Lower Sacramento River/Delta North Regional Flood Management Plan

July 2014

FLOOD Protect

PLANNING FOR ACTION

Lower Sacramento Delta North Region

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Abbreviations and Acronyms

ARCF	American River Common Features Project
BALMD	Brannan-Andrus Levee Maintenance District
BDCP	Bay Delta Conservation Plan
BWFS	Basin-wide Feasibility Studies
Cal OES	California Office of Emergency Services
Caltrans	California Department of Transportation
CCSB	Cache Creek Settling Basin
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CLVRP	California Levee Vegetation Research Program
CMP	Corridor Management Plan
CNRFC	California Nevada River Forecast Center
CR	County Road
CSA	County Service Area
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CVP	Central Valley Plan
CWA	Clean Water Act
CWC	California Water Code
DDT	dichlorodiphenyltrichloroethane
DFW	California Department of Fish and Wildlife
DOC	California Department of Conservation
DWR	California Department of Water Resources

EIP	early implementation project
FCSSR	Flood Control System Status Report
FEMA	Federal Emergency Management Agency
FEPRR	Flood Emergency Preparedness, Response, and Recovery
FOC	Flood Operations Center
FMMP	Farmland Mapping and Monitoring Program
FSRP	Flood System Repair Project
FSZ	Farmland Security Zone
GC	Government Code
GRR	General Reevaluation Report
HMP	Hazard Mitigation Plan
IRWMP	Integrated Regional Water Management
IWMP	Integrated Water Management Plan
JFP	Folsom Dam Joint Federal Project
KLRDD	Knights Landing Ridge Drainage District
LAT	Levee Assessment Tool
LiDAR	light detection and ranging
LMA	Local Maintaining Agency
LOI	Letter of Intent
NEMDC	Natomas East Main Drainage Canal
NFIP	National Flood Insurance Program
NMFS	National Marine Fisheries Service
NOAA	National Ocean and Atmospheric Administration
NULE	Non-Urban levee evaluation

NWS	National Weather Service
O&M	Operations & Maintenance
OA	Operational Areas
OCAP BiOp	Operations Criteria and Plan Biological Opinion
PACR	Post-Authorization Change Report
PCB	polychlorinated biphenyls
PCET	Parametric Cost Estimating Tool
PCS	Potential Conservation Sites
PL	Public Law
POWS	Port of West Sacramento
PPP	past performance problems
PRC	Public Resource Code
RD	Reclamation District
Region	Lower Sacramento/Delta North Region
RFMP	Regional Flood Management Plan
RIP	Rehabilitation and Inspection Program
RUCS	Rural-Urban Connections Strategy
RWQCB	Regional Water Quality Control Board
SACOG	Sacramento Area Council of Governments
SAFCA	Sacramento Area Flood Control Agency
SB	Senate Bill
SCWA	Solano County Water Agency
SEMS	Standardized Emergency Management System
SMARA	Surface Mining and Reclamation Act

SNRR	Southern Nevada Railroad
SPFC	State Plan of Flood Control
SRA	Shaded Riverine Habitat
SRBPP	Sacramento River Bank Protection Project
SRDWSC	Sacramento River Deep Water Ship Channel
SRFCP	Sacramento River Flood Control Project
SSIA	State Systemwide Investment Approach
SSSG	South Sacramento Streams Group
SWIF	System Wide Improvement Framework
SWP	State Water Project
SWRCB	State Water Resources Control Board
ULDC	Urban Levee Design Criteria
ULE	Urban Levee Evaluations
UPRR	Union Pacific Railroad
USACE	U. S. Army Corps of Engineers
USBOR	U. S. Bureau of Reclamation
USFWS	United States Fish and Wildlife Service
WSAFCA	West Sacramento Area Flood Control Agency
WSE	water surface elevation
WWTP	wastewater treatment plant

Executive Summary

Introduction

The Regional Flood Management Plan (RFMP) for the Lower Sacramento/Delta North Region (Region), shown in Figure ES-1, is the regional follow-on to the California Department of Water Resource's (DWR) 2012 Central Valley Flood Protection Plan (CVFPP). The RFMP followed guidelines established by DWR. The RFMP established the flood management vision for the Region and identified regional solutions to flood management problems at a pre-feasibility level.

Figure ES-1 Lower Sacramento/Delta North Region

Plan Participants

The RFMP, focused on a geographic area which includes portions of Solano, Yolo, Sacramento, and Sutter Counties, was developed by FloodProtect, a regional working group comprised of the counties, cities, flood management agencies, local maintaining agencies (LMA), water agencies, emergency response agencies, citizen groups, tribes, and other interested stakeholders in the Region. FloodProtect members are organized into two committees:

- West Side Coordinating Committee - The Counties of Yolo and Solano; the Cities of West Sacramento, Woodland, Rio Vista, and Davis; Solano County Water Agency; WSAFCA; Yolo County Flood Control and Water Conservation District; DWR Maintenance Areas; and Reclamation Districts (RD) 108, 900, 501, 536, 2060, 730, 1600, 2035, 827, 537, 765, 785, 307, 150, 999, 2068, 2093, 2098, 2104, 2084; and Knights Landing Ridge Drainage District.
- East Side Coordinating Committee - Sacramento Area Flood Control Agency (SAFCA); the Counties of Sacramento and Sutter; Sacramento County Water Agency; Sutter County Water Agency, City of Sacramento, American River Flood Control District, DWR Maintenance Areas, Brannan-Andrus Levee Maintenance District, and RDs 1000, 3, 341, 349, 551, 554, 556, 563, 744, 755, 813, 1601, and 369.

Additionally, FloodProtect has a committee made up of members from both the East Side and West Side Coordinating Committees. This Joint Administration Committee provides a voice for the entire Region in conversations with DWR, the Central Valley Flood Protection Board, and other regions. The development of the RFMP also included a robust outreach program. Stakeholders involved in the RFMP include agricultural, tribal, environmental, and other public interests. The outreach efforts included focused meetings, public workshops held at key project milestones, branding with the FloodProtect identity, and briefings to governing boards. FloodProtect has a dedicated website, www.floodprotectplan.com.

