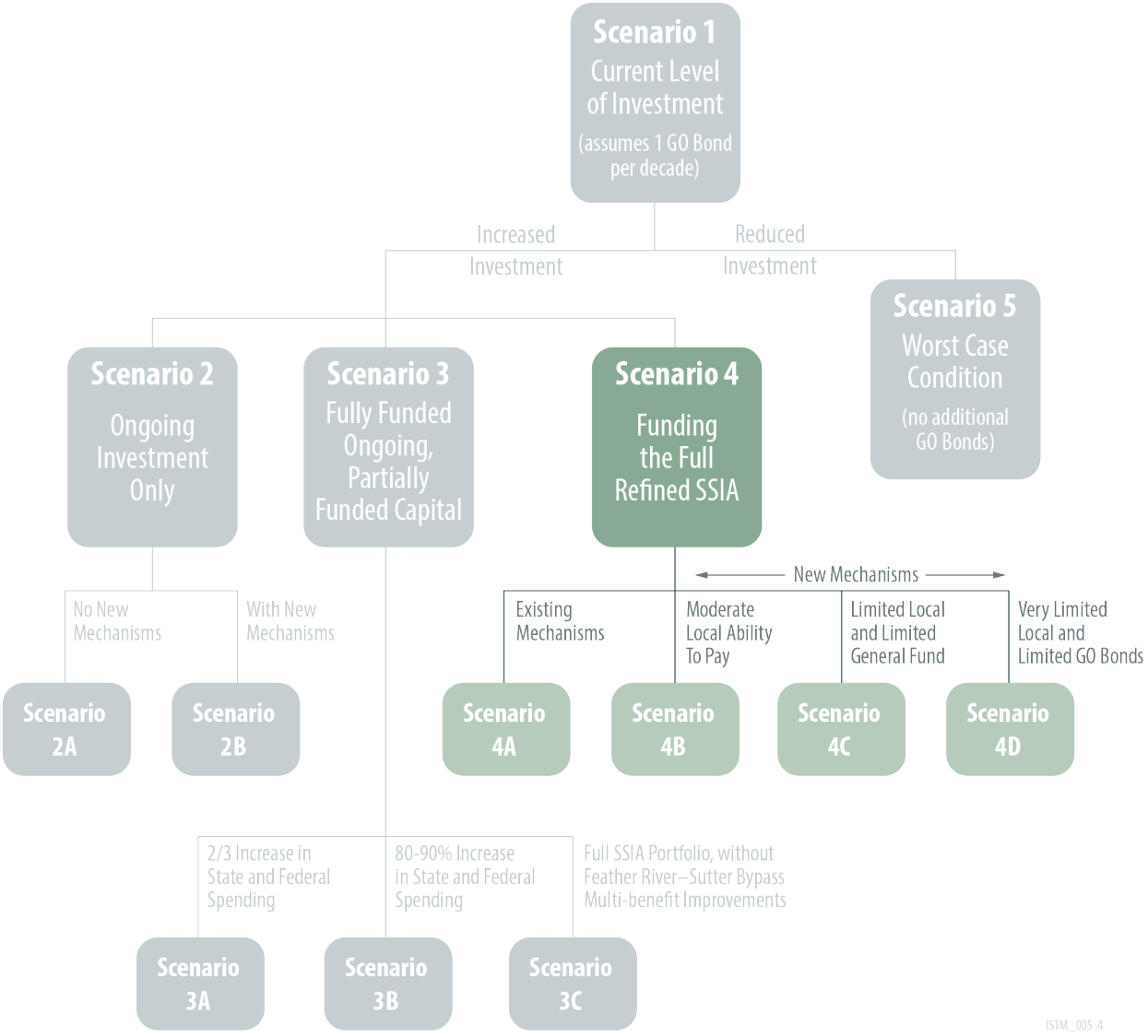
Table 7-15. Average Annual Funding Mechanism Use Over Time, Scenario 3c

| Timeframe | State GF | State GO Bonds | State River Basin Assess | State Insurance Program | Sac/SJ Drainage District | Local | FEMA | USACE |
|---|---|---|---|---|---|---|---|---|
| Years 1 - 10 | $124 | $234 | $0 | $0 | $20 | $60 | $8 | $233 |
| Years 11 - 20 | $148 | $290 | $15 | $7 | $25 | $65 | $20 | $163 |
| Years 21 - 30 | $169 | $156 | $18 | $5 | $25 | $65 | $25 | $93 |

### 7.5.3 Scenario 4: Funding the Full 2017 Refined SSIA Portfolio

Scenarios 4a through 4d build upon Scenario 3c, adding in the Feather River – Sutter Bypass multi-benefit improvements to fund the full 2017 refined SSIA portfolio, including all three Phases of ongoing and capital management actions as shown in Figure 7-8. Funding the full 2017 refined SSIA portfolio will require significantly higher revenues than are currently generated for Central Valley flood management. Scenario 4 explores various means of fully funding the full 2017 refined SSIA portfolio, with varied assumptions about the realistic limits and political viability (and timing) of different mechanisms.

Figure 7-8. Scenario 4: Funding the Full 2017 Refined SSIA Portfolio




***Scenario 4a: Existing Mechanisms, Limited Local Ability-to-Pay***

This scenario explores how to fund the full 2017 refined SSIA portfolio with currently existing funding sources, based solely on funding mechanism applicability and cost share constraints. Only currently existent funding mechanisms are made available (i.e. no river basin assessment, drainage district, or any other new source is applied), and no upper limits are applied to any State or federal mechanisms. Local sources are capped at no more than $90 million annually.

***Scenario 4b: New Mechanisms, Moderate Local Ability-to-Pay***

This scenario assumes the development of new funding mechanisms. Limited funds from the Sacramento and San Joaquin Drainage Districts are assumed available in Phase 1 (with more available in Phases 2 and 3), and the river basin assessment and State flood insurance are not

available until Phases 2 and 3 (based on the additional time and effort needed to develop these sources). Also, local funding mechanisms are constrained to no more than $90 million annually in Phase 1, and a maximum of $130 million annually in Phase 3.

### *Scenario 4c: New Mechanisms, Limited Local and Limited General Fund*

This scenario is similar to 4b, but also considers the potential for limited general fund dollars (with annual contributions never exceeding $145 in phase 1, and maxing out at $185 in Phase 3).

### *Scenario 4d: New Mechanisms, Very Limited Local and Limited GO Bonds*

This scenario considers an even more conservative set of constraints for local funding sources, exploring what may happen if local willingness to pay does not allow for even limited increases in property assessments.

### *Comparing Results from Scenarios 4a through 4d*

Table 7-16 summarizes the results for scenarios 4a, b, c and d in terms of cost share and deviation from historical pattern. It compares the new demand from local/State/federal sources to their historical averages for years 2003 through 2015. In all cases, the average annual investment is significantly higher than what has historically been provided by that given source. The last column also calculates the maximum spread, or difference, between the percent increase demanded from each source.

One way to look at this is that a lower spread represents a more "equitable" distribution. However, equity can also be interpreted by looking at contributions to overall CVFPP and broader Central Valley flood management shown in the pie charts. These pie charts demonstrate that even with significant increases in federal spending, federal investment in Central Valley flood management would still be low relative to State investment. These numbers also show that, regardless of varying assumptions about local and federal ability or willingness to pay, the State must approximately double (or more) its current level of investment in Central Valley flood management to fully implement the 2017 refined SSIA portfolio, with a cost share ranging between 54 and 62%.

Table 7-17 provides some additional detail on the various funding mechanisms applied in each scenario, and shows how well each scenario performed in terms of funding mechanism score. Not only do new mechanisms increase the funding applicability score, but so does a greater availability of local funds. This speaks to the trade-off between nexus and reliability, and political viability. Local property assessments and the Sacramento San Joaquin Drainage District, both targeted directly at flood management, have a much high degree of inter-annual reliability than the State's general fund or reactive GO Bonds. They also have a higher degree of nexus to certain management action categories. However, significant increases in revenues from these local mechanisms may be difficult given willingness and ability to pay considerations discussed in Section 4. The same is true for the development of other State mechanisms, like the River Basin assessment or State flood insurance program – both of these require significant political effort, yet would greatly increase the reliability of funding for ongoing management actions.

Table 7-16. Potential State, Federal and Local Contributions to CVFPP Implementation and Broader Central Valley Flood Management, Scenarios 4a – 4d

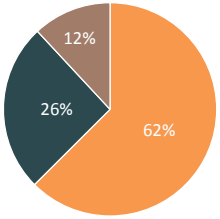
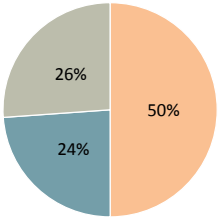
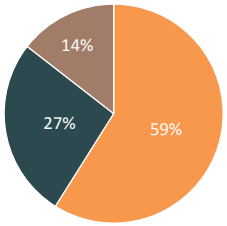
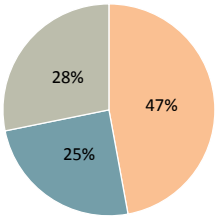
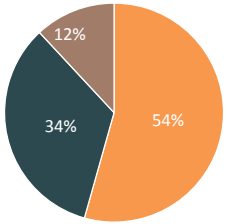
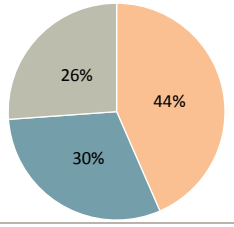
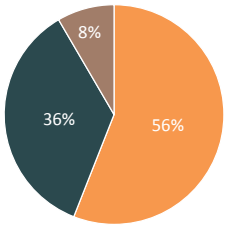
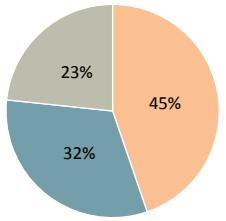
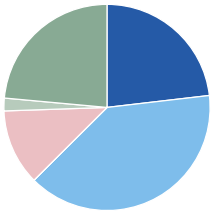
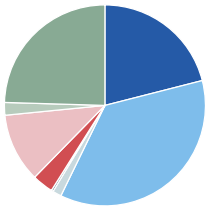
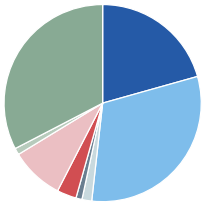
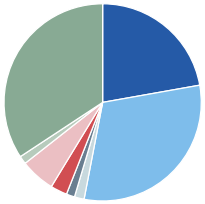
| Scenario | | % Increase from Average Historical Annual Contribution | | | Average Annual 2017 Refined SSIA Portfolio Investment | | | | Average Annual Contributions toward Central Valley Flood Management | | | | Max Spread |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | State | Federal | Local | Cost Share | State | Federal | Local | Cost Share | State | Federal | Local | |
| 4a | Existing Mechanisms, Limited Local Ability to Pay | 127% | 102% | 34% |  | $458 | $187 | $87 |  | $458 | $219 | $239 | 93% |
| 4b | New Mechanisms, Moderate Local Ability to Pay | 114% | 109% | 45% |  | $432 | $195 | $106 |  | $432 | $226 | $258 | 69% |
| 4c | New Mechanisms, Limited Local and General Fund Ability to Pay | 98% | 158% | 34% |  | $398 | $247 | $87 |  | $398 | $279 | $239 | 123% |
| 4d | New Mechanisms, Very Low Local and Limited GO Bond Availability | 103% | 170% | 20% |  | $410 | $261 | $62 |  | $410 | $292 | $214 | 150% |

Table 7-17. Varied Use of Individual Funding Mechanisms for Funding the Full Refined SSIA Portfolio

| Scenario | | Funding Applicability Score | Funding Mechanism Portfolio | State GF | State GO Bonds | State River Basin Assess | State Flood Insurance Program | Sac/SJ Drainage District | Local | FEMA | USACE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4a | Existing Mechanisms, Limited Local Ability to Pay | 62 |  | $170 | $288 | $0 | $0 | $0 | $87 | $15 | $172 |
| 4b | New Mechanisms, Moderate Local Ability to Pay | 80 |  | $154 | $265 | $10 | $2 | $25 | $81 | $15 | $180 |
| 4c | New Mechanisms, Limited Local and General Fund Ability to Pay | 75 |  | $151 | $228 | $12 | $7 | $23 | $64 | $8 | $239 |
| 4d | New Mechanisms, Very Low Local and Limited GO Bond Availability | 67 |  | $163 | $226 | $12 | $10 | $20 | $42 | $10 | $251 |

Note: Applicability scores are out of 100.

Finally, Tables 7-18 and 7-19 compare the cost shares for each capital and ongoing action category in scenarios 4a through 4d. When both local and State sources are limited, federal cost shares were increased for all systemwide actions, and for small scale levee setbacks and floodplain storage in the rural setting. However, this would require federal cost share guidelines to shift toward an approach that encourages more ecosystem and related multi-benefit investment, rather than 1983 Principles and Guidelines standard requiring a positive benefit/cost ratio (U.S. Water Resources Council, 1983). Also, as local sources are more constrained, State sources would need to contribute more toward some of the ongoing activities, like routine maintenance and risk awareness, floodproofing, and land use planning if they were to continue.

Table 7-18. Estimated Cost Shares for Capital Investments, Scenarios 4a through 4d

| Management Action Category and Area of Interest | Scenario 4a | | | Scenario 4b | | | Scenario 4c | | | Scenario 4d | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fed. | Local | State | Fed. | Local | State | Fed. | Local | State | Fed. | Local | State |
| Systemwide | | | | | | | | | | | | |
| Yolo Bypass Multi-Benefit Improvements | 15% | 5% | 80% | 15% | 5% | 80% | 50% | 5% | 45% | 50% | 2% | 48% |
| Feather River-Sutter Bypass Multi-Benefit Improvements | 20% | 0% | 80% | 20% | 0% | 80% | 50% | 0% | 50% | 50% | 0% | 50% |
| Paradise Cut Multi-Benefit Improvements | 20% | 5% | 75% | 47% | 5% | 48% | 50% | 5% | 45% | 50% | 2% | 48% |
| Reservoir and Floodplain Storage | 75% | 8% | 17% | 75% | 8% | 17% | 75% | 8% | 17% | 75% | 5% | 20% |
| Urban | | | | | | | | | | | | |
| Levee Improvements | 65% | 19% | 16% | 65% | 23% | 12% | 65% | 18% | 17% | 65% | 13% | 22% |
| Other Infrastructure and Multi-Benefit Improvements | 65% | 10% | 25% | 65% | 19% | 16% | 65% | 10% | 25% | 65% | 13% | 22% |
| Rural | | | | | | | | | | | | |
| Levee Repair and Infrastructure Improvements | 0% | 35% | 65% | 0% | 44% | 56% | 0% | 38% | 62% | 14% | 23% | 63% |
| Small Scale Levee Setbacks and Floodplain Storage | 10% | 5% | 85% | 11% | 5% | 84% | 20% | 5% | 75% | 30% | 5% | 65% |
| Land Acquisitions and Easements | 4% | 6% | 90% | 3% | 7% | 90% | 4% | 6% | 90% | 10% | 0% | 90% |
| Habitat Restoration/ Reconnection | 10% | 0% | 90% | 10% | 0% | 90% | 20% | 0% | 80% | 30% | 0% | 70% |
| Small Community | | | | | | | | | | | | |
| Levee Repair and Infrastructure improvements | 10% | 0% | 90% | 18% | 0% | 82% | 20% | 0% | 80% | 20% | 0% | 80% |
| Setbacks, Land Acquisitions and Habitat Restoration | 10% | 0% | 90% | 19% | 0% | 81% | 20% | 0% | 80% | 20% | 0% | 80% |
| **Total** | **32%** | **12%** | **56%** | **33%** | **14%** | **52%** | **43%** | **12%** | **45%** | **46%** | **7%** | **47%** |

Table 7-19. Estimated Cost Shares for Ongoing Investments, Scenarios 4a through 4d

| Management Action Category and Area of Interest | Scenario 4a | | | Scenario 4b | | | Scenario 4c | | | Scenario 4d | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fed. | Local | State | Fed. | Local | State | Fed. | Local | State | Fed. | Local | State |
| Systemwide | | | | | | | | | | | | |
| State Operations, Planning, and Performance Tracking | 0% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 100% |
| Emergency Management | 0% | 17% | 83% | 0% | 20% | 80% | 0% | 16% | 84% | 0% | 16% | 84% |
| Reservoir Operations | 0% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 100% | 0% | 0% | 100% |
| Routine Maintenance | 0% | 20% | 80% | 0% | 20% | 80% | 0% | 20% | 80% | 0% | 17% | 83% |
| Urban | | | | | | | | | | | | |
| Risk Awareness, Floodproofing and Land Use Planning | 50% | 10% | 40% | 50% | 36% | 14% | 50% | 13% | 37% | 50% | 5% | 45% |
| Studies and Analysis | 50% | 29% | 21% | 50% | 40% | 10% | 50% | 31% | 19% | 65% | 14% | 21% |
| Rural | | | | | | | | | | | | |
| Risk Awareness, Floodproofing and Land Use Planning | 75% | 5% | 20% | 75% | 5% | 20% | 72% | 5% | 23% | 67% | 5% | 28% |
| Studies and Analysis | 50% | 10% | 40% | 50% | 10% | 40% | 50% | 10% | 40% | 65% | 5% | 30% |
| Small Community | | | | | | | | | | | | |
| Risk Awareness, Floodproofing and Land Use Planning | 75% | 0% | 25% | 75% | 0% | 25% | 75% | 0% | 25% | 75% | 0% | 25% |
| Studies and Analysis | 50% | 0% | 50% | 50% | 0% | 50% | 50% | 0% | 50% | 65% | 0% | 35% |
| **Total** | **9%** | **13%** | **78%** | **9%** | **15%** | **76%** | **9%** | **13%** | **78%** | **10%** | **11%** | **79%** |

## 7.6 Scenario 5: Decreased Investment in Central Valley Flood Management

As shown in Scenarios 2, 3 and 4, even partial implementation of the 2017 refined SSIA portfolio not only requires continued investment in Central Valley Flood Management, but significant increases from current levels of investment. This last scenario takes a look at what would happen if instead of increased investment, there is a decreased interest in Central Valley Flood management and investment going forward. It explores the implications of continued current levels of investment from the General Fund, local and federal sources, but without any further GO Bonds passed in the next decades.