FloodSAFE/CVFPP

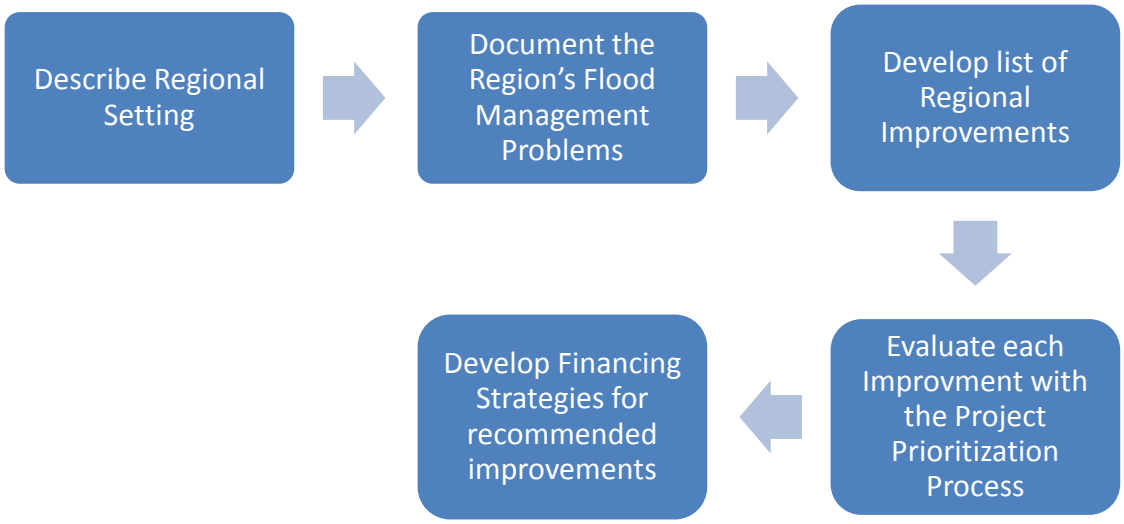
In response to flooding concerns, Hurricane Katrina, and legislation (Senate Bill 5), DWR is currently implementing FloodSAFE, a long-term strategic initiative developed to reduce flood risk in California. One important planning document of FloodSAFE is the CVFPP, which is a critical document to guide California's participation (and influence federal and local participation) in managing flood risk within lands protected by the State Plan of Flood Control (SPFC). The CVFPP, adopted in 2012, promotes a State Systemwide Investment Approach (SSIA) for sustainable, integrated flood management in areas currently protected by facilities of the SPFC.

Parallel to regional planning by local agencies, DWR is developing two Basinwide Feasibility Studies (BWFS) for the Sacramento and San Joaquin River Basins, respectively. DWR intends to fully coordinate the activities of the BWFSs and RFMPs in a way that the two planning processes inform each other and are properly integrated. This integration will facilitate further consideration of recommended regional improvements in the BWFSs.

Planning Process

The RFMP planning process was built upon previous work and work being performed concurrently in the Region, both at the local and statewide levels. The steps of the planning process (illustrated in Figure ES-2) are described in the following subsections.

Figure ES-2 Planning Process



Goals and Objectives

FloodProtect's overarching goal for the RFMP is:

- Develop the long-term vision for sustainable, integrated flood management in the Region through a collaborative process involving regional stakeholders.

To achieve this goal, FloodProtect's objectives are:

- Recommend feasible structural and nonstructural improvements to achieve 200-year level of protection in urban and urbanizing areas including Sacramento, West Sacramento, Davis, Woodland, and Rio Vista.
- Recommend feasible structural and nonstructural improvements to achieve 100-year level of protection in small communities including Clarksburg, Courtland, Hood, Isleton, Knights Landing, Locke, East & West Walnut Grove, and Yolo.

- Recommend levee improvements to rural areas using the rural levee repair guidelines developed by DWR in cooperation with LMAs to reduce the risk of flooding in the rural areas.
- Reduce flood risk to all essential infrastructures in the region. Reduce residual flood risk through improvements to emergency preparedness and response, and operations and maintenance (O&M) practices.
- Develop solutions that promote agricultural preservation, environmental enhancement, and protection of existing cultural resources, while anticipating the effects of climate change.
- Ensure that recommended solutions integrate with ongoing, parallel efforts of the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion of the Long-Term Operational Criteria and Plan (OCAP) for Coordination of the Central Valley Project and State Water Project (2008 OCAP BiOp), and the 2009 National Marine Fisheries Service (NMFS) Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project (CVP) and State Water Project (SWP) (2009 NMFS BiOp), the Bay Delta Conservation Plan (BDCP), the CVFPP Conservation Strategy, and the United States Army Corps of Engineers (USACE) feasibility studies.
- Develop financing strategies for identified flood risk reduction activities in small communities, rural, and urban areas consistent with the CVFPP system wide investment approach.

Regional Setting

The Region encompasses portions of Yolo, Solano, Sacramento, and Sutter Counties. Due to the concentration of developed lands within the Region, DWR estimated in the 2012 CVFPP that nearly 70% of total expected annual flood damages to lands protected by the flood management system that comprises the State Plan of Flood Control (SPFC)[1] occur within the Region (CVFPP, 2012). The Region is in a unique position in the State, with major features including the Sacramento River, Sacramento Weir and Bypass, Yolo Bypass, and the Sacramento San Joaquin Delta.

There is inherent flood risk to the Region's lands, citizens, infrastructure and environment, due to the proximity of the Sacramento River and its tributaries, including the American River and Cache Creek. Levees reduce the frequency of flooding on lands along these rivers. Since their construction, these levees and associated facilities have helped provide public safety and prevent billions of dollars of flood-related damages that would have occurred if the levees were not in place. However, portions of these levees have failed occasionally, resulting in significant property damage and loss of life. New development behind the levees places more lives and property in areas that face flood hazards, leading to higher flood risk because of greater

[1] Section 9110 (f) of the California Water Code (CWC):
"State Plan of Flood Control" means the state and federal flood control works, lands, programs, plans, policies, conditions, and mode of maintenance and operations of the Sacramento River Flood Control Project described in Section 8350, and of flood control projects in the Sacramento River and San Joaquin River watersheds authorized pursuant to Article 2 (commencing with Section 12648) of Chapter 2 of Part 6 of Division 6 for which the board or the department has provided the assurances of nonfederal cooperation to the United States, and those facilities identified in Section 8361.

consequences that would result if a flood occurs. Also, the levees have greatly constricted the river channel and impeded the ability of natural river processes to occur.