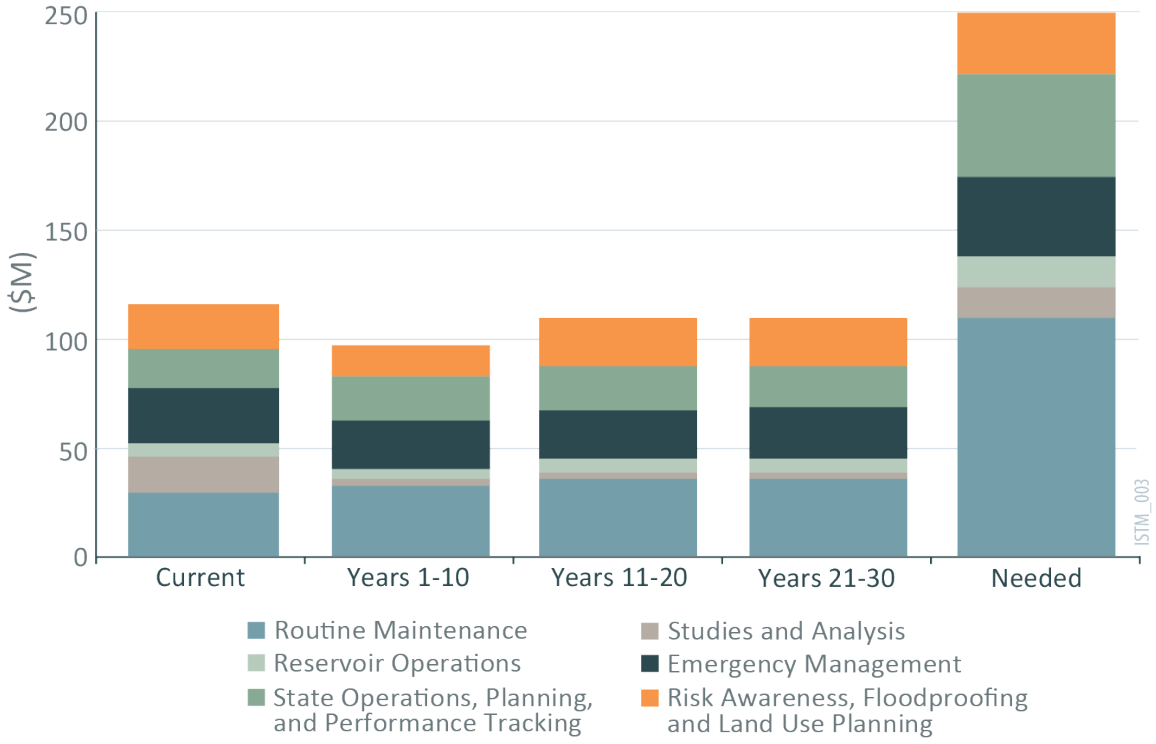
Table 7-20 shows the impact of this decreased level of investment on the ability to implement capital management actions in the 2017 refined SSIA portfolio. As is shown, only 10% of the total capital portfolio is funded over a 30-year timeframe, with rural areas and small communities experiencing the greatest impact. This is again because of the dependence that those areas of interest have on significant State cost sharing – without GO Bonds the State has very limited ability to assist with capital investments in those areas.

Table 7-20. Capital Investment by Phase, Scenario 5

| Management Action Category and Area of Interest | Years 1 -10 | Years 11 - 20 | Years 21 - 30 | % Funded |
|---|---|---|---|---|
| Systemwide | | | | |
| Yolo Bypass Multi-Benefit Improvements | $128 | $114 | $102 | 15% |
| Feather River-Sutter Bypass Multi-Benefit Improvements | $0 | $0 | $0 | 0% |
| Paradise Cut Multi-Benefit Improvements | $10 | $6 | $8 | 8% |
| Reservoir and Floodplain Storage | $34 | $29 | $33 | 12% |
| Urban | | | | |
| Levee Improvements | $216 | $175 | $228 | 13% |
| Other Infrastructure and Multi-Benefit Improvements | $43 | $33 | $54 | 28% |
| Rural | | | | |
| Levee Repair and Infrastructure Improvements | $10 | $17 | $23 | 3% |
| Small Scale Levee Setbacks and Floodplain Storage | $21 | $7 | $25 | 27% |
| Land Acquisitions and Easements | $39 | $3 | $5 | 5% |
| Habitat Restoration/Reconnection | $28 | $3 | $5 | 13% |
| Small Community | | | | |
| Levee Repair and Infrastructure improvements | $43 | $14 | $21 | 7% |
| Setbacks, Land Acquisitions and Habitat Restoration | $17 | $6 | $18 | 6% |
| **Total** | **$589** | **$405** | **$522** | **10%** |

Figure 7-9 shows the impact of decreased investment on ongoing management actions; while some very slight increases are made over the 30-year timeframe (at the expense of some capital investments), final levels of investment in years 21 – 30 still do not cover even half of the costs identified.. Also, some tradeoffs are apparent – investment in studies and analysis decrease significantly in favor of increased investment in routine maintenance and continued investment in high priority capital actions.

Figure 7-9. Impact of Decreased Investment in Ongoing Management Activities, Scenario 5



## 7.7 Scenario Conclusions

This following sections provide a broader comparison of Scenarios 1 through 5, and draws some conclusions about the relationships between funding mechanism applicability, constraints, cost shares and investment portfolios.

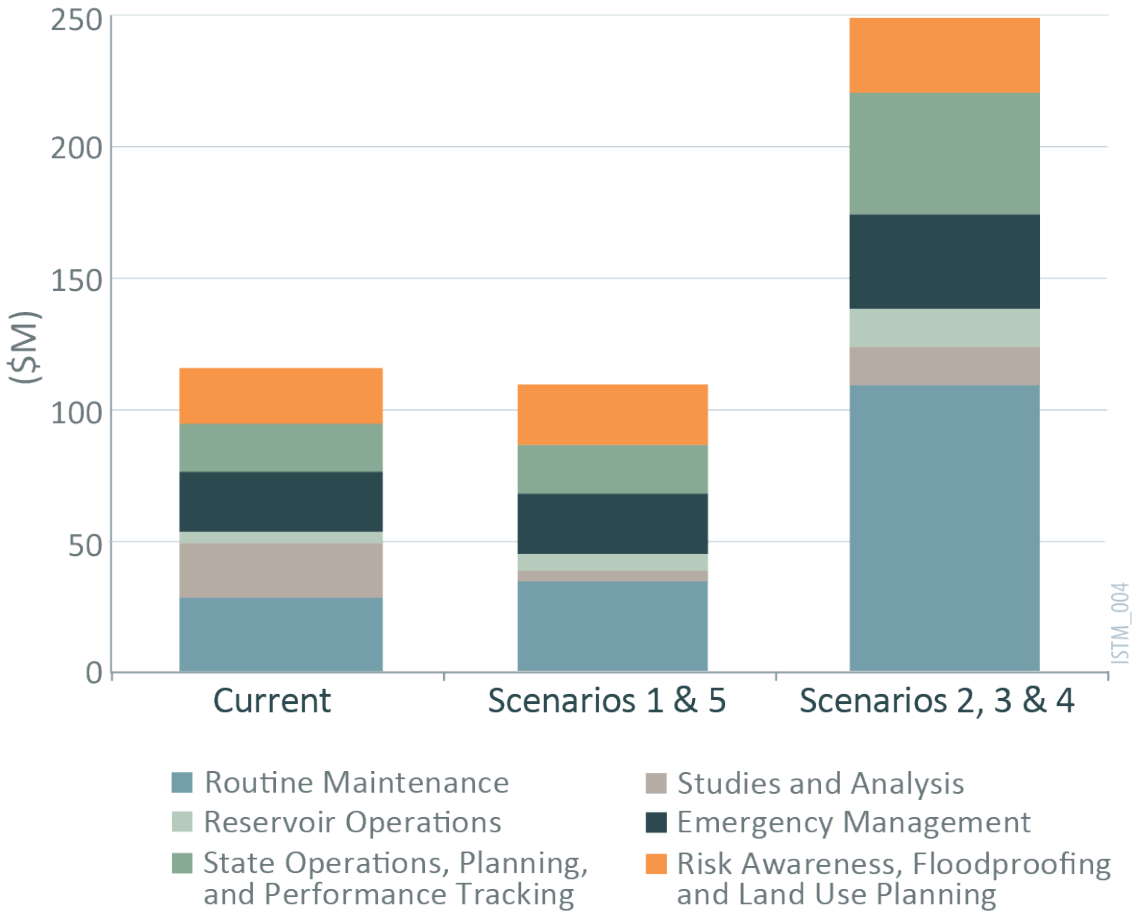
Table 7-21 provides an overview of the extent to which each capital management action type is funded for scenarios 1 through 5. None of the partial funding scenarios is able to completely fund all of the capital management actions. In scenarios 1, 3 and 5, only Phase 1 and part of Phase 2 could be funded for most capital activities over the 30-year timeframe. Systemwide actions and urban levees are the first action types to reach full funding, but this doesn't happen until average annual funding levels from State and federal sources are 80 – 90% higher than their historical averages (in Scenario 3b).

Table 7-21. Percent of Each Management Action Type Funded in Scenarios 1 through 5

| Management Action Category and Area of Interest | % Funded by Scenario | | | | | |
|---|---|---|---|---|---|---|
| | 5 | 1 | 3a | 3b | 3c | 4a - 4d |
| **Systemwide** | | | | | | |
| Yolo Bypass Multi-Benefit Improvements | 15% | 80% | 100% | 100% | 100% | 100% |
| Feather River-Sutter Bypass Multi-Benefit Improvements | 0% | 0% | 0% | 0% | 0% | 100% |
| Paradise Cut Multi-Benefit Improvements | 8% | 100% | 100% | 100% | 100% | 100% |
| Reservoir and Floodplain Storage | 12% | 60% | 67% | 100% | 100% | 100% |
| **Urban** | | | | | | |
| Levee Improvements | 13% | 58% | 80% | 100% | 100% | 100% |
| Other Infrastructure and Multi-Benefit Improvements | 28% | 57% | 78% | 80% | 100% | 100% |
| **Rural** | | | | | | |
| Levee Repair and Infrastructure Improvements | 3% | 26% | 65% | 73% | 100% | 100% |
| Small Scale Levee Setbacks and Floodplain Storage | 27% | 96% | 91% | 92% | 100% | 100% |
| Land Acquisitions and Easements | 5% | 61% | 70% | 80% | 100% | 100% |
| Habitat Restoration/Reconnection | 13% | 75% | 75% | 77% | 100% | 100% |
| **Small Community** | | | | | | |
| Levee Repair and Infrastructure improvements | 7% | 62% | 66% | 83% | 100% | 100% |
| Setbacks, Land Acquisitions and Habitat Restoration | 6% | 41% | 70% | 70% | 100% | 100% |

Figure 7-10 compares the extent to which ongoing activities are ramped up to full funding levels in each scenario All increased investment scenarios (2, 3 and 4) are able to fully fund all ongoing activities at the end of Phase 3, while scenarios 1 and 5 see only minimal increases from current levels of investment in these activities. In other words, current or decreased funding levels do nothing to fill the large investment gap toward critical maintenance, floodplain and residual risk management activities.

Figure 7-10. Maximum Investment in Ongoing Activities (Years 21-30 of Implementation) for Scenarios 1 - 5



The following sections provide some additional high-level conclusions from each scenario, and the funding mechanisms and strategies applied to each one.

### 7.7.1 Scenario 1: Continuation of Current Levels of Investment

Current funding levels are not enough to cover the ongoing investment needs, and are even less effective in making progress toward recommended capital investments. Only 50% of the 2017 refined SSIA portfolio can be funded at current levels.

### 7.7.2 Scenario 2: Funding Ongoing Investments Only

The ongoing investments needs ramp up to $250M/year by Phase 3. Increased investment from the State's general fund are needed to cover much of this cost, from $90M/year in Phase 1 to as much as $175M/year by Phase 3.

With application of new funding mechanisms, such as the Sacramento/San Joaquin Drainage District and a State river basin assessment, the average annual Phase 3 burden on the General Fund for ongoing action types drops to $160M/year. However, the application of the Sacramento and San Joaquin Drainage District will also increase the burden on local agencies. These new funding mechanisms are therefore essential to increase the long term stability and political viability of these essential ongoing flood management activities.

Federal contributions to ongoing investments do not change with the addition of new State and local funding mechanisms, ranging from an average of about $11 million annually in Phase 1, to $21 million annually in Phase 3, mostly for risk awareness, floodproofing, land use planning, and studies and analysis.

### 7.7.3 Scenario 3: Fully Funded Ongoing Investments, Partially Funded Capital Investments

Scenario 4 calls for a doubling or even tripling of State and federal levels of investment in Central Valley flood management as discussed earlier in this section. If this does not occur, and State and federal sources are instead limited to a (still large) increase of 64% – 90% over historical levels, then only 67 to 77% of all capital investments can be made. Over the 30-year timeline, over $2.5B of capital investments would be unfunded.

A GO Bond in Phase 1 is critical in order to make quick progress on high priority investments like the Yolo Bypass multi-benefit improvements and urban levees, and also to invest in rural actions in Phase 1, for which significant State cost shares would be needed.

Scenario 3c shows the extent to which the Feather River-Sutter Bypass multi-benefit improvements impacts the 2017 refined SSIA portfolio. Compared to Scenario 4, its absence reduces the average annual combined State and federal burdens by at least $50 million annually, and changes the focus of Phase 3 from continued prevalence of capital investment, to a greater focus on ongoing and proactive investment with reduced dependence on USACE and GO Bond sources.

### 7.7.4 Scenario 4: Funding the Full 2017 Refined SSIA Portfolio

If the full 2017 refined SSIA portfolio is implemented, State cost shares would likely range from 54 to 62%.

To implement the full 2017 refined SSIA portfolio, State spending on Central Valley flood management will need to at least double from the historical average, and will have to be at least 38% higher on average than the maximum amount spent in the last decade.

In the funding mechanism portfolios with the greatest degree of nexus and inter-annual reliability, local sources contribute an average of $106 million annually to CVFPP implementation. However, an alternative mix of funding mechanisms that is still relatively applicable and reliable can be found that only requires an average of $87 million annually from local sources.

Average annual federal contributions to CVFPP implementation will have to be a minimum of around $187 million annually, and up to as much as $261 annually

### 7.7.5 Scenario 5: Decreased Investment in Central Valley Flood Management

The freezing of current funding levels from most sources and absence of any new GO Bonds going forward has a significant impact on the system's ability to fund needed capital and ongoing investments, with almost no increase in ongoing spending, the cessation of most studies and analysis going forward, and only 10% of the total capital needs being addressed. Similar to Scenario 3b, rural and small community areas would be hardest hit by this reduction in State investment.

# 8.0 CVFPP Delivery Through Flood Management Programs

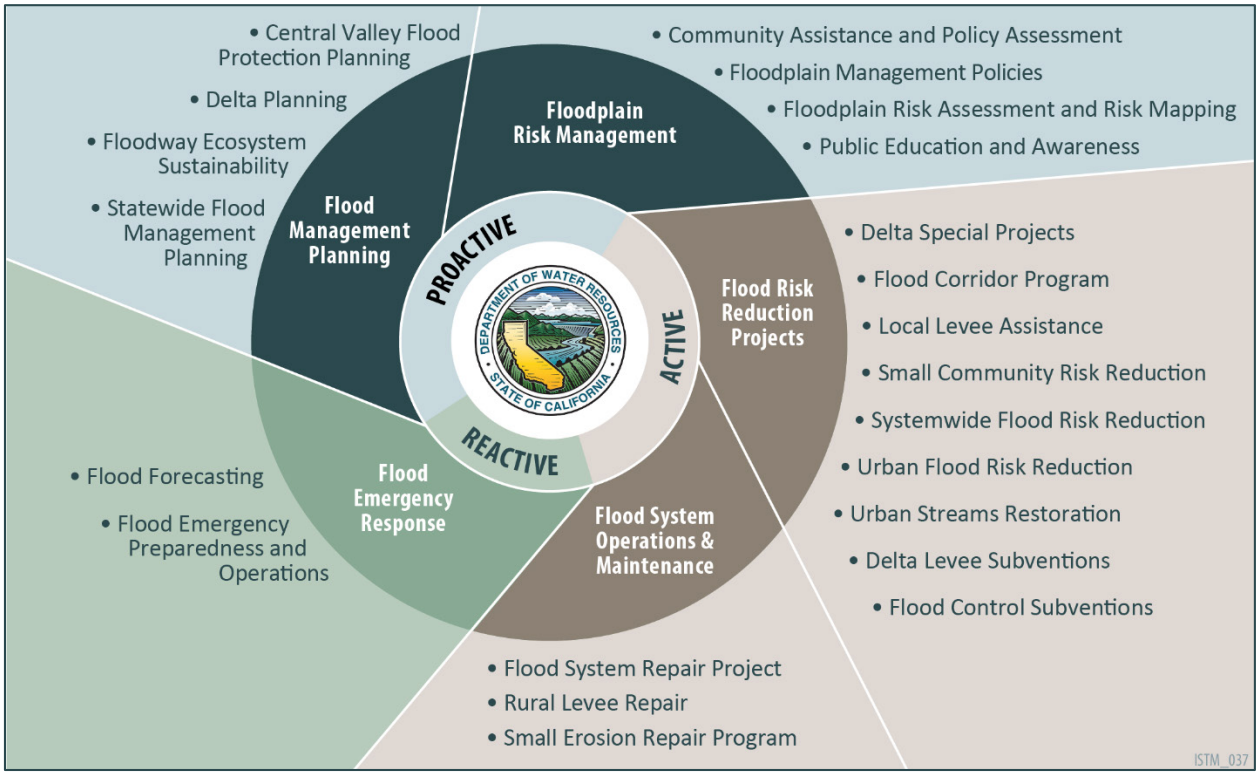
## Section 8 Highlights

- Section Outline:
  - Existing Flood Management Programs
  - Future Flood Management Program Needs
  - Other Potential Water-Related Programs
  - Mapping Management Actions to Existing Flood Management Programs
  - Flood Management Program Investments Over Time
- Key Section Takeaways:
  - Five existing DWR flood management programs and multiple supporting sub-programs that implement flood management activities.
  - Opportunities are available to expand the current programs' ability to support a diverse portfolio of flood management activities and provide local agencies with funding to incentivize and implement those activities.
  - To complete the financial analysis, management action categories in the 2017 refined SSIA portfolio were matched with the DWR flood management programs for delivery.
  - The 2017 refined SSIA portfolio is aimed in part at rebuilding and expanding the flood management programs with a surge of investment to reduce flood risk in the Central Valley and contribute toward CVFPP goals.

Progress toward CVFPP goals requires conditions that enable implementation of the 2017 refined SSIA portfolio through effective changes to behaviors, policies and objectives, organizational structures, institutional capacities, and funding priorities. Funding tied to clear and explicit intended outcomes must be provided to specific implementation programs. This will enable those programs to assist regional and local flood managers in developing and implementing effective management actions. The CVFPP provides estimates for the near and longer-term funding levels required for these programs to accomplish their intended outcomes. These estimates are the aggregation of cost estimates from a broad collection of potential management actions developed. The estimates are built upon explicit assumptions about the types of outcomes to which particular actions are most likely to contribute.

A wide range of expertise is needed to deliver the program activities and implement near-term and longer-term actions, including planning, design, funding, construction, and operations. At the State level, this work is organized into five major flood management programs, with DWR staff working closely with CVFPB and other local, State, and federal partner agencies. Each program is responsible for implementing specific types of actions (together, they cover all work required for implementation of the actions identified in the CVFPP) and for overall flood management in the areas protected by SPFC facilities. Each DWR flood management program is divided into sub-programs that are responsible for various aspects of flood management. Figure 8-1 shows the organization of the existing five flood management programs and their sub-programs. As part of CVFPP implementation, sub-programs within each of the major programs will be evaluated and where necessary, may be removed, expanded, renamed, or newly created in an effort to improve project delivery and more effectively and efficiently deliver CVFPP intended outcomes.

Figure 8-1. Existing DWR Flood Management Programs and Sub-Programs



The State covers the cost of operation and administration of all of these programs under the ongoing investment category of State operations, planning, and performance tracking to the extent funding is available. It is critical that the State maintain capacity to provide efficient project delivery to local agencies. The 2012 CVFPP organized the funding of the entire SSIA and the State's share of the SSIA over time through the flood management programs described above. Table 8-1 provides a comparison of the 2012 SSIA investment by program to the 2017 refined SSIA portfolio.

Table 8-1. Comparative Investment by DWR Flood Management Programs

*Total Program Investment (State, Local, and Federal Investment)*

| Flood Management Program | 2012 Total CVFPP Investment Estimate[1] | | 2017 Total CVFPP Investment Estimate | |
|---|---|---|---|---|
| | Low ($M) | High ($M) | Low ($M) | High ($M) |
| Flood Management Planning | $1,890 | $2,300 | $720 | $890 |
| Floodplain Risk Management | $600 | $800 | $2,040 | $2,480 |
| Flood Risk Reduction Projects | $10,520 | $12,740 | $12,760 | $15,590 |
| Flood System Operations and Maintenance | $440 | $560 | $1,600 | $1,950 |
| Flood Emergency Response | $480 | $510 | $310 | $390 |
| **Total** | **$13,920** | **$16,910** | **$17,430** | **$21,300** |

Notes:
1. From Table 4.3 in the 2012 CVFPP (DWR, 2012a)
2. Estimated totals reflect annual ongoing investments in present value terms (2016 dollars) and summed with present value capital investment costs.

## 8.1 Existing Flood Management Programs

The following section briefly describes the existing DWR flood management programs, their roles, and related key policies. Furthermore, each subprogram is mapped to its respective program and described. The five existing DWR flood management programs are as follows:

- Flood Management Planning
- Floodplain Risk Management
- Flood Risk Reduction Projects
- Flood System Operations and Maintenance
- Flood Emergency Response

### 8.1.1 Flood Management Planning

This program performs the planning and feasibility assessments of the SPFC facilities and formulates potential actions to repair, rehabilitate, or improve facilities. The program looks beyond individual projects to plan how all flood management facilities, operations, habitat and ecosystem restoration, and other practices work together as a system to protect life and property and enhance the ecosystem.

The program provides the rationale, engineering support, and feasibility evaluations to support development of site-specific improvements for the CVFPP. Feasibility studies and updates to the CVFPP are prepared under this program. This program also performs flood system engineering and ecosystem modeling assessments of existing facility conditions. These studies are used to identify areas needing improvements and flood management policy development. The program develops and maintains hydrologic, hydraulic, economic, and other models, providing the foundation of information necessary to develop site-specific and systemwide improvement projects.

USACE also prepares feasibility studies for improvement to SPFC facilities. These feasibility studies are a critical and integral part of federal authorization and appropriations new projects or modification to existing projects. The Flood Management Planning Program works closely and coordinates with USACE on their feasibility studies.

### *Central Valley Flood Protection Planning*

This planning sub-program focuses on improving flood risk management, improving operations and maintenance, promoting ecosystem functions, improving institutional support, and promoting ecosystem functions within the SPFC. The major component to this sub-program is producing the 5-year updates to the CVFPP and necessary supporting studies and analysis. As recommended in the 2012 CVFPP, this program has completed three major planning efforts in support of the 2017 CVFPP Update (DWR, 2016a): State-led BWFSs (DWR, 2016b and 2016c); locally led RFMPs, which included working with more than 180 local entities; and CVFPP Conservation Strategy (DWR, 2016d) elements. Each of these planning efforts, along with this investment strategy and other supporting documents, have informed the development of the 2017 CVFPP Update.

### *Delta Planning*

This sub-program conducts studies, investigations, research and analyses to better understand the Delta and how to manage its resources for a more sustainable Delta. It conducts analyses such as Delta LiDAR, radar interferometry, tidal datum, 100-year hydrology, bathymetric surveys, HMP/PL84-99 levee assessments, levee habitat, seismic performance of organic soils, and improvements to the National Hydrographic Dataset in the Delta. This program also maps Delta levees and supports research related to knowledge gaps in the Delta to improve the Delta ecosystem and flood management.

### *Floodway Ecosystem Sustainability*

This sub-program focuses on providing more specific ecological goals and information to help DWR, and others, plan, design and implement multiple-benefit flood improvement actions. It consists of three major components: Central Valley Flood Protection Plan Conservation Strategy development, integration, and updates; Regulatory Alignment including programmatic permitting and advance mitigation; and Science and Technical Support. These program components are, in turn, supported by an Outreach, Communication, and Engagement component.

#### *Statewide Flood Management Planning*

This sub-program continues to work closely with USACE and local agencies to identify statewide flood risks, propose solutions, and develop an investment strategy for future flood spending based on California's integrated water management investment needs. California's Flood Future: Recommendations for Managing the State's Flood Risk report (DWR, 2013a), released in 2013, identified the immediate need for more than $50 billion to complete flood management improvements and projects statewide. Further, it estimated that significant additional funding–approximately $100 billion in additional capital investment—is needed for flood management improvements and projects. DWR has built upon the work in California's Flood Future by initiating a new phase of work, which includes developing Investing in California's Flood Future: An Outcome-Driven Approach to Flood Management. This new report will expand understanding related to all of the recommendations from California's Flood Future, while focusing on the last recommendation – establishing sufficient and stable funding mechanisms to reduce flood risk. It also describes how public understanding of risk awareness, water and related resource management planning, and regulatory and environmental compliance processes affect funding for flood management.

### 8.1.2 Floodplain Risk Management

The Floodplain Risk Management Program strives to reduce the consequences of riverine flooding in the Central Valley. A major focus of this work is the delineation and evaluation of floodplains to assist local decision makers with their near-term and long-term land use planning efforts. Risk awareness campaigns and flood insurance activities are also a major focus of this program.

The State promotes an enhanced floodplain management program, especially in rural agricultural areas, through continued engagement with FEMA. The program helps provide grants to local agencies and citizens for applicable risk mitigation actions, including property acquisition, structure demolition, and relocation, and flood proofing and raising of residential and non-residential structures. The program will continue collaborating with local planning agencies and providing guidance regarding how to integrate local land use planning with the CVFPP to reduce flood risk for local jurisdictions and comply with the provisions of Senate Bill 5. In addition to its routine activities, this program will implement floodplain management enhancement activities from the CVFPP.

#### *Community Assistance and Policy Assessment*

This sub-program is designed to assist communities throughout the State to understand flood hazards and to take actions to reduce flood risks in the floodplain. It includes community services; interagency collaboration; and influencing land use decisions, zoning, and building standards. The information gathered and organized under the Risks Assessment and Risk Mapping Element provides an important set of tools for assisting communities.

Furthermore, this sub-program connects DWR staff with national experts and agencies in other states to investigate how flood risk situations are handled, including those for riverine, coastal, alluvial and agricultural areas. DWR staff participate in partner agency flood awareness events and organize outreach venues, such as California Flood Preparedness, webinars, and panels to disseminate flood management information.

Finally, this sub-program provides statewide technical support to federal, State, and local agencies, as well as the public. This technical support includes: flood hazard maps, levee data, and National Flood Insurance Program (NFIP) activities, including the Community Rating System (CRS). In partnership with FEMA, program staff train local officials and audit communities for NFIP compliance. The program also includes Silver Jackets and Flood Risk Notification – both engage in flood risk outreach and education to the public.

#### *Floodplain Management Policies*

This sub-program assesses policy development for best floodplain management practices and coordinates recommendations to address these policy issues. This element conducts policy research and assessment assistance on proposed federal and State information. It is important to keep abreast of national floodplain risk management items, trends, and initiatives. Additional insight is obtained through the Silver Jackets network of State teams, and participation in national and State floodplain management associations.

#### *Floodplain Risk Assessment and Risk Mapping*

This sub-program collects, assesses, organizes, maps, and disseminates the basic information needed to advance floodplain management in California. This element establishes priority for new studies and the need for new flood maps. It disseminates flood hazard information by establishing and maintaining a web-based information management system. This program includes the Watershed-Based Flood Risk Assessment, Flood Risk Mapping and Collection, and the Information Management components.

#### *Public Education and Awareness*

A major element of this sub-program is the Flood Risk Notification Program. The key goal of the Flood Risk Notification Program is to increase flood risk awareness by effectively communicating that risk to individual property owners, the public, and local, State, and federal agencies. This includes encouraging people to understand the levee system that protects them; to be prepared and aware of their flood risk; and to take appropriate actions before, during, and after flooding to protect themselves, minimize damage to their property or personal possessions, and facilitate recovery. DWR provides annual written notification to property owners whose property is located within a SPFC Levee Flood Protection Zones (LFPZs), and coordinates with federal, State, and local partners to provide information about flood risks. CWC Section 9121 requires DWR to provide written notices of potential flood risk to property owners in the LFPZs by September 1, 2010, and annually thereafter.

### 8.1.3 Flood Risk Reduction Projects

The Flood Risk Reduction Projects Program conducts the work necessary to implement on-the-ground projects that are formulated and approved through the CVFPP. State investments in system improvements may be through direct investment in new or improved facilities or through grant programs. System improvements will generally be implemented through partnership programs among DWR, the Board, and USACE, and in coordination with local agencies.

Flood Risk Reduction Projects is organized around geographical areas of the State (SPFC in the Central Valley, Delta, and statewide). The following is a summary of each flood management program for Flood Risk Reduction Projects.

### *Delta Special Projects*

Delta Levees Special Flood Control Projects (Delta Special Projects) works directly with local agencies to provide critical financial assistance for flood protection, habitat, and studies of features that affect levee stability in the Delta. This funding protects and enhances the economic, environmental and cultural resources in the Delta. The sub-program is authorized under the CWC to provide funding to safeguard public benefits, including water supply, roads, utilities, urbanized areas, water quality, recreation, navigation, and fish and wildlife, from flood hazards. The program mitigates the habitat impacts of each project and ensures a net long-term habitat improvement in the Delta.

Projects are periodically funded by the program based on applications received that meet the goals and objectives published by DWR for the Delta. The goals are guided by CWAP and the Delta Plan. Since its inception, the program has invested approximately $300 million in the Delta for flood protection, related habitat projects, and other program purposes. The program was originally authorized to address flooding on the eight western Delta islands. It was expanded in 1996 to the entire Delta and to portions of the Suisun Marsh as outlined in Section 12311 of the CWC.

### *Flood Corridor Program*

The Flood Corridor program is a statewide grant program in which non-structural flood risk reduction is the primary goal, with habitat and agricultural conservation incorporated as prominent program components. The goal of this sub-program is to reduce flood risk by enabling waterways to function more naturally, while enhancing native wildlife habitat and preserving agricultural uses. This program provides funding for acquisition, restoration, enhancement, and protection of real property while preserving sustainable agriculture and/or enhancing wildlife habitat in and near flood corridors throughout the State.

By acquiring easements for agricultural conservation, wildlife habitat preservation, and flood flow, and by restoring floodplain functions, floodwaters can be detained for later release or can safely spread over, and in some cases, move more quickly through, floodplains. Depending on the location and design of the project, these efforts can reduce peak flows upstream and downstream, in some cases allowing sediments to be trapped by the restored riparian vegetation. Other anticipated benefits include enhanced wetland development, groundwater recharge, wildlife habitat enhancement, and endangered species improvements. By incorporating non-structural solutions, the program achieves flood benefits at a fraction of the cost of traditional structural solutions.

### *Local Levee Assistance*

The Local Levee Assistance sub-program was developed to help fund projects implemented by flood management agencies, outside of the Sacramento-San Joaquin Delta and outside of the SPFC. The goals of this program include minimizing flood risk; identifying deficiencies in flood control structures; and minimizing high flood insurance costs related to FEMA unaccredited levees. This program utilizes two strategies to assist local agencies with meeting these goals. The Local Levee Evaluation approach provides funding to conduct hydrology and hydraulic studies and geotechnical evaluations of levees that are needed for accreditation by FEMA. The Local Levee Critical Repair approach provides funding for DWR-approved projects that

repair erosion damage, address freeboard deficiencies or substandard encroachments, and remediate unstable levee conditions.

### *Small Community Flood Risk Reduction*

This sub-program will coordinate the development of local flood damage reduction projects for small communities. The program activities include working with local agencies achieving 100-year flood protection by constructing new ring levees around small communities and improvement of existing levees and floodwalls, where feasible. In addition to feasible structural improvements, small communities may consider non-structural flood risk reduction measures, such as flood-proofing, raising structures, and relocation of structures. This program is being implemented in partnership with CVFPB, local agencies, FEMA, and USACE.

### *Systemwide Flood Risk Reduction*

This sub-program will coordinate development and implementation of more complicated system projects, such as system reservoir operations, expansion and extension of flood bypasses, new bypasses, flood system structures, and related ecosystem enhancements (including fish and wildlife habitat enhancement and fish passage improvements).

Participation and partnership in this sub-program by USACE is critical to implementing large-scale systemwide projects. Implementation of Yolo Bypass multi-benefit improvements is a priority program for system improvements.

### *Urban Flood Risk Reduction*

This sub-program will continue to coordinate with USACE and the local agencies to develop regional flood damage reduction projects for urban areas to achieve an urban level of flood protection (protection from a 200-year flood). This program is being implemented in partnership with the CVFPB, local and regional agencies (primarily regional joint powers authorities), and USACE. The goal of this program is to work with USACE and assist local urban agencies to attain 200-year flood protection by 2027.

### *Urban Streams Restoration*

This sub-program provides communities with technical support and matching grants to create effective urban creek protection, restoration, and enhancement projects. The program introduces communities to the concept of integrating flood risk reduction and ecosystem protection and enhancements. Focused on urban and urbanizing areas, the program requires partnerships between community groups and local agencies, creating broad public exposure for the projects.

### *Delta Levee Subventions*

This is a cost-share sub-program providing financial assistance to local agencies for maintenance, rehabilitation, and improvement of approximately 700 miles of eligible federal project and non-project levees in the Delta.

All local maintenance agencies (LMAs) with responsibility for both SPFC facilities and local non-project levees in the primary zone and/or local non-project levees in the secondary zone of the Delta, as defined by CWC Section 12220, are eligible to participate in this program. The State reimburses local agencies for part of the costs to maintain and improve non-project and eligible project levees guided by the program criteria and procedures approved by the CVFPB.

Maintenance includes routine annual maintenance, habitat mitigation, repairs to restore existing levee cross-sections, slope protection, repair of slips and scarps, and associated engineering and construction activities. Unavoidable impacts to habitat are mitigated through participation in programmatic mitigation banks and other environmental restoration activities of the program.

#### *Flood Control Subventions*

The State legislature created the Flood Control Subventions Program in 1945 because most non-federal local partners could not shoulder the financial burden of partnering with the federal government on flood management projects, and the State recognized the public safety and statewide economic benefits associated with these projects.

The sub-program provides State cost-share financial assistance to non-federal partners of federally authorized projects located outside of the SPFC. The Flood Control Subventions Program provides financial assistance to local agencies cooperating in the construction of federally authorized flood control projects.

### 8.1.4 Flood System Operations and Maintenance

The Flood System Operations and Maintenance Program includes work to keep SPFC flood management facilities (as defined in California Water Code Sections 8361 and 12878) maintained pursuant to State and federal requirements so facilities continue to function as designed. Currently, this is only in reference to about 10% of SPFC facilities, as local maintaining agencies (LMAs) provide the maintenance for the other 90% of the SPFC facilities through State and local agreements. Program activities include channel maintenance (hydraulic assessments, sediment removal, channel clearing, and vegetation management); erosion and levee repairs; levee inspection, evaluation, and maintenance; and repair and replacement of hydraulic structures. This program's work includes on-the-ground daily and annual routine maintenance activities, and frequent coordination with regulatory agencies. In addition to its routine responsibilities, this program will implement non-routine maintenance actions for SPFC facilities as described in the 2017 CVFPP Update.

#### *Flood System Repair Project*

In 2013, DWR finalized its Flood System Repair Project (FSRP) Guidelines (DWR, 2013b) that established the process and criteria DWR used to help LMAs repair documented critical problems on SPFC facilities. The FSRP primarily focuses on repairs to rural levees to prevent problems from becoming critical, reducing repair costs, and making the operations and maintenance programs sustainable. DWR developed these guidelines with input from local maintaining agencies and local engineering consultant groups. The sub-program developed a list of critical problems and proposed rural non-routine levee repairs for 150 problem areas on SPFC levees in concurrence with the LMAs.

#### *Rural Levee Repair Program*

The State supports cost-sharing of the rural-agricultural flood management improvements, subject to availability of funds, and where feasible. Through this sub-program the State also assists in repair of rural-agricultural erosion sites identified by the latest inspection on a priority basis.

In many rural and small communities, structural improvements may not be economically feasible and other management actions may be implemented, including working with FEMA to provide assistance for flood proofing of homes and structures, or relocation of agricultural structures from deep floodplains. In addition, this program works with FEMA to evaluate the feasibility of a program to provide post-flood recovery assistance to rural-agricultural areas.

#### *Small Erosion Repair Program*

The Small Erosion Repair Program (SERP) brings a streamlined programmatic approach to repair multiple erosion sites in a single construction season along the Sacramento River. It integrates the needs of public safety, environmental stewardship, and economic stability into projects.

### 8.1.5 Flood Emergency Response

The responsibility of the Flood Emergency Response Program is to prepare for floods, effectively respond to flood events, and support quick recovery when flooding occurs. Enhanced emergency response reduces flood risks and saves lives during flood events. It is also needed particularly for rural-agricultural areas where physical improvements are not anticipated to be as extensive as in more populated areas. This program will implement flood emergency response actions described in the CVFPP, including the provision of technical and funding assistance to local agencies to improve local flood emergency response.

#### *Flood Forecasting*

The Flood Forecasting sub-program consists of three predominant program elements:

- Real-Time Flood Conditions, Status, and Warning
- Hydro-Climate Data Collection and Precipitation/Runoff Forecasting
- Reservoir Operations and River Forecasting

**Real-Time Flood Conditions, Status, and Warning**

The purpose of this program element is to provide information needed to manage floods as they are occurring. This element supports flood operations by (1) inspecting, documenting, and assessing the integrity of the Sacramento and San Joaquin Flood Control Project levees; (2) storing and managing information so that it is accessible to flood managers and the general public; (3) providing emergency flood information and warnings based upon existing and forecasted conditions and field reports; and 4) developing information management tools to support emergency operations. The following components are also included within this program element:

- Flood Project Integrity/Vulnerability Assessments
- Inspections of Flood Projects
- Flood Emergency Information Dissemination and Warning

**Hydro-Climate Data Collection and Precipitation/Runoff Forecasting**
This program element supports Flood Emergency Response goals by providing information on current and forecasted water conditions, and by providing meteorological and climate information. Additionally, this element includes evaluating and improving the data collection and exchange network and forecasting models, providing water supply and watershed runoff information and forecasting, and the development of a new generation of forecasting and data collection tools to improve the quality, timeliness, and length of watershed and river forecasts. Real-time data, its timely availability, quantities and quality are all critical to improving forecasting quality and timeliness. The following components are also included within this program element:

- California Cooperative Snow Surveys
- California Data Exchange Center
- Real-Time Data Collection Network
- Hydrology Update and System Reoperation

**Reservoir Operations and River Forecasting**
This element is considered one of the most cost-effective measures to improve flood control, and is currently being implemented on the Yuba-Feather River system as well as being expanded to cover reservoirs in the San Joaquin River system. These operations help minimize the risk of exceeding river channel capacity and increase the warning times to communities along the major California rivers and downstream of flood control reservoirs through enhanced communication between local, State and federal agencies; improved data gathering and exchange; and utilization of the most recent advancements in weather and river forecasting. The following components are also included within this program element:

- Reservoir Operations
- California-Nevada River Forecast

***Flood Emergency Preparedness and Operations***
This sub-program includes preparing DWR to respond to flood emergencies by providing emergency response and flood fight training and exercises at State and local levels performing scientific studies related to developing emergency response options; coordinating emergency preparedness endeavors including the development of emergency plans with the various flood response partners; analyzing seasonal flood threats; developing and managing strategically positioned emergency response material stockpiles and transfer facilities; updating and operating real-time modeling tools for emergency strategy and decision support; and ensuring staffing and function of the Flood Operations Center (FOC) to coordinate State response to flood events.