Land use and Natural Resources

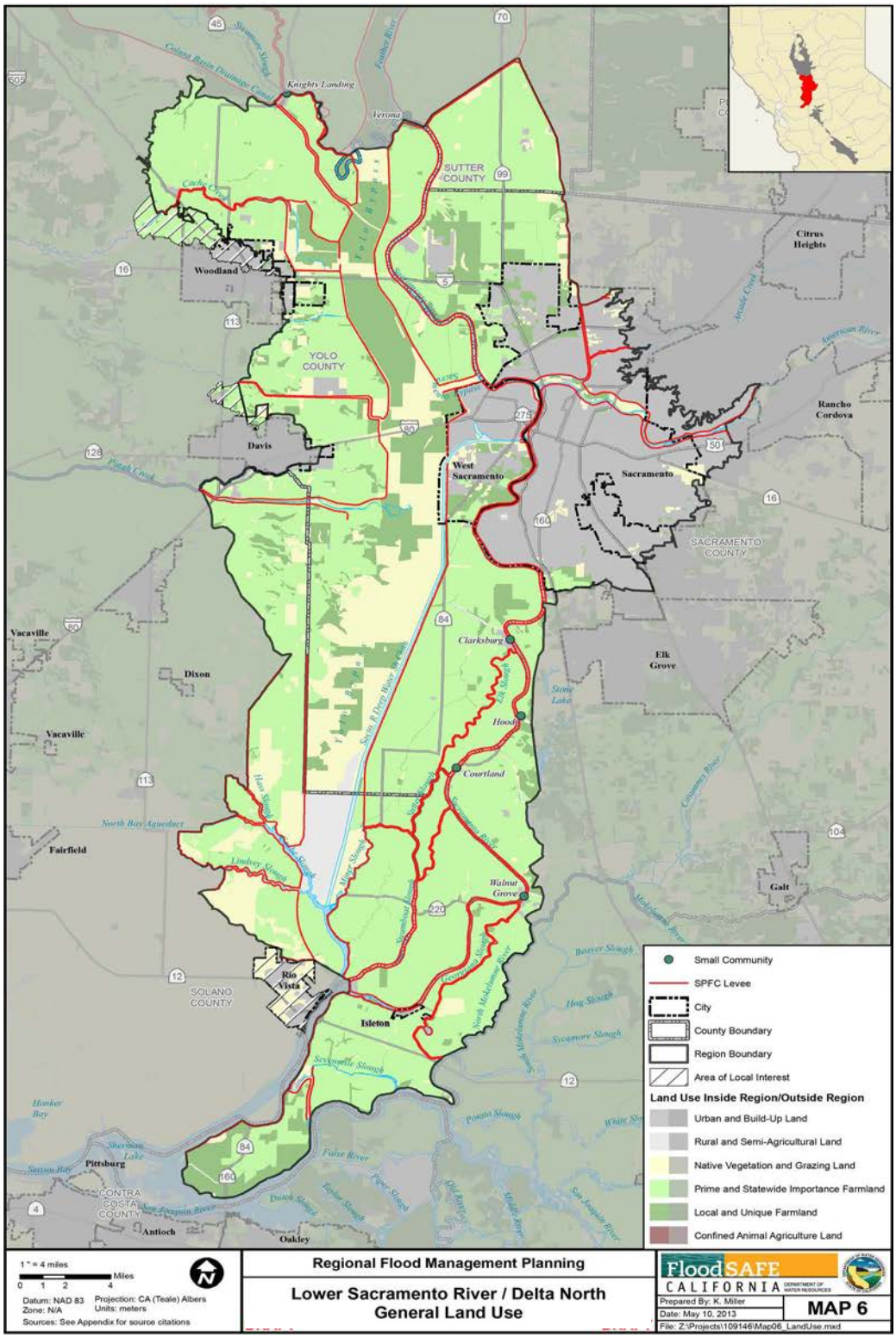
The Region is comprised of urban, agricultural, and environmental land use areas. Urban land is located within the City of Sacramento, County of Sacramento, and the City of West Sacramento. Only portions of the City of Woodland, City of Davis, and City of Rio Vista are located within the region. The agricultural land use predominates and is economically lucrative due to high-value and productive areas, most of which are in the State's highest category of agricultural land, either Prime or Statewide Important. Prime Farmland is land with characteristics that enable it to sustain high-yielding, long-term agricultural production. Statewide Important Farmland, which is only slightly less valuable due to characteristics that may limit some farming practices, makes up the largest land use category in the region. Native Vegetation and Grazing Land and Local and Unique Farmland (a lower quality category than Prime or Statewide Important) also make up significant portions of the region. Table ES-1 shows the acres of land type by category and Figure ES-3 presents recent general land use based on the California Department of Conservation (DOC) Farmland Mapping and Monitoring Program (FMMP) Land Use Data.

Because agricultural land makes up the largest portion of the region, the impact associated with inundation of the land can very negatively affect the regional economy. An example is the Yolo bypass, an important area for rice and other crops, which comprises tens of thousands of acres of productive farmland. Since it is also part of the flood system, the bypass is seasonally inundated. Longer term flooding in the bypass could have seriously detrimental effects which may include permanent or temporary crop damages, damage to farming equipment and facilities, and loss of employment.