The Flood Emergency Preparedness and Operations sub-program consists of three predominant program elements:

- Delta Flood Preparedness, Response, and Recovery
- Statewide Flood Emergency Operations Planning
- Flood Emergency Response (Flood ER) Local Assistance

### Delta Flood Preparedness, Response, and Recovery

This program element aims to 1) protect the lives, property, and infrastructure critical to the functioning of both the Sacramento-San Joaquin Delta and California; 2) protect water quality and restore water supply for both Delta and export water users; 3) reduce the recovery time of California's water supply from a catastrophic flood in the Delta; and 4) minimize impacts on environmental resources. This program element's activities include studies, planning, training, exercising to ensure agency alignment, and maintaining operational response facilities and material stockpiles to increase the State's operational capacity to respond to catastrophic flood events in the Sacramento-San Joaquin Delta.

### Statewide Flood Emergency Operations Planning

The FOC supports local response to flood emergencies, planning, training, and exercising DWR staff to perform emergency functions. Extensive coordination and the development of working relationships with LMAs, cities, and counties and other stakeholders throughout the State aim to develop better aligned local, county, State, and federal emergency response plans and enhanced operational capacity to respond to flood emergencies, as well as support for emergency communications capabilities and stockpiling flood fight materials.

The Flood Emergency Management System (FEMS) is being developed to deploy, manage, and track resources and information during flood events. FEMS assists the FOC in efficiently responding to and managing major flood events including management of incident command teams in the field as well as flood operations activities at the FOC. FEMS also provides the FOC with the capability to track and report incident costs for proper cost recovery from FEMA in real time.

### Flood Emergency Response Local Assistance

This program element is intended to improve local flood emergency response and increase public safety. The component consists of three grant categories: 1) Statewide Emergency Response Grant, which excludes the Delta; 2) Delta Emergency Response Grant for the Delta only; and 3) Delta Emergency Communications Grant, a one-time grant to local Delta agencies for communication enhancements among all flood emergency agencies in the Delta. Public agencies with primary responsibility for flood emergency response and coordination are eligible to apply for either statewide or Delta competitive grants. These grants fund the development of flood emergency plans, training, exercises, and acquisition of emergency flood fight materials. They improve agency alignment through coordination between local flood agencies and county emergency response operational areas, reinforcing the State's Standardized FEMS.

## 8.2 Future Flood Management Program Needs

In order to maintain productivity and reliability of the five DWR flood management programs, security of future funding is critical. Additionally, there are opportunities to expand the current major programs' ability to support a more diverse portfolio of flood management activities and provide local agencies with funding sources to incentivize and implement those activities. Table 8-2 outlines potential expansion of existing programs or new implementation programs that could be initiated for future support of CVFPP investment.

Table 8-2. Expanded Existing Flood Management Programs or Create New Sub-Programs

| Existing Flood Management Program | Description of Modification | Expand Existing Sub-Program | New Sub-Program |
|---|---|---|---|
| Flood Management Planning | Expand the Floodway Ecosystem Sustainability program to include a more robust Programmatic Permitting sub-program and expand capacity to support regulatory agency review and consultation. | X | |
| Floodplain Risk Management | Create a new sub-program entitled, Flood Easements and Land Acquisitions, to support easement and land acquisition actions by DWR. | | X |
| Floodplain Risk Management | Create a new sub-program entitled, Floodplain Management Policy Program, to support wise use of floodplains beyond the SPFC, through activities such as taskforces, NFIP reauthorization and reform and flood insurance evaluations. | | X |
| Floodplain Risk Management | Create a new sub-program entitled, Floodplain Mitigation Planning, to conduct watershed-based mitigation planning, assist in mitigation cost recovery and engage in post-flood activities and disaster recovery. | | X |
| Floodplain Risk Management | Create a new sub-program entitled City and County Local Assistance, to support direct interaction between DWR and local agencies for land use planning activities. | | X |
| Flood System Operation and Maintenance | Expand the Flood Control Subventions sub-program to be able to support SPFC related minor rehabilitation reimbursement to LMAs. | X | |
| Flood System Operation and Maintenance | Creation of a new sub-program to support and provide State funding assistance for specific DWR approved SPFC routine maintenance activities performed by Levee Maintaining Agencies (LMAs). | | X |

## 8.3 Other Potential Water-Related Programs

A number of other water-related funding programs exist at the State and federal levels that could potentially fund the 2017 refined SSIA portfolio. These mechanisms may provide funding for one or more of the multiple benefits associated with management actions of the CVFPP. Even though the main focus of many of these programs is not flood management, there often can be a flood nexus found to support the applicability of funds. All of these programs are grant-based programs and typically financed by GO Bonds. The other water funding programs, listed and described below, are meant to be a reference for other potential funding solutions outside of DWR's flood management programs. However, this is not an exhaustive list of other potential funding opportunities.

### 8.3.1 Water Storage Investment Program

The Water Storage Investment Program (WSIP) is implemented by the California Water Commission as directed by Proposition 1, passed by voters in 2014. WSIP provides $2.7 billion from State general obligation bonds to finance water storage projects that provide public benefits. Ecosystem improvement is required of any project that receives funding, but water quality improvement, flood control, recreation, and emergency response are also eligible public benefits. WSIP can provide no more than 50 percent of the capital cost of a project, and at least half of that amount must fund costs of ecosystem improvements. Local agencies or groups of agencies apply for bond money through a competitive process. The Commission intends to receive WSIP applications by late summer of 2017 and select projects by 2018.

### 8.3.2 California's Integrated Regional Water Management Program

California's Integrated Regional Water Management (IRWM) program supports a regional, multi-agency approach to water management. Voters have passed a series of bond measures providing implementation and planning grants for groups of local agencies to improve water supply, water quality, flood control, ecosystem improvement, and other benefits. The bond money cannot be used for operations and maintenance. Currently, 48 such regional groups of agencies are eligible to apply for grants funded by State general obligation bonds. The most recent bond measure, Proposition 1, provides just over $800 million for integrated regional water management, of which $200 million is specifically for multi-benefit stormwater management projects. To date, four statewide bond measures have provided funding for projects under the IRWM program. The number of funding rounds, required non-state cost shares, caps on grant amounts, and other preferences and requirements vary according to applicable statute and policy.

### 8.3.3 California State Parks

California State Parks (CSP) manages the Habitat Conservation Fund (HCF) program, which seeks to protect and restore sensitive habitats in California (CSP, 2012). Habitat improvement categories that can overlap with flood mitigation projects include wetlands, anadromous salmonids and trout habitat, riparian habitat, and wildlife area activities. For example, flood mitigation activities that include expanding and improving wetland and riparian habitats may slow flood water flows during storm events while also increasing the on-going opportunities for wildlife-related recreation. Cities, counties and districts are eligible to compete for the funds, with typical grants ranging from $50,000 to $1,000,000 and total program funding amounting to

approximately $2 million each year, but grantees have a 50 percent cost-share requirement. During the grant performance period, the HCP funds can be used for land acquisition and easements, capital outlays and direct project costs, including habitat restoration and building trails, for example.

### 8.3.4 California Wildlife Conservation Board Programs

California Wildlife Conservation Board (WCB) Programs. The primary responsibilities of WCB are to select, authorize and allocate funds for the purchase of land and waters suitable for recreation purposes and the preservation, protection and restoration of wildlife habitat. The California WCB manages several grant programs including land acquisition, ecosystem restoration on agricultural lands (ERAL), forest conservation program, habitat enhancement and restoration program, California riparian habitat conservation program (CRHCP), streamflow enhancement program, and the inlands wetlands conservation program. The latter may have the greatest nexus to the CVFPP given that it was created to assist the Central Valley Joint Venture in implementing its mission to "protect, restore and enhance wetlands and associated habitats." Nonprofit organizations, local governmental agencies, State Departments and federal agencies are all eligible for grants through the WCB programs related to restoring and enhancing wildlife. Cost-sharing or in-kind contributions are required and grants range from $10,000 to $1,000,000. Descriptions about these programs can be found on the WCB's website at https://wcb.ca.gov/Programs.

### 8.3.5 California River Parkways Program

The California Natural Resources Agency (CNRA) administers the California River Parkways Grant Program and the Urban Greening Project. The California River Parkways Grant Program funds state, local and community collaborative multiple benefits projects which reduce greenhouse gas emissions, increase water use efficiency, reduce risks from climate change impacts. CNRA grants go toward the acquisition, restoration, protection and development of river parkways in accordance with the California River Parkways Act of 2004 (CNRA, 2015). Flood management projects, especially those that target the expansion of existing river parkways to accommodate period flooding and those that restore land to natural floodplain, are eligible for CNRA California River Parkways grants. Also eligible for these grant funds are projects that acquire streamside parcels that have historically flooded to become a River Parkway (CNRA, 2015). For the FY 2015 Prop 13 bond-funded grant period, all requests were capped at $500,000.

### 8.3.6 Urban Greening Grant Program

The CNRA Urban Greening Grant Program (UGGP) is a program funded by the Greenhouse Gas Reduction Fund (GGRF). Of the $1.2 billion in Cap and Trade revenues authorized by SB 859 to fund GGRF, $80 million was allocated to Urban Greening Program for green infrastructure projects that reduce GHG emissions and provide multiple benefits (CNRA, 2017). GHG emissions reductions funds must achieve reductions of greenhouse gas emissions. Based on the draft guidelines[1], the UGGP will establish and fund projects that enhance parks and open space (CNRA, 2017). In addition to GHG emissions reductions requirement, 25 percent of UGGP

[1] The draft guidelines for the Urban Greening Program are currently under review and the final guidelines are expected to be released on March 1, 2017.

funds are to be allocated to projects that provide benefits to disadvantaged communities including those that reduce flood risk to these communities (CNRA, 2017).

### 8.3.7 California State Water Resources Control Board

The California State Water Resources Control Board (SWRCB) administers federal grant funds for the CWA 319(h) Non-Point Source Grant Program (SWRCB, 2017). These funds support projects to improve water quality by reducing non-point source pollution, especially in impaired waters slated for TMDL implementation and threatened waters. This program requires a minimum match of 25% of the total project cost. State agencies can use state funds and services for the funding match.

### 8.3.8 Clean Water State Revolving Fund

The Clean Water State Revolving Fund (CWSRF) program is a federal-state partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects (EPA, 2017). As capital and interest is paid back into the fund, those funds become available to initiate new loans. The state share of the capitalization is 20% to EPA's 80%, but the states operate their programs. Through the Green Project Reserve, the CWSRF targets critical green infrastructure and other environmentally innovative activities. Thus stormwater management can be eligible for funds under the program, but the projects must show a water quality improvement. The loans can be extended for up to 30 years, but interest rates must be at or below market rates.

## 8.4 Mapping Management Actions to Existing Flood Management Programs

In order to complete the financial analysis for the 2017 refined SSIA portfolio, the portfolio was organized by area of interest and by management action category as described earlier. Then, management action categories were matched with the DWR flood management programs for delivery. Each capital and ongoing investment type was assigned only one dominant DWR flood management program based on the program's primary function. This allowed capital and ongoing investments to be reported by program without overlap. Tables 8-3 and 8-4 provides the mapping of capital and ongoing investment types to DWR flood management programs that were used in the financial analysis. However, it is important to note that even though a primary flood program was assigned to the capital and ongoing investment types, multiple programs can deliver these two types of investments.

Table 8-3. Capital Investments by DWR Flood Management Program

| Management Action Category and Area of Interest | Dominant DWR Flood Management Program Assigned |
|---|---|
| Systemwide | |
| Yolo Bypass multi-benefit improvements | Flood Risk Reduction Projects |
| Feather River–Sutter Bypass multi-benefit improvements | Flood Risk Reduction Projects |
| Paradise Cut multi-benefit improvements | Flood Risk Reduction Projects |
| Reservoir and floodplain storage | Flood Risk Reduction Projects |
| Urban | |
| Levee improvements | Flood Risk Reduction Projects |
| Other infrastructure and multi-benefit improvements | Flood Risk Reduction Projects |
| Rural | |
| Levee repair and infrastructure improvements | Flood System Operations and Maintenance |
| Small-scale levee setbacks and floodplain storage | Flood Risk Reduction Projects |
| Land acquisitions and easements | Floodplain Risk Management |
| Habitat restoration/reconnection | Floodplain Risk Management |
| Small Community | |
| Levee repair and infrastructure improvements | Flood Risk Reduction Projects |
| Levee setbacks, land acquisitions, and habitat restoration | Floodplain Risk Management |

Table 8-4. Ongoing Investments by DWR Flood Management Program

| Management Action Category and Area of Interest | Dominant DWR Flood Management Program Assigned |
|---|---|
| Systemwide | |
| State operations, planning, and performance tracking | Flood Management Planning |
| Emergency management | Flood Emergency Response |
| Reservoir operations | Flood System Operations and Maintenance |
| Routine maintenance | Flood System Operations and Maintenance |
| Urban | |
| Risk awareness, floodproofing, and land use planning | Floodplain Risk Management |
| Studies and analysis | Flood Management Planning |
| Rural | |
| Risk awareness, floodproofing, and land use planning | Floodplain Risk Management |
| Studies and analysis | Flood Management Planning |
| Small Community | |
| Risk awareness, floodproofing and land use planning | Floodplain Risk Management |
| Studies and analysis | Flood Management Planning |

## 8.5 Flood Management Program Investments Over Time

To implement the CVFPP over the next 30 years, much larger contributions would be required from all entities than has been invested historically. For the State, this would include a much larger contribution from the State General Fund, successfully passing new State bonds, and developing new mechanisms. Contributions from the federal government, predominantly from USACE, would need to increase from current levels. Local entities would need to generate funds to provide the local match for federal and State capital investments. Local entities would also need to generate more funds for their share of ongoing costs. In order to fully understand the additional resources needed, the 2017 refined SSIA portfolio investment was organized by DWR flood management program and by cost-share partners.

Table 8-5 presents the 2017 refined SSIA portfolio phased investment over time (in 2016 dollars) organized by DWR flood management program and broken down by federal, State, and local share. This information was provided similarly in the 2012 CVFPP. The 2017 refined SSIA portfolio provides more clarity on the funding need for several of the flood management programs, specifically the Flood Emergency Response and Flood System Operations and Maintenance programs.

Table 8-6 presents only the capital portion of the 2017 refined SSIA portfolio investment phased over time in present value terms.

Table 8-7 presents only the ongoing portion of the 2017 refined SSIA portfolio in annualized amounts. Annual ongoing investments are shown without discounting in order to highlight the real need for increased resources to many of the DWR flood management programs necessary for achieving CVFPP goals. Ramping of ongoing investments is based on assumptions of time needed to build capacity for these programs.

The 2017 refined SSIA portfolio is aimed in part at rebuilding and expanding the programs with a surge of investment to reduce flood risk in the Central Valley and contribute toward CVFPP goals. This is why recommended investments include categories of management actions rather than individual projects. This approach allows flexibility for the individual programs to fund the necessary types of management actions as priorities or conditions change throughout time. Individual projects will still have to apply for these programs and comply with program guidelines to receive implementation funding. Additionally, individual projects can pursue other potential avenues of funding, including funding from other State or federal grant programs, philanthropic contributions, private industry investment, and non-governmental organizations (NGOs).

Table 8-5. Combined Present Value Capital and Ongoing State Systemwide Investment Approach Range of Investments over Time

| Flood Management Programs | | Flood Management Planning | | Floodplain Risk Management | | Flood Risk Reduction Projects | | Flood System Operations and Maintenance | | Flood Emergency Response | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) |
| **Phase 1** | State | $180 | $220 | $920 | $1,130 | $1,280 | $1,570 | $540 | $670 | $200 | $240 | $3,130 | $3,820 |
| | Federal | $30 | $40 | $620 | $760 | $1,670 | $2,040 | $0 | $0 | $0 | $0 | $2,320 | $2,840 |
| | Local | $0 | $0 | $20 | $30 | $340 | $420 | $90 | $120 | $10 | $10 | $470 | $570 |
| | ***Subtotal*** | **$210** | **$260** | **$1,560** | **$1,910** | **$3,290** | **$4,020** | **$640** | **$780** | **$210** | **$250** | **$5,920** | **$7,230** |
| **Phase 2** | State | $210 | $260 | $940 | $1,150 | $1,300 | $1,590 | $560 | $680 | $160 | $200 | $3,180 | $3,890 |
| | Federal | $40 | $50 | $610 | $740 | $1,480 | $1,810 | $0 | $0 | $0 | $0 | $2,130 | $2,600 |
| | Local | $0 | $0 | $40 | $50 | $380 | $460 | $100 | $120 | $40 | $50 | $560 | $680 |
| | ***Subtotal*** | **$250** | **$310** | **$1,580** | **$1,940** | **$3,170** | **$3,870** | **$660** | **$800** | **$210** | **$250** | **$5,870** | **$7,170** |
| **Phase 3** | State | $210 | $260 | $630 | $770 | $1,570 | $1,880 | $450 | $550 | $120 | $150 | $2,920 | $3,730 |
| | Federal | $40 | $50 | $280 | $340 | $1,800 | $2,160 | $0 | $0 | $0 | $0 | $2,100 | $2,680 |
| | Local | $0 | $0 | $20 | $30 | $480 | $580 | $80 | $100 | $30 | $40 | $610 | $780 |
| | ***Subtotal*** | **$250** | **$310** | **$930** | **$1,130** | **$3,780** | **$4,620** | **$530** | **$650** | **$150** | **$190** | **$5,620** | **$7,190** |
| **Total** | State | $610 | $740 | $2,490 | $3,040 | $4,150 | $5,040 | $1,550 | $1,900 | $490 | $590 | $9,290 | $11,320 |
| | Federal | $110 | $130 | $1,500 | $1,840 | $4,950 | $6,010 | $0 | $0 | $0 | $0 | $6,560 | $7,980 |
| | Local | $0 | $10 | $80 | $100 | $1,200 | $1,460 | $270 | $330 | $80 | $100 | $1,640 | $2,000 |
| | ***Subtotal*** | **$720** | **$880** | **$4,080** | **$4,980** | **$10,240** | **$12,510** | **$1,830** | **$2,230** | **$570** | **$690** | **$17,430** | **$21,300** |

Notes:
1. Table columns and row totals may not sum correctly due to rounding.
2. Estimated totals are the sum of annual ongoing and capital investments in present value terms (2016 dollars).
3. Flood Emergency Response program does not include federal contributions because the 2017 refined SSIA portfolio only includes State and local emergency response activities. The federal government does not participate in cost share on these State and local emergency response activities.

Table 8-6. Capital State Systemwide Investment Approach Range of Investments over Time

| Flood Management Programs | | Flood Management Planning | | Floodplain Risk Management | | Flood Risk Reduction Projects | | Flood System Operations and Maintenance | | Flood Emergency Response | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) | Low ($M) | High ($M) |
| **Phase 1** | State | $0 | $0 | $870 | $1,070 | $1,280 | $1,570 | $0 | $0 | $0 | $0 | $2,160 | $2,630 |
| | Federal | $0 | $0 | $550 | $670 | $1,670 | $2,040 | $0 | $0 | $0 | $0 | $2,220 | $2,720 |
| | Local | $0 | $0 | $20 | $20 | $340 | $420 | $0 | $0 | $0 | $0 | $360 | $440 |
| | ***Subtotal*** | **$0** | **$0** | **$1,440** | **$1,770** | **$3,290** | **$4,020** | **$0** | **$0** | **$0** | **$0** | **$4,730** | **$5,790** |
| **Phase 2** | State | $0 | $0 | $900 | $1,090 | $1,300 | $1,590 | $0 | $0 | $0 | $0 | $2,200 | $2,690 |
| | Federal | $0 | $0 | $520 | $640 | $1,480 | $1,810 | $0 | $0 | $0 | $0 | $2,010 | $2,450 |
| | Local | $0 | $0 | $30 | $40 | $380 | $460 | $0 | $0 | $0 | $0 | $410 | $510 |
| | ***Subtotal*** | **$0** | **$0** | **$1,450** | **$1,770** | **$3,170** | **$3,870** | **$0** | **$0** | **$0** | **$0** | **$4,620** | **$5,650** |
| **Phase 3** | State | $0 | $0 | $590 | $720 | $900 | $1,910 | $0 | $0 | $0 | $0 | $1,490 | $2,630 |
| | Federal | $0 | $0 | $200 | $240 | $1,150 | $2,190 | $0 | $0 | $0 | $0 | $1,350 | $2,440 |
| | Local | $0 | $0 | $20 | $20 | $500 | $580 | $0 | $0 | $0 | $0 | $520 | $600 |
| | ***Subtotal*** | **$0** | **$0** | **$800** | **$980** | **$2,560** | **$4,680** | **$0** | **$0** | **$0** | **$0** | **$3,360** | **$5,660** |
| **Total** | State | $0 | $0 | $2,360 | $2,880 | $3,490 | $5,070 | $0 | $0 | $0 | $0 | $5,850 | $7,950 |
| | Federal | $0 | $0 | $1,270 | $1,550 | $4,310 | $6,050 | $0 | $0 | $0 | $0 | $5,580 | $7,600 |
| | Local | $0 | $0 | $70 | $90 | $1,220 | $1,460 | $0 | $0 | $0 | $0 | $1,290 | $1,540 |
| | ***Subtotal*** | **$0** | **$0** | **$3,700** | **$4,520** | **$9,020** | **$12,570** | **$0** | **$0** | **$0** | **$0** | **$12,720** | **$17,100** |

Notes:
1. Table columns and row totals may not sum correctly due to rounding.
2. Estimated capital investment costs are in present value (2016 $) terms.

Table 8-7. Annual Ongoing State Systemwide Investment Approach Range of Investments over Time

| Flood Management Programs | | Flood Management Planning | | Floodplain Risk Management | | Flood Risk Reduction Projects | | Flood System Operations and Maintenance | | Flood Emergency Response | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low ($M/yr.) | High ($M/yr.) | Low ($M/yr.) | High ($M/yr.) | Low ($M/yr.) | High ($M/yr.) | Low ($M/yr.) | High ($M/yr.) | Low ($M/yr.) | High ($M/yr.) | Low ($M/yr.) | High ($M/yr.) |
| **Phase 1** | State | $21 | $26 | $6 | $7 | $0 | $0 | $64 | $78 | $23 | $28 | $114 | $139 |
| | Federal | $4 | $5 | $8 | $10 | $0 | $0 | $0 | $0 | $0 | $0 | $12 | $14 |
| | Local | $0 | $0 | $0 | $1 | $0 | $0 | $11 | $14 | $1 | $1 | $13 | $16 |
| | ***Subtotal*** | **$25** | **$31** | **$14** | **$17** | **$0** | **$0** | **$75** | **$92** | **$24** | **$30** | **$138** | **$169** |
| **Phase 2** | State | $34 | $41 | $7 | $9 | $0 | $0 | $88 | $108 | $26 | $32 | $155 | $189 |
| | Federal | $6 | $7 | $13 | $16 | $0 | $0 | $0 | $0 | $0 | $0 | $19 | $23 |
| | Local | $0 | $0 | $1 | $1 | $0 | $0 | $15 | $19 | $6 | $8 | $23 | $28 |
| | ***Subtotal*** | **$40** | **$48** | **$21** | **$25** | **$0** | **$0** | **$104** | **$127** | **$32** | **$40** | **$197** | **$240** |
| **Phase 3** | State | $45 | $55 | $9 | $11 | $0 | $0 | $95 | $116 | $26 | $32 | $175 | $214 |
| | Federal | $8 | $10 | $17 | $20 | $0 | $0 | $0 | $0 | $0 | $0 | $25 | $30 |
| | Local | $0 | $1 | $1 | $1 | $0 | $0 | $17 | $21 | $7 | $8 | $25 | $30 |
| | ***Subtotal*** | **$54** | **$65** | **$26** | **$32** | **$0** | **$0** | **$112** | **$137** | **$33** | **$40** | **$224** | **$274** |

Notes:
1. Table columns and row totals may not sum correctly due to rounding.
2. Estimated ongoing annual investments are in 2016 dollars. They have not been discounted to present value nor escalated for inflation.
3. Phase 3 allocations represent the real need of annual ongoing investments within the 2017 refined SSIA portfolio. Ramping of investments shown here represent the time needed to build capacity of staff and resources for all programs other than Flood Risk Reduction Projects.
4. Present value of total ongoing investments is approximately $5 billion over 30 years.
5. Flood Emergency Response program does not include federal contributions because the 2017 refined SSIA portfolio only includes State and local emergency response activities. The federal government does not participate in cost share on these State and local emergency response activities.

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# 9.0 CVFPP Funding Plan

**Section 9 Highlights**

- Section Outline:
  - Five-Year Infrastructure Plan
  - Recommended CVFPP Funding Plan
  - Immediate Next Steps
- Key Section Takeaways:
  - New funding mechanisms are critical, and additional GO Bonds are needed.
  - Historical State, federal, and local contribution levels need to double.
  - Local, State, and federal entities must collaborate and push for legislation needed to develop new funding mechanisms and reform State implementation programs.

## 9.1 Five-Year Infrastructure Plan

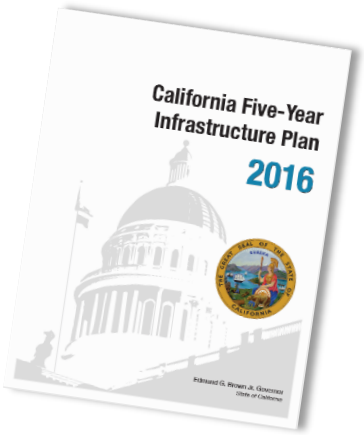
In 1999, the Legislature enacted a bill that requires the Governor, in conjunction with the Governor's Budget, to submit annually to the Legislature a proposed Five-Year Infrastructure Plan containing specified information concerning infrastructure needed by State agencies, schools, and postsecondary institutions, along with a proposal for funding the needed infrastructure.

As stated in Government Code Section 13100, the plan would identify state infrastructure needs and set out priorities for funding. The plan need not identify specific infrastructure projects to be funded, but it shall be sufficiently detailed to provide a clear understanding of the type and amount of infrastructure to be funded and the programmatic objectives to be achieved by this funding. The plan is intended to complement the existing State budget process for appropriating funds for infrastructure by providing a comprehensive guideline for the types of projects to be funded through that process. The proposal should also include identifying how the infrastructure would be funded, including but not limited to the General Fund, state special funds, federal funds, and general obligation bonds.

The Five-Year Infrastructure Plan also includes deferred maintenance. Deferred maintenance is defined as maintenance activities that have not been completed to keep state-owned facilities in an acceptable and operation condition, and that are intended to maintain or extend their useful life (Governor Brown, 2016).

In 2015, the remaining $738 million Proposition 1E bond funding for Systemwide Flood Risk Reduction, Urban Flood Risk Reduction, and Non-Urban and Small Community Flood Risk Reduction capital outlay infrastructure projects was appropriated. In addition, approximately $398.5 million was appropriated to support several infrastructure investment programs ranging from local subvention grants (statewide and in the Delta), Delta Special Projects (including ecosystem restoration), Operations and Maintenance projects (including rehabilitation and

replacement of flood control structures) and Flood Emergency Response activities (Governor Brown, 2016).




New funds are required in order for DWR to increase flood protection in the Central Valley consistent with the recommendations of the CVFPP for prioritizing flood management projects and the California Water Action Plan. As part of its obligation to help prepare the Five-Year Infrastructure Plan, DWR is providing the CVFPP funding plan recommendation for the first 5 years of the 2017 refined SSIA portfolio Phase 1 to inform the estimate for the 2017 Five-Year Infrastructure Plan. The intention of this discussion and Table 9-1 is to be able to provide this information directly into the Five-Year Infrastructure Plan. The following describes how the 2017 refined SSIA portfolio Phase 1 organization conforms to the Five-Year Infrastructure Plan, including deferred maintenance, which has been disaggregated into its own line item.

- **SPFC deferred maintenance:** includes cost estimates for repair, rehabilitation and replacement of urban, rural and small community:
  - Levees, including deferred maintenance of levee pipe penetration repairs or removal
  - Channels, including deferred giant reed and invasive *Arundo donax* removal activities
    - Minor structures such as deferred maintenance of stop logs, gated closure structures, and retaining walls
    - Major structures such as deferred maintenance of weirs and pump stations
- **Systemwide capital investments:** includes improvement of system performance, capacity and resiliency such as Yolo Bypass multi-benefit improvements , Paradise Cut multi-benefit improvements, and reservoir and floodplain storage actions.
- **Urban capital investments:** includes continued 200-year level of protection levee improvements for urban areas and enhancements to other critical infrastructure including incorporation of multi-benefit opportunities. Deferred maintenance costs were included in this category for the purposes of the 2017 refined SSIA portfolio, they have been deducted to inform the separate deferred maintenance line item.
- **Rural capital investments:** includes critical levee repair and infrastructure improvements, small-scale levee setbacks and floodplain storage for increased flow attenuation, land acquisitions and easements for future system flexibility, and incorporation of habitat restoration/reconnection opportunities. Deferred maintenance costs were included in this category for the purposes of the 2017 refined SSIA portfolio, they have been deducted to inform the separate deferred maintenance line item.
- **Small Community capital investments:** includes continued 100-year level of protection levee improvements for small communities and enhancements to other critical infrastructure, levee setbacks and land acquisitions for future flexibility of flow attenuation including incorporation of habitat restoration opportunities. Deferred maintenance costs were included in this category for the purposes of the 2017 refined SSIA portfolio, they have been deducted to inform the separate deferred maintenance line item.

Table 9-1. Proposed 2017 Five Year Infrastructure Plan, Average Annual Estimate ($M/year)

| Department of Water Resources | Fiscal Year 1 (2017-2018) | Fiscal Year 2 (2018-2019) | Fiscal Year 3 (2019-2020) | Fiscal Year 4 (2020-2021) | Fiscal Year 5 (2021-2022) | Potential Funding Sources |
|---|---|---|---|---|---|---|
| *Deferred Maintenance* | | | | | | |
| Repair, Rehabilitation and Replacement | $21 | $21 | $21 | $21 | $21 | State GF, State GO Bonds Local |
| **Deferred Maintenance Total:** | **$21** | **$21** | **$21** | **$21** | **$21** | |
| *Capital* | | | | | | |
| Systemwide – Yolo Bypass multi-benefit improvements | $103 | $103 | $103 | $103 | $103 | State GO Bonds, USACE, Sac/SJ Drainage District |
| Systemwide – Paradise Cut multi-benefit improvements | $3 | $3 | $3 | $3 | $3 | State GO Bonds, USACE, Sac/SJ Drainage District |
| Systemwide – Reservoir and floodplain storage | $28 | $28 | $28 | $28 | $28 | State GO Bonds, federal (e.g., USACE, Reclamation etc.), Sac/SJ Drainage District, Local |
| **Systemwide Subtotal:** | **$133** | **$133** | **$133** | **$133** | **$133** | |
| Urban – Levee improvements | $184 | $184 | $184 | $184 | $184 | State GO Bonds, USACE, Local |
| Urban – Other infrastructure and multi-benefit improvements | $35 | $35 | $35 | $35 | $35 | State GO Bonds, USACE, Local |
| **Urban Subtotal:** | **$219** | **$219** | **$219** | **$219** | **$219** | |
| Rural – Levee repair and infrastructure improvements | $57 | $57 | $57 | $57 | $57 | State GF, State GO Bonds, USACE, Local |
| Rural – Small-scale levee setbacks and floodplain storage | $17 | $17 | $17 | $17 | $17 | State GO Bonds, USACE, Local |
| Rural – Land acquisitions and easements | $34 | $34 | $34 | $34 | $34 | State GO Bonds, FEMA |
| Rural – Habitat restoration/reconnection | $20 | $20 | $20 | $20 | $20 | State GO Bonds, USACE |
| **Rural Subtotal:** | **$128** | **$128** | **$128** | **$128** | **$128** | |
| Small Community – Levee repair and infrastructure improvements | 21 | 21 | 21 | 21 | 21 | State GO Bonds, USACE |
| Small Community – Levee setbacks, land acquisitions, and habitat restoration | $5 | $5 | $5 | $5 | $5 | State GF, USACE |
| **Small Community Subtotal:** | **$25** | **$25** | **$25** | **$25** | **$25** | |
| **Capital Total:** | **$505** | **$505** | **$505** | **$505** | **$505** | |

Note:
1. Phase 1 cost estimates were divided by the 10-year period to calculate the above average annual estimate. It is likely that years 3-5 will be more than years 1 and 2. However, a straight line projection was used for now.

## 9.2 Recommended CVFPP Funding Plan

### 9.2.1 Guidance from the Financial Model

Section 7 explored a variety of potential funding scenarios for implementing the CVFPP. These scenarios considered investment priorities, availability and applicability of funding mechanisms, and other influential factors in order to explore tradeoffs between available funds, cost shares, and investment phasing. Influential factors included: historical expenditures, political sentiment, potential cost-share ranges, project magnitude and scope, and ability and willingness to pay.

These scenarios implied that funding the full 2017 refined SSIA portfolio would require a State cost share of somewhere between 54 and 62%, a federal cost share of between 26 and 36%, and a local cost share of between 8 and 14%. The recommended CVFPP funding plan for fully funding the 2017 refined SSIA portfolio over 30 years is largely guided by Scenario 4d (Section 7). Table 9-2 compares Scenario 4d's use of funding mechanisms in Phase 1 and 2 to the revenue generation potential for these mechanisms summarized in Section 6. As shown below, the burden on each funding mechanism in this scenario falls within (or very close to) its potential revenue generating range as described in Section 6.

Table 9-2. Funding Mechanism Contributions by Phase ($M/Year, 2016 dollars)

| | State GF | State GO Bonds | State River Basin Assess | State Flood Insurance Program | Sac/SJ Drainage District | Local | FEMA | USACE and Federal Ecosystem Programs |
|---|---|---|---|---|---|---|---|---|
| **Phase 1** | $138 | $230 | | | $15 | $37 | $8 | $252 |
| **Phase 2** | $160 | $224 | $15 | $15 | $20 | $42 | $10 | $245 |
| **Phase 3** | $190 | $223 | $20 | $15 | $25 | $46 | $11 | $256 |
| **Revenue Generating Potential** | $128 in Phase 1; $160 in Phase 2 | $150 - $300 | $25 | $12 | $10 - $50 | $28 - $78* | $5 - $15 | $100 - $260 |

Notes:
1. The total revenue generation capacity of the Sac/SJ Drainage District and Local Assessments is $78 million annually. Any revenue generated by the Sac/SJ Drainage district must be subtracted from 78 in order to generate the true Local revenue generation potential. In this case, the total local burden averages $52 million per year in Phase 1, and $62 million per year in Phase 2, well below the upper threshold of $78 million.
2. Revenue generating potential for each funding mechanism is described in Section 6.

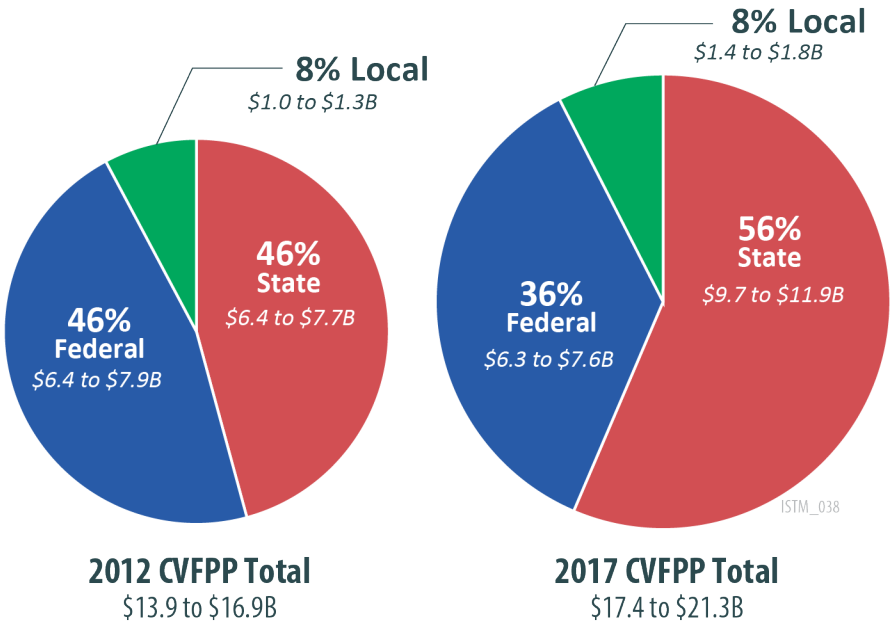
Scenario 4d noticeably relies on federal sources and the State general fund for funding amounts much closer to the upper limit of revenue generation potential than it does of GO Bonds and local sources. The push for more federal investment (over large GO Bonds) was chosen as a guide to the recommended CVFPP funding plan because federal entities are just beginning a shift towards including multi-benefit and ecosystem investments in the Central Valley in a way that California voters have already done with current levels investment from recent GO Bonds. Large federal programs in the Florida Everglades, the Louisiana Coastal Area, and the Great Lakes

already spend significant sums of money on actions with ecosystem and other benefits beyond economic performance, in a way that has not yet been matched in California's Central Valley. This suggests there is a larger degree of untapped potential for a much higher level of participation from the USACE and other federal entities on multi-benefit flood projects in California, than there is from State voters and GO Bonds.

The general fund contribution in Phase 1 exceeds the revenue generating potential. This high level of reliance on the general fund in Phase 1 in this scenario is due to the fact that no new funding mechanisms are available to share the burden of a much higher level of investment in ongoing activities. This is one example of the way that models can be used to guide recommendations, but are not presumed to represent the final strategy. The recommended funding plan (discussed below) considers some ways to slightly ease this general fund burden during the first 10 years of investment, so that the general fund contributes is within the revenue generation potential capacity.

Figure 9-1 presents Scenario 4d's cost shares for federal, State, and local investment in the 2017 refined SSIA portfolio, and compares them to CVFPP cost shares as estimated in 2012. The State's estimated share of the SSIA has increased, whereas the federal share has decreased. The 2017 refined SSIA portfolio also has greater investment needs identified for rural and small communities compared to 2012. It is anticipated that these types of investments are less likely to meet current federal guidelines for federal participation, so these costs shifted more to the State.

Figure 9-1. 2012 and 2017 Cost Share Comparisons




Notes:

1. 2017 CVFPP Totals reflect annual ongoing investments in present value terms (2016 dollars) and summed with present value capital investment costs.
2. 2012 CVFPP Totals are from Table 4.3 in the 2012 CVFPP.

With the overall cost shares in mind for all cost sharing partners, there are cost shares associated with each management action category for both capital and ongoing investments. Table 9-3 and Table 9-4 presents the estimated cost shares between federal, State, and local for the capital investments and ongoing investments of the 2017 refined SSIA portfolio, respectively.