Table ES-1 Land Use Area in LSDN Region

Land Type Category	Acres of Land Type	Total % of Region
Urban and Build-Up Land	73,930	18.2%
Native Vegetation and Grazing Land	63,870	15.7%
Local and Unique Farmland	53,320	13.1%
Prime and Statewide Importance Farmland	214,770	52.9%
Confined Animal Agricultural Land	0	0%
Rural and Semi-Agricultural Land	0	0%
Total	405,890	100%

Figure ES-3 LSDN General Land Use



LSDN Atlas, 2013

The Region also has significant natural resources such as: aquatic habitats, wetlands, riparian habitats, and wildlife foraging areas. Many of the more than 500 species of native plants and wildlife found in the Central Valley rely on hydrologic functions, water quality, and other processes and resources within the Region. Many of the habitat resources are located within wildlife refuge areas within the Region. A diversity of habitat resources are also located outside of the wildlife refuge area boundaries. Examples include the remnant riparian vegetation located along the banks of the Sacramento and American rivers, and along the tributaries of these major rivers. Agricultural areas within the Region also provide valuable habitat for wintering waterfowl within flooded rice fields and Swainson's hawk foraging habitat within alfalfa fields.

Flood Management Infrastructure

The Region contains a number of flood management facilities both locally owned and operated as well as State owned and operated through the SPFC. The main purpose of these facilities is to control storm water runoff and protect the local population and property in the Region from flood risks. Some SPFC facilities also convey the State's potable water supply. Major flood management facilities include the Willow Slough Weir, Knights Landing Ridge Cut, Cache Creek Settling Basin, Fremont Weir, Sacramento Weir and Bypass, and Yolo Bypass.

Problem Definition

FloodProtect and its stakeholders identified and documented flood management problems found throughout the Region. These problems were grouped into eight main overarching categories. It is understood that many problems in the Region fall within multiple categories and are not discrete. The categories of the problems in no particular order are:

- Flood management infrastructure
- Operations and maintenance
- Environmental and ecosystem
- Agricultural sustainability
- Funding
- Climate change
- Institutional
- Flood Emergency Preparedness, Response, and Recovery

Regional Improvements and Prioritization

To address the identified flood management problems, FloodProtect developed a list of recommended structural and non-structural improvements. The list was developed from existing documents that include, but are not limited to: Reclamation District 5-year plans; Integrated Regional Water Management Plans and information from DWR. Some new recommendations for improvements were developed through communications with LMAs and other flood managers at the city, county, and local levels. When available, improvement details

such as quantities, costs, permitting, funding, and schedule were included in the descriptions at their existing level of detail. Unless information was available, improvements are mostly at pre-feasibility levels. The discussions about the improvements include: general descriptions, location maps, potential for multi-benefits, and costs.

The final list of 116 regional improvements with over $2 billion in total cost included 65 rural improvements, 30 urban improvements, 21 small community improvements.

As required by DWR, the improvements were prioritized by considering design, permitting, and funding readiness, while accounting for multi-benefit possibilities. The prioritized improvements were organized by county (Yolo, Solano, and Sacramento) and then by type (urban, small community, and rural) to compare similar improvements with each other.

Ecosystem Restoration and Agricultural Sustainability

FloodProtect developed the Resources and Agricultural Sustainability Plan (RASP) specifically to identify potential conservation opportunities within or adjacent to the region that could be implemented to offset the adverse ecological impacts associated with single-purpose flood projects. Although not directly connected geographically, the potential conservation sites are intended to provide opportunities for linkages between conservation projects and flood management projects. By pairing or bundling single-purpose flood management projects with conservation sites, a more integrated multi-function flood management system will be developed. This approach would also have the added benefit of offsetting the ongoing operations and maintenance activities required to be implemented by local maintaining agencies.

The RASP is also intended to create ecological enhancement to the degree that a net overall increase in the region's ecological values will be created. This approach would specifically increase and improve the quantity, diversity, quality, and connectivity of riverine habitats including the agricultural and ecological values of these lands, and contributing to the recovery and stability of native species populations and overall biotic community diversity.

Finally, the RASP has been developed to ensure that inherent benefits, provided by agricultural land uses in achieving flood risk reduction and providing wildlife-friendly land areas, are appropriately integrated into the flood planning and regional conservation efforts. Agriculture has long been recognized as an appropriate use within floodplains as it affords an economically viable way of maintaining the landscape consistent with the operations of flood risk management infrastructure. A healthy agricultural economy also provides a viable use for lands that otherwise could be converted to urban uses; therefore, limiting the expansion of residential land practices within flood-prone areas.

Yolo Bypass/Cache Slough Integrated Water Management Plan

During the course of developing this RFMP, several key partner agencies recognized a unique opportunity to develop an ambitious multi-objective plan in the heart of the Sacramento River Flood Control Project. This plan, the Yolo Bypass / Cache Slough Integrated Water Management Plan (IWMP), seeks to provide system-wide flood benefits through modifications

to the Yolo Bypass while simultaneously implementing significant habitat conservation, water supply, and agricultural sustainability improvements.

The vision of this IWMP is to reduce the economic, environmental, and social costs of individually implementing competing project objectives in a small geographic area like the Yolo Bypass / Cache Slough complex. This vision can be accomplished through the achievement of the following five goals established for flood management in the region:

- Implement system-wide flood improvements – Identify viable and locally supportable modifications to flood management infrastructure in and around the Yolo and Sacramento Bypasses.
- Improve agricultural sustainability – Undertake efforts to improve rural levee systems, implement feasible rural floodplain management requirements, and establish dedicated funding for rural agricultural economic development.
- Conserve / create high value habitat – Improve aquatic and other habitat values in a manner that preserves flood management function and minimizes impacts on farming and other existing land uses.
- Consider water supply facilities in project development – Coordinate flood management and ecosystem restoration project development with existing local diversion facilities and planned improvements to water supply facilities for consistency and efficiency.
- Establish a more sustainable approach to O&M – Identify a long-term plan for operating and maintaining flood control and related facilities associated with the bypasses including possible changes to governance, financing, and environmental compliance.

In order to achieve these goals, the current IWMP concept is developed around eleven (11) plan elements as follows:

1. Small community protection (Yolo and Knights Landing)
2. Reconfiguration of the Elkhorn Basin for additional flood capacity and habitat
3. City of Woodland flood protection incorporating Westside rail relocation
4. Sacramento bypass and weir widening
5. Lower Bypass / Cache Slough reconfiguration for additional flood capacity and habitat
6. Increased flood protection and mitigation of any hydraulic impacts for Rio Vista
7. North Bay Aqueduct Alternate Intake Project implementation
8. Yolo Bypass / Cache Slough Corridor Management Plan development
9. FEMA National Flood Insurance Program (NFIP) regulatory relief for rural areas (Clarksburg)
10. Yolo Bypass / Cache Slough O&M Authority and Funding
11. Agriculture Sustainability Fund establishment

Financial Plan

The purpose of the Financial Plan, included as an appendix to the RFMP, is to provide information that can be utilized by local flood managers to develop a financial strategy to advance flood risk reduction projects. The Financial Plan provides important regional economic information that should be considered when determining the capacity to pay for flood risk reduction improvements. The Financial Plan includes a screening level analysis of the ability of local flood managers to pay for improvements and suggestions on existing programs that could fund improvements.

Ultimately, creating a sustainable and politically actionable funding source for flood management will require some action by the State legislature to change the current constitutional and statutory constraints on raising new revenue. The State and DWR should explore the following recommendations, some of which could be implemented in the near-term. In the long-term, the State should continue efforts to implement recommendations made in recent studies focusing on long-term stable funding for flood management.

Recommendation 1: The State should support a suite of projects that, together, provide multiple benefits for flood management, water supply, and the environment.

Recommendation 2: The State and locals should work together to formulate a multi-benefit "mega-project" that would improve the ability to maintain significant federal appropriations over time.

Recommendation 3: Local agencies should work with the State to align the incentives within funding programs to the goals and objectives outlined in the CVFPP.

Recommendation 4: The State should support the Region's efforts for flood insurance reform, ensuring that the agricultural use of the area is sustainable and allowing for the existing vibrant agricultural economy to thrive.

Recommendation 5: The State should consider developing state-funded programs that would evaluate and implement new local financing mechanisms that could be used to generate the local cost share of projects consistent with the SSIA.

Recommendation 6: The State should continue to explore regional, basin or valley-wide funding districts that ensure that all beneficiaries of the flood management infrastructure pay.

Recommendation 7: In the context of NFIP reform and rising flood insurance rates, the State could explore alternative flood or hazard insurance programs that could satisfy both federal lending requirements as well as provide structural mitigation to reduce risk.

Next Steps

It was always envisioned that the RFMP would be a living and on-going process. To the extent DWR will provide funding for regional planning through adoption of the 2017 update to the CVFPP, FloodProtect will provide support as additional funds become available. FloodProtect

will submit the completed RFMP, including the list of proposed regional improvements, to DWR as a condition of the funding agreement, and FloodProtect will continue to support the region in implementing the recommendations in the RFMP which will include these actions:

- Coordinate with DWR on the Sacramento River Basinwide Feasibility Study including planning assumptions, hydrologic and hydraulic modeling analyses, ecosystem restoration opportunities, benefits, peer review, and financing capabilities. FloodProtect will provide any available additional regional improvement information requested by DWR for its BWFS planning and technical analysis.
- Track future funding opportunities from DWR, such as the Urban Flood Risk Reduction and Small Communities Programs, to identify recommended regional improvements that may be eligible for direct or competitive funding.
- Conduct the necessary stakeholder outreach and coordination to develop organizational structure/governance, cost, policy/procedure, training requirements and synchronization to consolidate LMA, O&M and ER activities.
- Conduct advanced planning (to include: more detailed cost and schedule estimates, identification of potential multi-benefit opportunities and permit requirements, and stakeholder coordination) of the four roughly defined alternatives for 100-yr level of protection for each of the region's other small communities (Hood, Courtland, Isleton, East & West Walnut Grove, and Locke) to support their qualification for future grant funding.
- Research potential funding opportunities for the development of pre-feasibility level analyses of the 15 identified potential conservation sites in the RFMP.
- Continue to develop the Yolo Bypass/Cache Slough IWMP including coordination with DWR, Yolo County, Solano County, Sacramento County, and all affected stakeholders. Additional planning and study is required to fully develop this plan.
- Continue coordination with other Sacramento River Basin RFMP planning teams to ensure that regional and system improvements are not in conflict and can be integrated with plans of adjacent planning regions to promote greater benefit.

1.0 Introduction

The Regional Flood Management Plan (RFMP) for the Lower Sacramento/Delta North Region (Region) is the regional follow-on to the 2012 Central Valley Flood Protection Plan (CVFPP) and is being developed at the local and regional level with partial funding from the California Department of Water Resources (DWR). The RFMP establishes the flood management vision for the Region and identifies a list of regional actions including improvements to existing flood management facilities. Proposed improvements were generally evaluated at pre-feasibility levels, with preliminary engineering, costs, and financing improvements completed for the majority of the proposed projects. DWR will consider these regional improvements in their Basin-wide Feasibility Studies (BWFS), assessing their consistency with refined system improvements and other aspects of the State Systemwide Investment Approach (SSIA).

The Region encompasses portions of Yolo, Solano, Sacramento, and Sutter Counties and contains a diverse set of stakeholder groups in urban and rural areas with varied interests. The RFMP was developed by FloodProtect, a regional working group made up of representatives from nearly all of the Region's land use and flood management agencies and stakeholders. Due to the concentration of developed lands within the Region, it is estimated that nearly 70% of total expected annual flood damages to lands protected by the flood management system that comprises the State Plan of Flood Control (SPFC)[1] occur within the Region (CVFPP, 2012).

1.1 Regional Flood Management Plans

The goals of the regional flood management plans, as expressed by DWR, are to build upon flood risk management information developed through, and contained in the 2012 CVFPP, and to develop more detailed regional information.