Table 9-3. Estimated Capital Investment Cost Shares

| Management Action Category and Area of Interest | State | Federal | Local |
|---|---|---|---|
| Systemwide | | | |
| Yolo Bypass multi-benefit improvements | 48% | 50% | 2% |
| Feather River–Sutter Bypass multi-benefit improvements | 50% | 50% | 0% |
| Paradise Cut multi-benefit improvements | 48% | 50% | 2% |
| Reservoir and floodplain storage | 20% | 75% | 5% |
| Urban | | | |
| Levee improvements | 22% | 65% | 13% |
| Other infrastructure and multi-benefit improvements | 22% | 65% | 13% |
| Rural | | | |
| Levee repair and infrastructure improvements | 63% | 14% | 23% |
| Small-scale levee setbacks and floodplain storage | 65% | 30% | 5% |
| Land acquisitions and easements | 90% | 10% | 0% |
| Habitat restoration/reconnection | 70% | 30% | 0% |
| Small Community | | | |
| Levee repair and infrastructure improvements | 80% | 20% | 0% |
| Levee setbacks, land acquisitions, and habitat restoration | 80% | 20% | 0% |
| **Capital Cost Share Total** | **47%** | **46%** | **7%** |
| **30-year Capital and Ongoing Cost Share Total** | **56%** | **36%** | **8%** |

Table 9-4. Estimated Ongoing Investment Cost Shares

| Management Action Category and Area of Interest | Local | State | Federal |
|---|---|---|---|
| Systemwide | | | |
| State operations, planning and performance tracking | 0% | 100% | 0% |
| Emergency management | 16% | 84% | 0% |
| Reservoir operations | 0% | 100% | 0% |
| Routine maintenance | 17% | 83% | 0% |
| Urban | | | |
| Risk awareness, floodproofing and land use planning | 5% | 45% | 50% |
| Studies and analysis | 14% | 21% | 65% |
| Rural | | | |
| Risk awareness, floodproofing and land use planning | 5% | 28% | 67% |
| Studies and analysis | 5% | 30% | 65% |
| Small Community | | | |
| Risk awareness, floodproofing and land use planning | 0% | 25% | 75% |
| Studies and analysis | 0% | 35% | 65% |
| **Ongoing Cost Share Total** | **11%** | **79%** | **10%** |
| **30-year Capital and Ongoing Cost Share Total** | **8%** | **56%** | **36%** |

### 9.2.2 Contributions from Recommended Funding Mechanisms

CVFPP investments are divided into three 10-year phases generally described below. Table 9-5 gives an overview of the recommended funding mechanisms for the capital and ongoing investment types within the 2017 refined SSIA portfolio in each phase. Table 9-6 and Table 9-7 provide additional detail, showing how each management action category is funded during each of the three phases. The recommended investment in Phase 1 has been adjusted slightly from the model results for Scenario 4d. For example, all State contributions to capital investments in Phase 1 would be funded with GO Bonds rather than State general fund to help ease the burden on the general fund in this early phase of investment. Some funds in Phases 2 and 3 would also be shifted from the State flood insurance program to the river basin assessment, because the river basin assessment has slightly higher revenue generation potential than the insurance program.

Table 9-5. Recommended Timing of CVFPP Investments shown by Average Annual Expenditures in by each Phase ($M/yr, 2016 dollars)

| | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| **Focus** | **Reactively** address the highest levels of risk to lives and assets concentrated in the densely populated areas | **Actively** transition to more balanced investments | **Proactively** balance flood investments for both capital and ongoing activities in a sustainable manner |
| **Anticipated Duration** | 2017 to 2027 | 2027 to 2037 | 2037 to 2047 |
| **Capital Investment** | | | |
| **Capital Revenue Sources** | ■ State<br>▸ $4M/year Sacramento/San Joaquin Drainage District (once established)<br>▸ 2020s $2.5B GO Bond<br>■ Federal<br>▸ $240M/year USACE<br>▸ $4M/year FEMA<br>■ Local<br>▸ $35 M/year of local revenues | ■ State<br>▸ $9M/year general fund<br>▸ $4M/year Sacramento/San Joaquin Drainage District<br>▸ $1M/year State river basin assessment (once established)<br>▸ $8M/year State flood insurance program (once established)<br>▸ 2030s $2.5B GO Bond<br>■ Federal<br>▸ $230M/year USACE<br>▸ $4M/year FEMA<br>■ Local<br>▸ $33M/year local revenue | ■ State<br>▸ $19M/year general fund<br>▸ $6M/year Sacramento/San Joaquin Drainage District<br>▸ $4M/year river basin assessment<br>▸ $8M/year state flood insurance program<br>▸ 2040s $2.5B GO Bond<br>■ Federal<br>▸ $240M/year USACE<br>■ Local<br>▸ $37M/year local revenue |
| **Ongoing Investment** | | | |
| **Ongoing Revenue Sources** | ■ State<br>▸ $126M/year general fund<br>▸ $12M/year Sacramento/San Joaquin Drainage District<br>■ Federal<br>▸ $9M/year USACE<br>▸ $4M/year FEMA<br>■ Local<br>▸ $3M/year local revenue | ■ State<br>▸ $151M/year general fund<br>▸ $16M/year Sacramento/San Joaquin Drainage District<br>▸ $17M/year State river basin assessment (once established)<br>▸ $4M/year State flood insurance program (once established)<br>■ Federal<br>▸ $14M/year USACE<br>▸ $7M/year FEMA<br>■ Local<br>▸ $9M/year local revenue | ■ State<br>▸ $171M/year general fund<br>▸ $18M/year Sacramento/San Joaquin Drainage District<br>▸ $21M/year State river basin assessment (once established)<br>▸ $4M/year State flood insurance program (once established)<br>■ Federal<br>▸ $18M/year USACE<br>▸ $9M/year FEMA<br>■ Local<br>▸ $9M/year local revenue |

Notes:
1. These values represent contributions from these sources towards CVFPP implementation, and do not represent the marginal increase for these sources relative to current levels of expenditures towards CVFPP-related investments. For example, a total of $38 million a year is needed from local revenues in Phase 1. This represents only about a $10 million per year increase from current spending on CVFPP-related expenditures (like RR&R).
2. Estimated values are in 2016 dollars, and are annual averages over each 10-year period.
3. General Obligation Bond (GO Bond): GO Bonds issued by the State of California are full faith and credit bonds pledged by the State's general fund instead of tax revenue, and require majority voter approval.
4. Phase 3 allocations represent the real need of annual ongoing investments within the 2017 refined SSIA portfolio. Ramping of investments shown here represent needed capacity building of staff and resources.

Table 9-6. Recommended Capital Investment Timing by Funding Mechanism ($M, 2016 dollars)

| Action Type and Area of Interest | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| Systemwide | | | |
| Yolo Bypass multi-benefit improvements | State GO Bonds: $491<br>USACE: $511<br>Sac/SJ Drainage District: $20 | State GO Bonds: $491<br>USACE: $511<br>Sac/SJ Drainage District: $20 | State GO Bonds: $109<br>USACE: $114<br>Sac/SJ Drainage District: $5 |
| Feather River–Sutter Bypass multi-benefit improvements | | | State GO Bonds: $1150<br>USACE: $1150 |
| Paradise Cut multi-benefit improvements | State GO Bonds: $15<br>USACE: $15<br>Sac/SJ Drainage District: $1 | State GO Bonds: $133<br>USACE: $139<br>Sac/SJ Drainage District: $6 | |
| Reservoir and floodplain storage | State GO Bonds: $55<br>USACE: $206<br>Sac/SJ Drainage District: $14 | State GO Bonds: $55<br>USACE: $206<br>Sac/SJ Drainage District: $14 | State GO Bonds: $11<br>State Flood Insurance Program: $44<br>USACE: $206<br>Sac/SJ Drainage District: $14 |
| Urban | | | |
| Levee improvements | State GO Bonds: $415<br>USACE: $1196<br>Local: $229 | State GO Bonds: $442<br>USACE: $1196<br>Local: $202 | State GO Bonds: $173<br>USACE: $598<br>Local: $149 |
| Other infrastructure and multi-benefit improvements | State GO Bonds: $94<br>USACE: $226<br>Local: $28 | State GO Bonds: $5<br>USACE: $12<br>Local: $1 | State GO Bonds: $2<br>USACE: $59<br>Sac/SJ Drainage District: $30 |
| Rural | | | |
| Levee repair and infrastructure improvements | State GO Bonds: $495<br>USACE: $115<br>Local: $77 | State GO Bonds: $396<br>State Flood Insurance Program: $19<br>USACE: $96<br>Local: $123 | State GO Bonds: $211<br>USACE: $66<br>Local: $224<br>Sac/SJ Drainage District: $14 |
| Small-scale levee setbacks and floodplain storage | State GO Bonds: $111<br>USACE: $51<br>Local: $9 | State GO Bonds: $6<br>USACE: $3 | State GO Bonds: $11<br>USACE: $5<br>Local: $1 |
| Land acquisitions and easements | State GO Bonds: $306<br>FEMA: $34 | State GO Bonds: $306<br>FEMA: $34 | State GO Bonds: $94<br>State Flood Insurance Program: $23<br>State River Basin Assess: $36<br>FEMA: $17 |
| Habitat restoration/ reconnection | State GO Bonds: $137<br>USACE: $59 | State GO Bonds: $14<br>USACE: $6 | State GO Bonds: $46<br>USACE: $20 |
| Small Community | | | |
| Levee repair and infrastructure improvements | State GO Bonds: $181<br>USACE: $45 | State GO Bonds: $362<br>State River Basin Assess: $7<br>USACE: $92 | State GO Bonds: $281<br>State River Basin Assess: $3<br>USACE: $71 |
| Levee setbacks, land acquisitions, and habitat restoration | State GO Bonds: $37<br>USACE: $9 | State GF: $94<br>State GO Bonds: $30<br>State Flood Insurance Program: $60<br>USACE: $46 | State GF: $186<br>State GO Bonds: $143<br>State Flood Insurance Program: $15<br>USACE: $86 |
| **Total** | State GO Bonds: $2416<br>USACE: $2434<br>FEMA: $34<br>Local: $342<br>Sac/SJ Drainage District: $35<br>**Total: $5261** | State GF: $94<br>State GO Bonds: $2240<br>State Flood Insurance Program: $80<br>State River Basin Assess: $7<br>USACE: $2307<br>FEMA: $34<br>Local: $327<br>Sac/SJ Drainage District: $40<br>**Total: $5129** | State GF: $186<br>State GO Bonds: $2230<br>State Flood Insurance Program: $82<br>State River Basin Assess: $39<br>USACE: $2375<br>FEMA: $17<br>Local: $374<br>Sac/SJ Drainage District: $62<br>**Total: $5366** |

Table 9-7. Recommended Ongoing Investment Timing by Funding Mechanism ($M/year, 2016 dollars)

| Action Type and Area of Interest | Phase 1 | Phase 2 | Phase 3 |
|---|---|---|---|
| **Systemwide** | | | |
| State operations, planning and performance tracking | State GF: $21.4 | State GF: $34 | State GF: $45.6 |
| Emergency management | State GF: $25.7<br>Local: $1.4 | State GF: $28.9<br>Local: $7.2 | State GF: $28.9<br>Local: $7.2 |
| Reservoir operations | State GF: $10.7 | State River Basin Assess: $14.3 | State River Basin Assess: $14.3 |
| Routine maintenance | State GF: $60.2<br>Local: $0.8<br>Sac/SJ Drainage District: $11.5 | State GF: $83.8<br>Local: $1.1<br>Sac/SJ Drainage District: $16 | State GF: $91.5<br>Sac/SJ Drainage District: $18 |
| **Urban** | | | |
| Risk awareness, floodproofing and land use planning | State GF: $3.4<br>USACE: $3.8<br>Local: $0.4 | State Flood Insurance Program: $4<br>State River Basin Assess: $1.2<br>USACE: $5.4<br>Local: $0.5 | State Flood Insurance Program: $4<br>State River Basin Assess: $3.9<br>USACE: $6.4<br>Local: $0.6 |
| Studies and analysis | State GF: $0.3<br>USACE: $0.7<br>Local: $0.1 | State GF: $0.4<br>USACE: $1.1<br>Local: $0.2 | State GF: $0.3<br>USACE: $1.4<br>Local: $0.4 |
| **Rural** | | | |
| Risk awareness, floodproofing and land use planning | State GF: $1.3<br>USACE: $0.8<br>Local: $0.1 | State GF: $0.7<br>USACE: $2.6<br>Local: $0.2 | State GF: $1<br>USACE: $3.7<br>Local: $0.2 |
| Studies and analysis | State GF: $0.1<br>FEMA: $0.1 | State GF: $0.2<br>FEMA: $0.4 | State GF: $0.3<br>FEMA: $0.7 |
| **Small Community** | | | |
| Risk awareness, floodproofing and land use planning | State GF: $1.4<br>FEMA: $4.3 | State River Basin Assess: $2.2<br>FEMA: $6.6 | State River Basin Assess: $3.8<br>FEMA: $8.5 |
| Studies and analysis | State GF: $1.8<br>USACE: $3.4 | State GF: $2.8<br>USACE: $5.1 | State GF: $3.7<br>USACE: $6.9 |
| **Total:** | State GF: $126<br>USACE: $9<br>FEMA: $4<br>Local: $3<br>Sac/SJ Drainage District: $12<br>**Total: $154** | State GF: $151<br>State Flood Insurance Program: $4<br>State River Basin Assess: $17<br>USACE: $14<br>FEMA: $7<br>Local: $9<br>Sac/SJ Drainage District: $16<br>**Total: $218** | State GF: $171<br>State Flood Insurance Program: $4<br>State River Basin Assess: $21<br>USACE: $18<br>FEMA: $9<br>Local: $9<br>Sac/SJ Drainage District: $18<br>**Total: $249** |

### 9.2.3 Long-Term Funding Actions

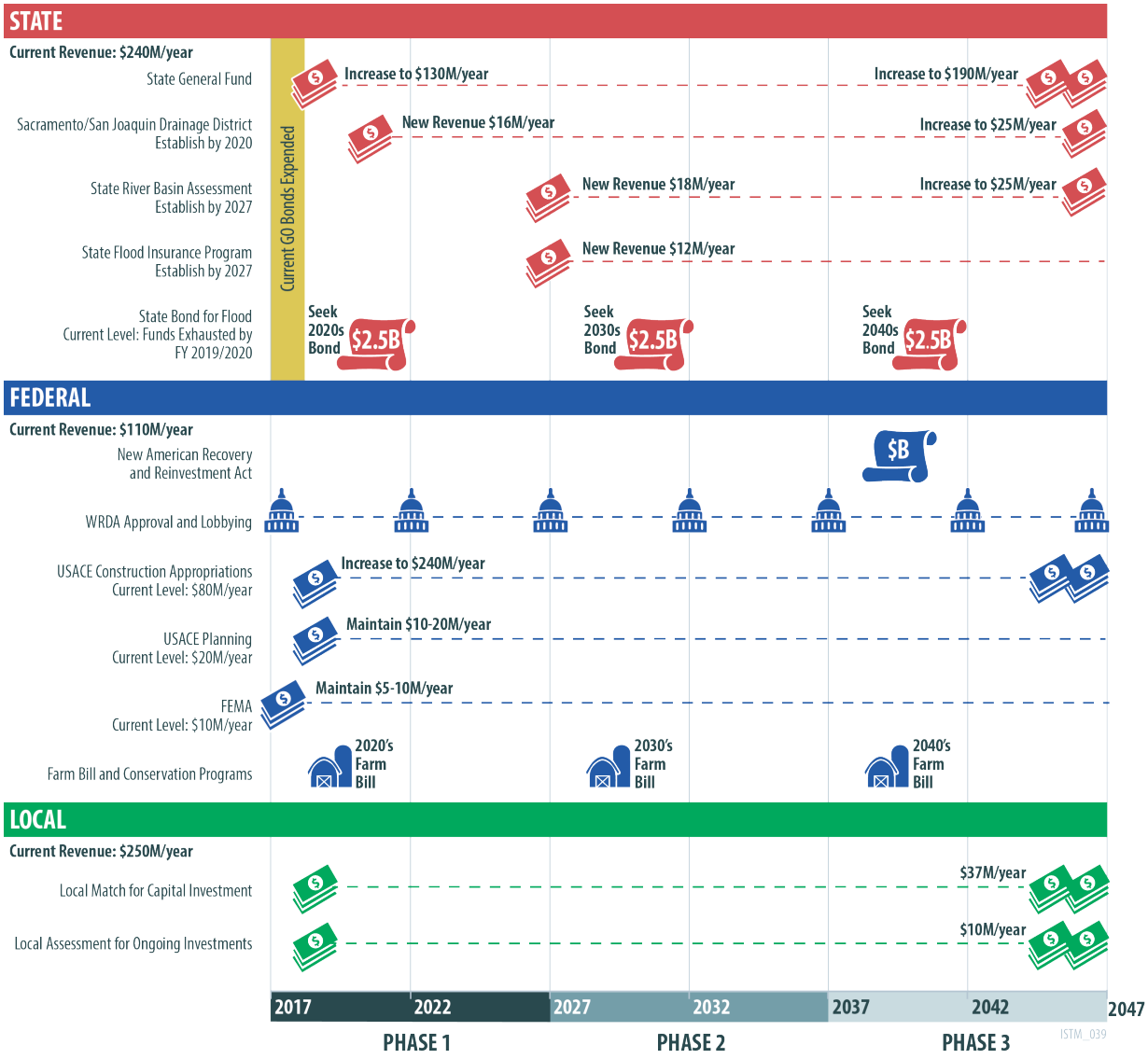
To implement the CVFPP over the next 30 years, larger contributions will be required from all entities. Figure 9-2 outlines recommended funding and phasing of funding for each cost share partner to support the CVFPP funding plan. The information is presented this way to demonstrate when funding mechanisms could be available and how much would be needed. The recommended CVFPP funding plan would take advantage of existing revenue sources and needed increases in revenue-generation capacity.

For the State, this would include a much larger contribution from the General Fund and successfully passing new State bonds. The three bonds would be unprecedented in the amount of funding requested and frequency for flood-specific investments: an estimated 10-year frequency tied to overall State capacity to implement flood management system improvements. Time and effort would be required to develop new funding mechanisms, including evaluating the feasibility of a State flood insurance program and implementing a river basin assessment program. In addition, the Sacramento and San Joaquin Drainage District could be investigated as a potential vehicle to implement an assessment at a broad scale.

For the federal government, contributions from the USACE would need to increase from current levels. This requires the State to effectively promote the CVFPP, likely seeking federal authorizations through the WRDA and annual appropriations from Congress to fund the authorized projects. FEMA contributions could remain at current levels. The NRCS programs (such as the Farm Bill and Conservation Programs) could also provide some funds for flood management and ecosystem restoration projects.

Local entities would also need to generate funds to provide the local match for federal and State capital investments. Locals would also need to generate more funds for their share of ongoing costs.

Figure 9-2. Recommended Funding Plan Timeline for CVFPP




Notes:

1. Although revenues from the Sacramento/San Joaquin Drainage District would be generated from locals within the district boundaries, it would require action by the California State Legislature to implement. This is why this funding mechanism appears as a State mechanism.
2. Current State contributions include approximately $40M/year from the General Fund and current GO Bond funding from Prop 84 and 1E.
3. Current local contributions to capital and ongoing investment are unknown.

Additional funding sources might be required to manage and improve the flood management system into the future. However, additional funding alone is not enough; flood management policy issues present longstanding impediments to achieving full implementation of the CVFPP that must be addressed. To promote progress toward addressing these longstanding impediments, the eight primary flood management policy issues are identified and discussed in the 2017 CVFPP Update (DWR, 2016). Funding is one of the eight policy issues and is focused around the longer term actions presented in Figure 9-2. Recommendations to address the funding policy issue and achieve the CVFPP Funding Plan are listed below. Recommended actions are a compiled list of longer-term recommendations with supporting details and recommended participating agencies. Where applicable, potential participating agencies are denoted as State (S), federal (F), and local (L). Future creation of work plans to collectively address all eight flood management policy issues will drive toward near-term implementation progress. The funding policy issue work plan is discussed in more detail in Section 9.2.4.

## Recommendations for Funding

Issue Summary: Insufficient and unstable flood management funding has led to delayed investment and greater risk to life and property.

### Recommended Actions:

- Continue to closely coordinate with State agencies, to generate State funding and support for CVFPP's flood investments.
  - **Seek increased appropriation from the State general fund and pursue general obligation bonds (S/L).** It is recommended that appropriations from the State general fund for Central Valley flood management increase from the $40M currently expected to $190M annually by the end of the 30-year period. General obligation bonds could be used to fund some of the more critical flood risk reduction projects, including the completion of the Yolo Bypass expansion. The CVFPP funding plan recommends pursuing flood management funding in three bond issues. The first issue of $2.5 billion would be targeted for the 2020 election, the second issue of $2.5 billion approximately a decade later, and the third issue of $2.5 billion a decade after that.
  - **Reutilize the Sacramento and San Joaquin Drainage District (S/L).** The Sacramento and San Joaquin Drainage District is currently in the Water Code to fund capital projects. It has been nearly 80 years since this district generated funds. The ability of the district to conduct assessments should be reutilized, with legislative changes necessary to allow revenue generated to be used for O&M and capital projects. The CVFPP funding plan assumes this mechanism would begin in approximately 2020 and could potentially generate $25M/year by the end of the 30-year period.
  - **Establish a State river basin assessment (S).** IWM is the focus of this type of assessment, and the State should develop a watershed approach to managing and funding projects. For example, a river basin assessment would return money to the watershed, to be shared across the IWM activities. The CVFPP funding plan assumes that this mechanism could begin in Phase 2 and potentially generate $25M/year by the end of the 30-year period.

- **Establish a State flood insurance program (S).** Following the evaluation of the statewide flood insurance as described in the floodplain and land use management recommendations, a new approach to insurance could potentially generate funds to reduce flood risk while providing the same level of financial protection as offered by the NFIP. The CVFPP funding plan assumes that $12M/year of potential revenue from this mechanism could begin in Phase 2. A state flood insurance program could use a portion of the premiums to reduce flood risk by contributing funds for flood management system repairs, improvements, and flood risk mapping and notification. Another version of this could be a local basin-wide insurance program. This could potentially be a companion program with a statewide flood insurance program. Any new program should also consider insurance for agricultural properties. All of these potential uses of funds from a State flood insurance program would need to be further evaluated.
- **Track outcomes from flood investments to demonstrate value (S).** Outcomes from local, State, and federal investments should be tracked to demonstrate the value of their actions through annual progress reports. These reports can help inform updates to the California Water Plan and California's Five-year Infrastructure Plan.
- **Commit to annually updating California's Five-year Infrastructure Plan (S).** DWR will provide the necessary annual budget information regarding flood system ongoing and capital investments to the California Department of Finance for incorporation into the California's Five-year Infrastructure Plan, which compiles all infrastructure needs, including water, flood, transportation, and others, across the State. Incorporate infrastructure life-cycle analysis per California Executive Order B-30-15.

- Continue to closely coordinate with federal agencies, to generate federal funding and support for CVFPP's flood investments.
  - **Establish a strategic, integrated flood management approach for California's Central Valley (S/F/L).** A strategic, integrated approach that emphasizes cooperation across all levels of government is required. This would require USACE programmatic authorities to conduct project budgeting and planning on a systemwide/watershed basis to streamline the time and reduce the costs incurred by all levels of government in managing California's flood risks. This should reduce transactional costs and avoid redundancy in programs. This recommendation would stretch the spending for State operations, planning, and performance tracking. This should also include federal funding for IWM science and services. DWR should continue to support language in upcoming federal water infrastructure legislation that would authorize the USACE, in coordination with other federal, State, and local agencies, to develop watershed-based flood-risk planning and budgeting for projects across multiple communities and regions. Similar programs include the Greater Mississippi River Basin, the Comprehensive Everglades Restoration Program, and the Chesapeake Bay Program.
  - **Seek Congressional Support of State-sponsored projects in federal water infrastructure legislation (S/F/L).** The State should seek Congressional support for State-sponsored flood risk reduction and ecosystem restoration projects in federal water infrastructure legislation. Several State-sponsored flood risk and ecosystem restoration projects would benefit from continued Congressional support.

- **Seek guidance clarification for USACE project credit usage (F).** The State will seek guidance clarification (or modification) from USACE for implementing Section 1020 of the WRDA 2014. Currently, credits can be utilized only after completion of the Integral Determination Reports and approval by the Secretary. The approvals should be delegated to the District or Division Commander level. The USACE can use the CVFPP to help demonstrate the appropriateness for this determination. The guidance could also be modified to allow the use of credits prior to project completion. This would help maximize the leveraging of local dollars.
- **Support integration of federal and State floodplain management policies (S/F).** To prevent continued risk intensification in deep floodplains, the State supports integration of federal and State floodplain management policies to facilitate consistency. Ongoing trends for urbanization behind levees originally intended only for rural flood protection have brought the issue of risk intensification in deep floodplains in California to the forefront. As part of this, the State should seek Congressional support for USACE and FEMA to develop plans and encourage additional investments in rural flood risk management. This should include risk awareness, easements, ecosystem restoration, as well as sustaining agriculture in the floodplain
- **Seek Federal support for flood risk reduction and for ecosystem improvements in rural areas (S/F/L).** Bringing more federal dollars to the Central Valley for flood risk reduction and ecosystem improvements in rural areas will likely have to take a different approach in how projects are approved or selected. It is typically very difficult to meet the benefit-cost ratio requirements for these types of projects using current guidelines. Current guidelines tend to favor projects in an urban area. The State supports USACE developing a project funding approach that takes into account more of the qualitative and other non-monetary benefits to support land productivity for agricultural and ecosystem purposes. The approach could also recognize that support of agriculture helps prevent risk intensification in rural areas.
- **Support annual contribution to 2017 refined SSIA portfolio (S/F/L).** To implement the 2017 refined SSIA portfolio within 30 years would require a federal contribution of 36% (mostly through USACE), ramping up to $260 million per year. This would require the State to effectively lobby the federal government for inclusion into federal water infrastructure legislation on an ongoing basis and secure annual appropriations from USACE. The State would also seek funding available from United States Department of Agriculture (USDA) at current levels through NRCS.

- Continue to closely coordinate with local agencies, to generate local funding for CVFPP investments. If more revenue is requested from the federal and state governments, local governments would also need to raise additional revenue to meet increased O&M and their cost-share requirements.
  - **Pursue a coordinated effort to amend Proposition 218 (S/L).** There have been many attempts to amend Proposition 218 requirements so that flood control can be treated similar to water, sewer, and sanitation utilities. A coordinated effort could make the process of raising assessments for flood control agencies similar to other utilities. Additionally, local flood risk awareness campaigns and accomplishments reporting have been effective in increasing local support for funding flood management system improvements.

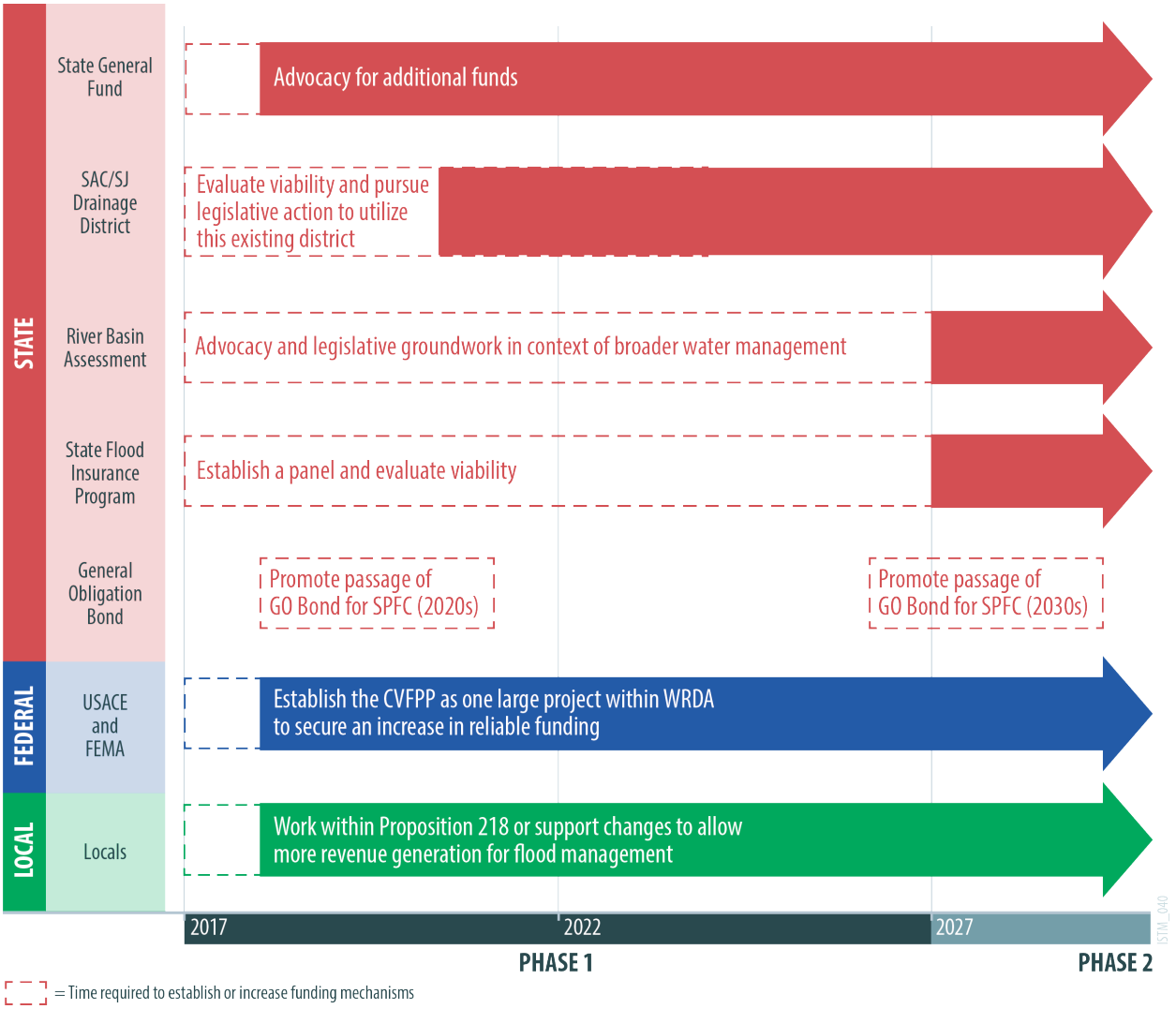
- **Increase assessments to meet cost-share requirements (L).** Local agencies may increase their assessments to meet cost-share requirements for the proposed projects and their share of O&M.

### 9.2.4 Near-Term Funding Actions

To be as efficient as possible with limited funding, a strategic, integrated approach that emphasizes cooperation across all levels of government is required. All cost-sharing partners would need to contribute significantly more than they have in the past, as historical revenue sources would only be able to fund approximately 47% of needed flood system investment, or closer to 20% if no additional GO Bonds are passed. With the large investment recommended for implementation of the CVFPP, it is imperative for local and State entities to being coordinating immediately in seeking the legislative and programmatic changes necessary to bring about increased funding and develop new funding mechanisms. Local and State entities must also begin immediately working with the USACE and other federal partners to seek increased federal funds for Central Valley flood management.

Each funding mechanism in the CVFPP funding plan requires some level of groundwork to establish and/or be implemented. Figure 9-3 illustrates the actions necessary to initiate each potential funding mechanism, along with the estimated date the funding would become available. The State and its partners must work closely together over the next few years to initiate these actions so that additional funding can be realized beyond current levels. The next section outlines the near-term funding actions that are necessary for implementation to proceed.

Figure 9-3. Ten-year Recommended Funding Actions for CVFPP



To effectively address the flood management policy issues described in the 2017 CVFPP Update, a series of work plans are being developed to provide a consistent framework and to drive CVFPP implementation progress. With funding being one of the most important policy issues, a great deal of work has already been initiated and presented in this CVFPP investment strategy. To provide more detail on the near-term funding actions presented in 10-year recommended funding actions for CVFPP, a funding work plan is necessary.

The funding work plan should include a description of what actions would be taken, who would lead or participate in the action (State, federal, and local partners), and when the action would be initiated and completed, if sufficient resources are available. The funding work plan should ultimately build upon the CVFPP investment strategy and define a path for activities for State, federal and local partners to work towards the next CVFPP Update. Table 9-8 provides a preliminary funding work plan that presents near-term actions needed to implement the funding mechanisms required for the CVFPP funding plan.

## Table 9-8. Preliminary Funding Work Plan

| Funding Flood Management Policy Issue | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Funding Mechanism | Near-Term Actions | Initiation Timeframe | | | | | | Lead Agency Responsible | | |
| | | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | State | Federal | Local |
| State General Fund | ■ Advocate for increased General Fund dollars by a budget change proposal for fiscal year 2017-2018 with 2017 CVFPP Update as justification. | X | | | | | | X | | |
| Sacramento and San Joaquin Drainage District | ■ Establish a committee to evaluate the reutilization and updating of the Sacramento and San Joaquin Drainage District to conduct assessments to increase the State's ability to more reliably fund ongoing activities. | X | | | | | | X | | |
| | ■ Craft legislation that reutilizes the Sacramento and San Joaquin Drainage District. | | X | | | | | X | | |
| State River Basin Assessment | ■ Evaluate State river basin assessment as a supplement/replacement to the IRWM program. | | X | | | | | X | | |
| | ■ Establish a committee to evaluate the implementation of a State river basin assessment. | | X | | | | | X | | |
| | ■ Craft legislation that implements a State river basin assessment. | | | | | X | | X | | |
| State Flood Insurance Program | ■ Establish a panel to evaluate the feasibility of a State (or regional) flood insurance program. | | X | | | | | X | | |
| | ■ Craft legislation that implements a State flood insurance program. | | | | | X | | X | | |
| State General Obligation Bond | ■ Demonstrate the need and appropriateness for a new flood-focused GO bond to fund capital improvements that reduce flood risk across the Central Valley. | X | | | | | | X | | |
| | ■ Pass a new flood-focused GO bond to fund capital improvements that reduce flood risk across the Central Valley. | | | X | | | | X | | |
| USACE and FEMA | ■ Advocate for the CVFPP for inclusion in USACE's budgets, need to establish a presence in Washington, D.C. | X | | | | | | X | | |
| | ■ Establish the CVFPP as one large project within WRDA to secure an increase in reliable funding | X | | | | | | | X | |
| | ■ Partner and engage with FEMA to increase investments in non-structural risk mitigation actions | X | | | | | | X | X | |
| Locals | ■ Pursue a coordinated effort to amend Prop 218. | X | | | | | | X | | X |
| | ■ Increase assessments to provide local cost-share. | | X | | | | | | | X |

Note:

1. Near-term actions are contingent upon sufficient resources being available to complete those actions.

## 9.3 Immediate Next Steps

Several immediate steps are needed following the proposed adoption of the 2017 CVFPP Update to seek funding for the 2017 refined SSIA portfolio (aside from development of a funding work plan). Immediate next steps for DWR and the CVFPB to take could include the following:

1. Expedite capabilities of the State to allocate remaining Proposition 1E and 84 funds to appropriated programs in Fiscal Years 2016-2017 and 2017-2018. This would include the expansion of State staffing levels and resources.

2. Expedite the Governor's announced package of Proposition 1 and State general fund, pending Legislator approval.

3. The 2017 CVFPP Update highlights the need for extensive investments in routine and deferred maintenance. Additional funding from the State general fund is required to increase maintenance efforts. The general fund would increase DWR's Flood System Maintenance and Operation implementation program activities.

4. DWR and CVFPB should assemble a committee with local partners to evaluate reutilizing and updating the Sacramento and San Joaquin Drainage District. As that evaluation takes place, the CVFPB will evaluate the effectiveness of implementing State maintenance areas in places where needed, in coordination with local agencies.

5. Document and solidify federal credits for State-local led projects to demonstrate to the USACE the need for increased federal appropriations.

# 10.0 References

## 10.1 References for Introduction and Context Section

California Department of Water Resources (DWR). 2010. State Plan of Flood Control Descriptive Document. November. http://www.water.ca.gov/cvfmp/

_____. 2012. 2012 Central Valley Flood Protection Plan. Final. June. http://www.water.ca.gov/cvfmp/2012-cvfpp-docs.cfm

_____. 2013. California's Flood Future: Recommendations for Managing the State's Flood Risk. November. http://www.water.ca.gov/sfmp/resources/ca_flood_future_highlight.pdf

_____. 2014. California Water Action Plan Update 2013. October. http://www.water.ca.gov/waterplan/cwpu2013/final/index.cfm

_____. 2016a. Draft 2017 Central Valley Flood Protection Plan Update. December. http://www.water.ca.gov/cvfmp/

_____. 2016b. Draft 2017 Central Valley Flood Protection Plan Update Conservation Strategy. November. http://www.water.ca.gov/conservationstrategy/docs/cs_draft.pdf

_____. 2016c. Draft Basin-Wide Feasibility Study: Sacramento River Basin. March. http://www.water.ca.gov/cvfmp/

_____. 2016d. Draft Basin-Wide Feasibility Study: San Joaquin Basin. October. http://www.water.ca.gov/cvfmp/

_____. 2016e. Revised Draft Investing in California’s Flood Future: An Outcome Driven Approach to Flood Management. Attachment H: Flood Management Financing Mechanisms. November.

_____. 2017a. California Water Plan Update. Under development. http://www.water.ca.gov/waterplan/cwp/update2018/index.cfm

_____. 2017b. Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum. January. http://www.water.ca.gov/cvfmp/

Feather River Regional Partners. 2014. Feather River Regional Flood Management Plan. Administrative Draft. July. http://frrfmp.com/documents/

FloodProtect. 2014. Lower Sacramento River/Delta North Regional Flood Management Plan. July. http://www.floodprotectplan.com/resources.php

Government Finance Officers Association. 2008. Long-Term Financial Planning. February. http://www.gfoa.org/long-term-financial-planning-0

Mid and Upper Sacramento River Regional Flood Management Plan Partners, 2014. Mid and Upper Sacramento River Regional Flood Management Plan. November. http://musacrfmp.com/

Reclamation District 2092. 2014. Regional Flood Management Plan for the Mid-San Joaquin River Region. October. http://www.midsjrfloodplan.org/2014-rfmp

San Joaquin Area Flood Control Agency. 2014. Lower San Joaquin River and Delta South Regional Flood Management Plan. November. http://sjafca.com/lsjrdsrfmp.php

San Joaquin River Flood Control Project Agency. 2015. Upper San Joaquin River Regional Flood Management Plan. Final. February. http://usjrflood.org/2015/03/09/final-rfmp/

## 10.2 References for Intended Outcomes of the 2017 Refined SSIA Portfolio Section

California Department of Water Resources (DWR). 2013. California's Flood Future: Recommendations for Managing the State's Flood Risk. November. http://www.water.ca.gov/sfmp/resources/ca_flood_future_highlight.pdf

_____. 2016a. Letter to congressional leadership outlining requested actions for consideration in the next Water Resources Development Act. Sent February 2.