Specifically the RFMPs:

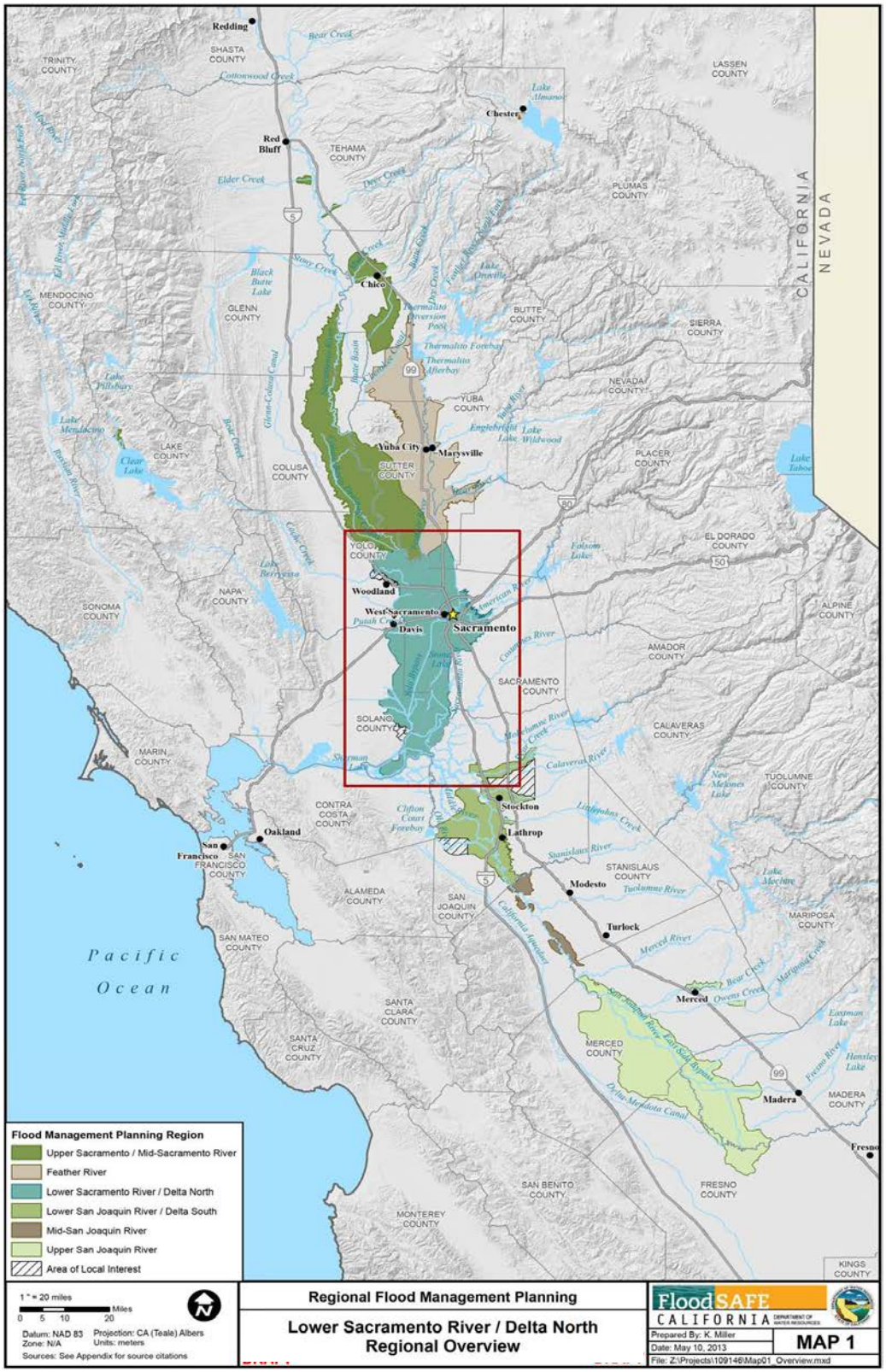
1. Identify regional flood risk characteristics.
2. Identify regional priorities.
3. Identify and prioritize proposed regional improvements.
4. Estimate costs, and identify sources of financing for proposed regional projects.
5. Identify strategies and funding for projects including operations and maintenance, land use and environmental restoration and emergency response for the region.

1 Section 9110 (f) of the California Water Code (CWC):
"State Plan of Flood Control" means the state and federal flood control works, lands, programs, plans, policies, conditions, and mode of maintenance and operations of the Sacramento River Flood Control Project described in Section 8350, and of flood control projects in the Sacramento River and San Joaquin River watersheds authorized pursuant to Article 2 (commencing with Section 12648) of Chapter 2 of Part 6 of Division 6 for which the board or the department has provided the assurances of nonfederal cooperation to the United States, and those facilities identified in Section 8361.

6. Evaluate and enhance the ability of the Region to manage residual risks (e.g., Emergency Response).

There are six RFMPs being developed, including the Lower Sacramento/Delta North RFMP. The other five regions are Upper Sacramento River/Mid-Sacramento River, Feather River, Lower San Joaquin River/Delta-South, Mid-San Joaquin River, and Upper San Joaquin River. The location of each of the RFMPs is shown on Figure 1-1.

Figure 1-1 Map of Regional Flood Management Planning Areas



-LSDN Atlas, 2013

1.2 Plan Participants

The RFMP was developed by FloodProtect; comprised of counties, cities, flood management agencies, local maintaining agencies (LMA), water agencies, emergency response agencies, citizen groups, tribes, and other interested stakeholders. The West Sacramento Area Flood Control Agency (WSAFCA) administered all agreements for FloodProtect and acted as the Region's coordinator.

FloodProtect members are organized into two committees, west and east of the Sacramento River, and an overarching Joint Administration Committee. These committees are described in the following sections.

1.2.1 West Side Coordinating Committee

The Lower Sacramento River Flood Plain Coordinating Committee existed prior to the RFMP and includes flood managers from the west side of the Sacramento River. For the purposes of the RFMP, this existing committee is referred to as the West Side Coordinating Committee, and its function is to broadly represent the interests on the west side of the river, including assessing regional flood risk, prioritizing projects, and evaluating funding options. Members include: the Counties of Yolo and Solano; the Cities of West Sacramento, Woodland, Rio Vista, and Davis; Solano County Water Agency; WSAFCA; Yolo County Flood Control and Water Conservation District; DWR Maintenance Areas; and Reclamation Districts (RD) 108, 900, 501, 536, 2060, 730, 1600, 2035, 827, 537, 765, 785, 307, 150, 999, 2068, 2093, 2098, 2104, 2084; and Knights Landing Ridge Drainage District.