_____. 2016b. Draft 2017 Central Valley Flood Protection Plan Update Conservation Strategy. November. http://www.water.ca.gov/conservationstrategy/docs/cs_draft.pdf

California Floodplain Management Task Force Independent Panel. 2007. A California Challenge Flooding in the Central Valley: A Report from an Independent Panel to the Department of Water Resources, State of California. October. http://www.water.ca.gov/news/newsreleases/2008/101507challenge.pdf

California Natural Resources Agency (CNRS). 2016. California Water Action Plan 2016 Update. http://resources.ca.gov/docs/california_water_action_plan/Final_California_Water_Action_Plan.pdf

Feather River Regional Partners. 2014. Feather River Regional Flood Management Plan. Administrative Draft. July. http://frrfmp.com/documents/

FloodProtect. 2014. Lower Sacramento River/Delta North Regional Flood Management Plan. July. http://www.floodprotectplan.com/resources.php

Interagency Floodplain Management Review Committee (IPCC). 1994. Sharing the Challenge: Floodplain Management into the 21st Century. June. https://fas.org/irp/agency/dhs/fema/sharing.pdf

Mid and Upper Sacramento River Regional Flood Management Plan Partners, 2014. Mid and Upper Sacramento River Regional Flood Management Plan. November. http://musacrfmp.com/

Reclamation District 2092. 2014. Regional Flood Management Plan for the Mid-San Joaquin River Region. October. http://www.midsjrfloodplan.org/2014-rfmp

San Joaquin Area Flood Control Agency. 2014. Lower San Joaquin River and Delta South Regional Flood Management Plan. November. http://sjafca.com/lsjrdsrfmp.php

San Joaquin River Flood Control Project Agency. 2015. Upper San Joaquin River Regional Flood Management Plan. Final. February. http://usjrflood.org/2015/03/09/final-rfmp/

White, G.F. 1945. Human Adjustment to Floods. Department of Geography Research Paper 29. University of Chicago. http://biotech.law.lsu.edu/climate/docs/Human_Adj_Floods_White.pdf

## 10.3 References for Prioritizing Investment to Support Intended Outcomes Section

California Department of Water Resources (DWR). 2016c. Draft 2017 Central Valley Flood Protection Plan Update. December. http://www.water.ca.gov/cvfmp/

_____. 2016d. Draft 2017 Central Valley Flood Protection Plan Update Conservation Strategy. November. http://www.water.ca.gov/conservationstrategy/docs/cs_draft.pdf

_____. 2017. Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum. January. Sacramento, California. http://www.water.ca.gov/cvfmp/

Central Valley Integrated Flood Management Study (CVIFMS) Phase 2 – future, unpublished.

U.S. Army Corps of Engineers (USACE). 2009. Review Plan: Yuba River Basin, California Flood Risk Management General Reevaluation Study. March. http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/Review%20Plans/Yuba%20Approved%20RP-042009.pdf

_____. 2010. Review Plan: Lower Cache Creek, Yolo County, City of Woodland and Vicinity, CA Feasibility Study. August. http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/Review%20Plans/LCC_RP_.pdf

_____. 2015a. American River Common Features Project General Reevaluation Report. Draft. March. http://www.spk.usace.army.mil/Portals/12/documents/civil_works/CommonFeatures/Documents/GRR/ARCF_Draft_GRR_Mar2015.pdf

_____. 2015b. West Sacramento Project General Reevaluation Report. December. http://www.spk.usace.army.mil/Portals/12/documents/civil_works/WestSac/FINAL_WestSacramento_GRR_Jan2016.pdf

_____. 2015c. Final Independent External Peer Review Report: Lower San Joaquin River, California Flood Risk Management Feasibility Study. May. http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/Review%20Plans/LSJRFS_Final_IEPR_May2015.pdf

_____. 2015d. Review Plan: Sacramento River Bank Protection Project, California GRR. June. http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/Review%20Plans/SacBankGRR_ReviewPlan_12Jun2015.pdf

## 10.4 References for Other Influencing Factors Section

Alexander, A. and G. Bass-Golud. 1974. Schools, Taxes, and Voter Behavior: An Analysis of School District Property Tax Elections. http://www.rand.org/pubs/reports/R1465.html

California Department of Water Resources (DWR). 2014. Cost Share Guidelines for State-Local Cost Shared Flood Programs and Projects. http://www.water.ca.gov/floodmgmt/docs/Cost-Share-Guidelines-Final-12-11-14.pdf

_____. 2014. California Water Action Plan Update 2013. October. http://www.water.ca.gov/waterplan/cwpu2013/final/index.cfm

_____. 2017. California Water Plan Update. Under development. http://www.water.ca.gov/waterplan/cwp/update2018/index.cfm

_____. 2017. Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum. January. Sacramento, California. http://www.water.ca.gov/cvfmp/

California Natural Resources Agency (CNRS). 2016. California Water Action Plan 2016 Update. http://resources.ca.gov/docs/california_water_action_plan/Final_California_Water_Action_Plan.pdf

Council on Environmental Quality (CEQ). 2014. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies; Final Interagency Guidelines. https://www.federalregister.gov/documents/2014/12/24/2014-30170/economic-and-environmental-principles-and-guidelines-for-water-and-related-land-resources. Accessed February 2017.

_____. 2013. Principles and Requirement for Federal Investments in Water Resources. March. https://obamawhitehouse.archives.gov/administration/eop/ceq/initiatives/PandG

Delta Protection Commission. 2016. Delta Flood Risk Management Assessment District Feasibility Study.

Delta Stewardship Council. 2013. The Delta Plan. May. http://deltacouncil.ca.gov/delta-plan-0

Public Policy Institute of California (PPIC). 2014a. Paying for Water in California. March. http://www.ppic.org/content/pubs/report/R_314EHR.pdf

U.S. Army Corps of Engineers (USACE). 2000. Engineer Regulation 1105-2-100, Planning Guidance Notebook. http://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_1105-2-100.pdf

United States Water Resources Council. 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. March. https://obamawhitehouse.archives.gov/administration/eop/ceq/initiatives/PandG

Wasmer, R. and R. Fisher. 2011. Debt Burdens of California State and Local Governments: Past, Present and Future. July. http://www.treasurer.ca.gov/cdiac/publications/burdens.pdf

## 10.5 References for Investment Costs and Phasing Section

California Department of Water Resources (DWR). 2016a. Draft Basin-Wide Feasibility Study: Sacramento River Basin. March. Sacramento, California. http://www.water.ca.gov/cvfmp/

_____. 2016b. Draft Basin-Wide Feasibility Study: San Joaquin Basin. October. Sacramento, California. http://www.water.ca.gov/cvfmp/

_____. 2016c. Draft 2017 Central Valley Flood Protection Plan Update Conservation Strategy. November. http://www.water.ca.gov/conservationstrategy/docs/cs_draft.pdf

_____. 2016d. Draft Flood System Status Report Update. December. http://www.water.ca.gov/cvfmp/

_____. 2016e. Draft State Plan of Flood Control Descriptive Document Update. December. http://www.water.ca.gov/cvfmp/

_____. 2017. Draft Flood System Long-Term Operations, Maintenance, Repair, Rehabilitation, and Replacement Cost Evaluation Technical Memorandum. January. Sacramento, California.

Feather River Regional Partners. 2014. Feather River Regional Flood Management Plan. Administrative Draft. July. http://frrfmp.com/documents/

U.S. Army Corps of Engineers (USACE). 2009. Review Plan: Yuba River Basin, California Flood Risk Management General Reevaluation Study. March. http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/Review%20Plans/Yuba%20Approved%20RP-042009.pdf

_____. 2010. Review Plan: Lower Cache Creek, Yolo County, City of Woodland and Vicinity, CA Feasibility Study. August. http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/Review%20Plans/LCC_RP_.pdf

_____. 2015b. West Sacramento Project General Reevaluation Report. December. http://www.spk.usace.army.mil/Portals/12/documents/civil_works/WestSac/FINAL_WestSacramento_GRR_Jan2016.pdf

_____. 2015d. Review Plan: Sacramento River Bank Protection Project, California GRR. June. http://www.spk.usace.army.mil/Portals/12/documents/usace_project_public_notices/Review%20Plans/SacBankGRR_ReviewPlan_12Jun2015.pdf

## 10.6 References for Potential Funding Mechanisms for CVFPP Implementation Section

Agricultural Floodplain Ordinance Task Force (AFOTF). 2016. Technical Memorandum: Recommendations for Relieving Agriculture in Leveed Special Flood Hazard Areas from NFIP Requirements. Working Draft. September 28, 2016.

California Department of Water Resources (DWR). 2014. California Water Plan Update 2013. http://www.water.ca.gov/waterplan/cwpu2013/final/

_____. 2016. Division of Flood Management (DFM) Fiscal Database, California Data Exchange Center. May.

California Natural Resources Agency (CNRA). 2015. California River Parkways Grant Program – Bond Funded Grant Guidelines and Application. http://resources.ca.gov/docs/bonds_and_grants/Prop_13_River_Parkways_2015.pdf. Accessed January 24, 2017.

_____. 2017a. Urban Greening Grant Program. http://resources.ca.gov/grants/urban-greening/. Accessed January 24, 2017.

_____. 2017b. Urban Greening Grant Program – Draft Guidelines – Funded by California Climate Investments. http:// http://resources.ca.gov/grants/wp-content/uploads/2016/09/Urban-Greening-Draft-Guidelines.pdf/. Accessed January 24, 2017.

California State Controller's Office (SCO). 2016a. Cities Annual Report. http://www.sco.ca.gov/ard_locrep_cities.html. Accessed February, 2016.

_____. 2016b. Counties Annual Report. http://www.sco.ca.gov/ard_locrep_counties.html. Accessed February, 2016.

_____. 2016c. Special Districts Annual Report. http://www.sco.ca.gov/ard_locarep_districts.html. Accessed April 2016.

Federal Emergency Management Agency (FEMA). 2015. Flood Insurance: How it Works. https://www.floodsmart.gov/toolkits/flood/downloads/Flood_Insurance_How_It_Works.pdf. Accessed December 12, 2016.

National Flood Insurance Program (NFIP). 2016. California NFIP Statistics.

National Park Service (NPS). 2017a. History of the Land and Water Conservation Fund (LWCF). Web site: https://www.nps.gov/subjects/lwcf/index.htm/lwcfhistory.htm. Accessed January 24, 2017.

_____. 2017b. Land and Water Conservation Fund (LWCP) – How State Plan and Select Projects. https://www.nps.gov/subjects/lwcf/planningprojects.htm.

_____. 2017c. The Land and Water Conservation Fund (LWCP) - FY 2016 Regular Apportionment to the "States" of $94,839,000 and the Supplemental Apportionment of $85,972 Pursuant to the Gulf of Mexico Energy Security Act (GOMESA). Web site: https://www.nps.gov/subjects/lwcf/upload/signed-FY16-lwcf-certificate.pdf. Accessed January 24, 2017.

Public Policy Institute of California (PPIC). 2011. Managing California's Water – From Conflict to Reconciliation. Web site: http://www.ppic.org/content/pubs/report/R_211EHR.pdf. Accessed December 2014.

State of California. 2015. Schedule 11 Statement of General Obligation Bond and Commercial Paper Debt of the State of California, State of California Budget Summary. http://www.ebudget.ca.gov/2012-13-EN/pdf/BudgetSummary/BS_SCH11.pdf. Accessed December 28, 2015.

_____. 2016. 9600 Debt Service General Obligation Bonds and Commercial Paper, State of California Budget Summary. http://www.ebudget.ca.gov/2015-16/pdf/GovernorsBudget/8000/9600.pdf. Accessed January 13, 2016. http://www.ebudget.ca.gov/2016-17/pdf/GovernorsBudget/8000/9600_fig1f.pdf. Accessed January 13, 2016.

United States Army Corps of Engineers (USACE). 2015. Fiscal Year 2016 Civil Works Budget of the U.S. Army Corps of Engineers. Washington, D.C.

U.S. Fish and Wildlife Service (USFWS). 2001. A Plan to Increase Natural Production of Anadromous Fish in the Central Valley of California. https://www.fws.gov/cno/fisheries/CAMP/Documents/Final_Restoration_Plan_for_the_AFRP.pdf. Accessed January 24, 2017.

_____. 2017a. U.S. Fish and Wildlife Service North American Wetlands Conservation Act (NAWCA) 2014-2015 Progress Report. https://www.fws.gov/migratorybirds/pdf/grants/nawca.progrpt.14-15.pdf. Accessed January 24, 2017.

_____. 2017b. U.S. Fish and Wildlife Service North American Wetlands Conservation Act (NAWCA) California NAWCA Fact Sheet FY 2015. https://www.fws.gov/lodi/anadromous_fish_restoration/afrp_index.htm. Accessed January 24, 2017.

_____. 2017c. U.S. Fish and Wildlife Service, Lodi Fish and Wildlife Office - Anadromous Fish Restoration Program (AFRP). https://www.fws.gov/lodi/anadromous_fish_restoration/afrp_index.htm. Accessed January 24, 2017.

_____. 2017d. Cooperative Endangered Species Conservation Fund Grants (Section 6 of the Endangered Species Act). https://www.fws.gov/Endangered/esa-library/pdf/section6.pdf. Accessed January 24, 2017.

_____. 2017d. U.S. Fish and Wildlife Service FY 2016 Cooperative Endangered Species Conservation Fund Project Descriptions. https://www.fws.gov/Endangered/grants/pdf/FY16.CESCF-ProjectDescriptions.pdf. Accessed January 24, 2017.

Wharton Center for Risk Management and Decision Processes (WCRMDP). 2011. Informed Decisions on Catastrophe Risk: Who's Paying and Who's Benefiting Most from Flood Insurance under the NFIP – A Financial Analysis of the U.S. National Flood Insurance Program (NFIP). Issue Brief. University of Pennsylvania. Fall 2011. http://opim.wharton.upenn.edu/risk/library/WRCib2011b-nfip-who-pays.pdf. Accessed March 2015.

## 10.7 References for Funding Scenarios Section

United States Water Resources Council. 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. March. https://obamawhitehouse.archives.gov/administration/eop/ceq/initiatives/PandG.

## 10.8 References for Delivery Through Implementation Programs Section

California State Water Resources Control Board. 2017. Financial Assistance Programs – Grants and Loans web page. http://www.waterboards.ca.gov/water_issues/programs/grants_loans/319h/

California Natural Resources Agency (CNRA). 2015. California River Parkways Grant Program – Bond Funded Grant Guidelines and Application. http://resources.ca.gov/docs/bonds_and_grants/Prop_13_River_Parkways_2015.pdf. Accessed January 24, 2017.

_____. 2017a. Urban Greening Grant Program. http://resources.ca.gov/grants/urban-greening/. Accessed January 24, 2017.

_____. 2017b. Urban Greening Grant Program – Draft Guidelines – Funded by California Climate Investments. http:// http://resources.ca.gov/grants/wp-content/uploads/2016/09/Urban-Greening-Draft-Guidelines.pdf/. Accessed January 24, 2017.

_____. Land and Water Conservation Fund (LWCP) – How State Plan and Select Projects.

_____. The Land and Water Conservation Fund (LWCP) - FY 2016 Regular Apportionment to the "States" of $94,839,000 and the Supplemental Apportionment of $85,972 Pursuant to the Gulf of Mexico Energy Security Act (GOMESA). Web site: https://www.nps.gov/subjects/lwcf/upload/signed-FY16-lwcf-certificate.pdf. Accessed January 24, 2017.

California State Parks. 2012. Habitat Conservation Fund Program Grant Administration Guide. https://www.parks.ca.gov/pages/1008/files/hcf_grant%20administration%20guide_final%205.31.12.pdf

National Park Service (NPS). 2017. History of the Land and Water Conservation Fund (LWCF). https://www.nps.gov/subjects/lwcf/index.htm/lwcfhistory.htm. Accessed January 24, 2017.

U.S. Environmental Protection Agency. 2017. Clean Water State Revolving Fun web page. https://www.epa.gov/cwsrf/learn-about-clean-water-state-revolving-fund-cwsrf

U.S. Fish and Wildlife Service. 2001. A Plan to Increase Natural Production of Anadromous Fish in the Central Valley of California. https://www.fws.gov/cno/fisheries/CAMP/Documents/Final_Restoration_Plan_for_the_AFRP.pdf. Accessed January 24, 2017.

_____. 2017a. U.S. Fish and Wildlife Service North American Wetlands Conservation Act (NAWCA) 2014-2015 Progress Report. https://www.fws.gov/migratorybirds/pdf/grants/nawca.progrpt.14-15.pdf. Accessed January 24, 2017.

_____. 2017b. U.S. Fish and Wildlife Service North American Wetlands Conservation Act (NAWCA) California NAWCA Fact Sheet FY 2015. https://www.fws.gov/lodi/anadromous_fish_restoration/afrp_index.htm. Accessed January 24, 2017.

_____. 2017c. U.S. Fish and Wildlife Service, Lodi Fish and Wildlife Office - Anadromous Fish Restoration Program (AFRP). https://www.fws.gov/lodi/anadromous_fish_restoration/afrp_index.htm. Accessed January 24, 2017.

_____. 2017d. Cooperative Endangered Species Conservation Fund Grants (Section 6 of the Endangered Species Act). https://www.fws.gov/Endangered/esa-library/pdf/section6.pdf. Accessed January 24, 2017.

_____. 2017d. U.S. Fish and Wildlife Service FY 2016 Cooperative Endangered Species Conservation Fund Project Descriptions. https://www.fws.gov/Endangered/grants/pdf/FY16.CESCF-ProjectDescriptions.pdf. Accessed January 24, 2017.

## 10.9 References for CVFPP Funding Plan Section

California Department of Water Resources (DWR). 2016. Draft 2017 Central Valley Flood Protection Plan Update. December. http://www.water.ca.gov/cvfmp/

# Acronyms and Abbreviations

AFOTF ..... Agricultural Floodplain Ordinance Task Force
AFRP ..... Anadromous Fish Restoration Program
ARCF ..... American River Common Features
BWFS..... Basin-Wide Feasibility Study
CDIAC..... California Debt and Investment Advisory Commission
CTP..... Cooperating Technical Partners (FEMA Program)
CVFPB ..... Central Valley Flood Protection Board
CVFPP ..... Central Valley Flood Protection Plan
CVIFMS ..... Central Valley Integrated Flood Management Study
CVP..... Central Valley Project
CWAP ..... California Water Action Plan
DWR ..... Department of Water Resources
EIFD..... enhanced infrastructure financing district
EMA ..... Emergency Management Agency
ETR..... effective tax rate
F-CO ..... Forecast-Coordinated Operations
FEMA ..... Federal Emergency Management Agency
F-IO..... Forecast-Informed Operations
FSRP ..... Flood System Repair Project
FY ..... fiscal year
GO ..... general obligation (bond)
GRR..... General Re-Evaluation Report
HCP ..... habitat conservation plan(ning)
HMA..... Hazard Mitigation Assistance (FEMA)
HMGP ..... Hazard Mitigation Grant Program (FEMA)
LMA..... local maintaining agency
LWCF..... Land and Water Conservation Fund
NAWCA..... North American Wildlife and Conservation Act
NFIP..... National Flood Insurance Program
NULE ..... Non-Urban Levee Evaluation
O&M..... operations and maintenance

OES ..... Office of Emergency Services
PDM ..... Pre-Disaster Mitigation (FEMA Program)
Reclamation ..... Bureau of Reclamation, U.S. Department of the Interior
RFMP ..... Regional Flood Management Plan
RR&R ..... repair, rehabilitation, and replacement
SCO ..... State Controller's Office
SFHA ..... Special Flood Hazard Areas
SFMP ..... Statewide Flood Management Planning
SGMA ..... Sustainable Groundwater Management Act
SPFC ..... State Plan of Flood Control
SRBA ..... State river-basin area
SRFCP ..... Sacramento River Flood Control Project
SSIA ..... State Systemwide Investment Approach
USACE ..... United States Army Corps of Engineers
USFWS ..... U.S. Fish and Wildlife Service
WRDA ..... Water Resource Development Act
WSAFCA ..... West Sacramento Area Flood Control Agency
WTP ..... willingness to pay