1.2.2 East Side Coordinating Committee

The east side of the Sacramento River is represented by the East Side Coordinating Committee, whose function is to broadly represent the interests on the east side of the river including: assessing regional flood risk, prioritizing projects, and evaluating funding options. Members of this committee include: Sacramento Area Flood Control Agency (SAFCA), the Counties of Sacramento and Sutter, Sacramento County Water Agency, Sutter County Water Agency, City of Sacramento, American River Flood Control District, DWR Maintenance Areas, Brannan-Andrus Levee Maintenance District, and RDs 1000, 3, 341, 349, 551, 554, 556, 563, 744, 755, 813, 1601, and 369.

1.2.3 Joint Administration Committee

Additionally, FloodProtect has a committee made up of members from both the East Side and West Side Coordinating Committees. This Joint Administration Committee provides a voice for the entire Region in conversations with DWR, the Central Valley Flood Protection Board (CVFPB), and other regions. Plenary meetings of both coordinating committees provide opportunities to update all stakeholders on the progress of the RFMP and to solicit input from participants.

1.2.4 FloodProtect

The regional working group has branded itself as FloodProtect to invigorate stakeholders, bring attention to its website (www.floodprotectplan.com), raise the awareness of flood management issues in the region, and set the Region apart from other RFMP regions. The FloodProtect brand is meant to represent "forward-thinking" and demonstrate long-term solutions. A visual identity was created to help with the branding, and material distributed to stakeholders has typically contained the FloodProtect logo. The Lower Sacramento River/ Delta North RFMP and FloodProtect are synonymous and will both continue to be used as the RFMP is implemented.

1.3 Background

The RFMPs are related to other efforts currently being implemented by DWR. These include the FloodSAFE program and planning and implementation efforts associated with the CVFPP. The RFMPs fall under the umbrella of the State's FloodSAFE program and the Central Valley Flood Management Planning Program.

1.3.1 FloodSAFE

In response to flooding concerns, Hurricane Katrina, and legislation (SB5), DWR is currently implementing FloodSAFE, a long-term strategic initiative developed to reduce flood risk in California. The vision of FloodSAFE is:

> *A sustainable integrated flood management and emergency response system throughout California that improves public safety, protects and enhances environmental and cultural resources, and supports economic growth by reducing the probability of destructive floods, promoting beneficial floodplain processes, and lowering the damages caused by flooding. The DWR will provide leadership and work with local, regional, state, tribal, and federal officials to improve flood management and emergency response systems throughout California.*

The goals of FloodSAFE are:

- Reduce the Chance of Flooding - Reduce the frequency and size of floods that could damage California communities, homes and property, and critical public infrastructure.
- Reduce the Consequences of Flooding - Take actions prior to flooding that will help reduce the adverse consequences of floods when they do occur and allow for quicker recovery after flooding.
- Sustain Economic Growth - Provide continuing opportunities for prudent economic development that supports robust regional and statewide economies without creating additional flood risk.
- Protect and Enhance Ecosystems - Improve flood management systems in ways that protect, restore and where possible enhance ecosystems and other public trust resources.

- Promote Sustainability - Take actions that improve compatibility with the natural environment and reduce the expected costs to operate and maintain flood management systems into the future.

1.3.2 Central Valley Flood Protection Plan

One important planning document of FloodSAFE is the CVFPP, which is a critical document to guide California's participation (and influence Federal and local participation) in managing flood risk within lands protected by the State Plan of Flood Control. The CVFPP, adopted in 2012, promotes a SSIA for sustainable, integrated flood management in areas currently protected by facilities of the SPFC. The CVFPP will be updated every five years and the RFMPs represent a key step toward the 2017 CVFPP update.

1.3.2.1 Basin-wide Feasibility Studies

Parallel to regional planning by local agencies, DWR is developing two BWFSs for the Sacramento and San Joaquin River Basins, respectively. Through the BWFSs, DWR will refine and evaluate elements broadly identified in the 2012 CVFPP to implement the SSIA. Management actions that will be considered include: multi-objective system improvements (like weirs and bypasses), regional flood risk reduction actions (especially those that incorporate other societal benefits such as recreation or water supply), and implementation of a habitat conservation strategy which integrates environmental enhancement and sustainability objectives into flood management projects and activities.

While the BWFS will focus on refining system improvements, they will also consider and may include actions recommended by the RFMPs that are determined to be consistent with the CVFPP. The improvements will be evaluated based on ability to meet basin-wide objectives, such as resiliency, flexibility, and sustainability of the flood management system along the Sacramento and San Joaquin rivers. DWR intends to fully coordinate the activities of the BWFSs and RFMPs in a way that the two planning processes inform each other and are properly integrated. This integration will facilitate further consideration of recommended regional improvements in the BWFSs.

1.4 Report Organization

The development of the RFMP occurred in phases. Each phase built upon the previous phase and relied on existing material and input gathered from participants and stakeholders. This RFMP is organized into various sections:

1. Introduction – This section presents background on statewide flood planning initiatives, the RFMP development process, and the development of the problem definition report.
2. Planning Process – This section describes the RFMP planning process.
3. Regional Setting – This section describes the regional setting.
4. Problem Definition – This section provides a summary of the Region's flood management problems.

5. Regional Improvements – This section presents proposed solutions to the Region's flood management problems.
6. References

2.0 Planning Process

2.1 Plan Development

DWR encouraged regions to develop their own RFMPs. However, DWR understood that to get the necessary information needed for the BWFSs, certain minimum information must be included in all of the RFMPs. These include a description of the current state of flood management in the Region and a long-term vision for flood risk reduction through the identification of potential solutions. The regional setting relied mostly on existing sources of information, supplemented with local information. Existing sources of information included, but was not limited to, the 2012 CVFPP and associated working group documents, 2011 Flood Control System Status Report (FCSSR), 2010 Management Actions Report, 2010 Regional Conditions Report, the 2013 Flood Future Report, and the 2010 SPFC Descriptive Document.

2.1.1 Planning Process

This section defines the planning process that FloodProtect used to develop the RFMP. The planning process built upon previous work and work being performed concurrently in the Region, both at the local and statewide levels. The desired outcome of the planning process was a list of proposed regional flood management improvement that will be recommended for future evaluation and possible implementation.

The first step in the planning process was to describe the regional setting. The description of the regional setting relied mostly upon existing information. More detailed regional description information may be developed at a later date, such as during project feasibility or design phases.

With an understanding of the regional setting, the next step in the planning process was to document the flood management problems in the Region. Problems may be described as challenges, issues or opportunities. Opportunities are included because an opportunity may be considered related to and the result of a problem, i.e. a “problem” represents an “opportunity” for a solution.

As FloodProtect develops a firm understanding of the flood management problems in the region, it can move on to document the solutions that could address these problems. The scope of the RFMP was pre-feasibility so FloodProtect was not able to analyze alternative solutions for each identified problem. Proposed solutions came from existing plans, recommendations from local responsible agencies, or review of successful historical improvements in the region. Proposed solutions include structural and non-structural improvements documented from information collected during outreach with the members of the FloodProtect, existing proposed projects, and new projects developed during this process. These improvements may vary in terms of scale, single or multi-benefits, type, and phase.

Another feature of the RFMP and an important aspect to stakeholders was the development of a financial plan. The financial plan presents various options for funding the proposed

improvements, such as new legislation or modifications to existing legislation, use of assessment districts, modifications to existing flood insurance programs, increased funding for State Revolving Fund Programs, creating a Federal infrastructure trust fund, or modifying bond restrictions.

As project information was collected, a project prioritization process was developed. This process was required by DWR and communicates the region's priorities to address its flood management problems. The prioritization process used criteria such as:

- Project financing
- Design Readiness
- Permitting Readiness
- Funding Readiness

Using the prioritization process, a list of recommended projects was generated and sent to DWR. DWR will use its own evaluation process to determine if the recommended projects potentially add systemwide benefits and should be incorporated into the BWFSs and eventually implemented for the SSIA.

2.1.2 Goals and Objectives

FloodProtect's overarching goal for the RFMP is:

- Develop the long-term vision for sustainable, integrated flood management in the Region through a collaborative process involving regional stakeholders.

To achieve this goal, FloodProtect's objectives are:

- Recommend feasible structural and nonstructural improvements to achieve 200-year level of protection in urban and urbanizing areas including: Sacramento, West Sacramento, Davis, Woodland, and Rio Vista.
- Recommend feasible structural and nonstructural improvements to achieve 100-year level of protection in small communities including: Clarksburg, Courtland, Hood, Isleton, Knights Landing, Locke, East & West Walnut Grove, and Yolo.
- Recommend levee improvements to the rural areas using the rural levee repair guidelines developed by DWR in cooperation with LMAs to reduce the risk of flooding in the rural areas.
- Reduce flood risk to all essential infrastructures in the region. Reduce residual flood risk through improvements to emergency preparedness and response, and operations and maintenance practices.

- Develop solutions that promote agricultural preservation, environmental enhancement, and protection of existing cultural resources, while anticipating effects of climate change.
- Ensure recommended solutions integrate with ongoing, parallel efforts of the 2008 U.S. Fish and Wildlife Service (USFWS) Biological Opinion of the Long-Term Operational Criteria and Plan (OCAP) for Coordination of the Central Valley Project and State Water Project (2008 OCAP BiOp), and the 2009 National Marine Fisheries Service (NMFS) Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project (CVP) and State Water Project (SWP) (2009 NMFS BiOp), the Bay Delta Conservation Plan (BDCP), the CVFPP Conservation Strategy, and the United States Army Corps of Engineers (USACE) feasibility studies.
- Develop financing strategies for identified flood risk reduction activities in small communities, rural, and urban areas consistent with the CVFPP system wide investment approach.

2.1.3 Focus Areas

FloodProtect developed this RFMP by concentrating its efforts through specific areas of focus. Therefore, several Focus Areas were established. The purpose of the Focus Areas was to drive discussions, hold specific meetings, and develop content for the RFMP. Table 2-1, lists each Focus Area and its purpose.

Table 2-1 Focus Areas

Focus Area	Purpose
Rural Areas, Small Communities, Urban/Urbanizing Areas	Develop strategies for determining the structural and non-structural improvements needed in each particular land use.
Yolo Bypass	Analyze options to improve the capacity of the Yolo Bypass while improving the level of protection through various repair and improvement projects on a local and/or systemwide level. Environmental mitigation and enhancement will be analyzed.
Agricultural Preservation	Develop a strategy which provides short-term and long-term incentives for continued agricultural use in the Region including consideration of how to preserve or enhance agriculture, the agricultural economy and protect existing agricultural water rights.
Environmental	Assess environmental resources and identify opportunities to preserve or enhance riverine habitats and agricultural lands in a manner that provides environmental value. Identify projects that promote natural dynamic hydrologic and geomorphic processes; work to increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands; and promote the recovery and stability of native species populations and overall biotic community diversity.
Finance	Create a coherent regional financial strategy that identifies costs, benefits, and potential sources of funding (e.g., Federal, State, and local cost-shares) for proposed improvements. Address long-term capital improvement investments, as well as funding for flood emergency response operations, and O&M (Operations and Maintenance) of the region's flood management facilities. Look for opportunities to bundle proposed improvements that collectively can be supported by multiple sources of funding.

Focus Area	Purpose
Federal Emergency Management Agency (FEMA)	Analyze on-going and future potential FEMA policy and procedural approaches in the Region and describe and determine their impacts/benefits to the RFMP.
Outreach	Develop and implement the strategy to ensure a thorough outreach effort that covers all internal regional stakeholders; the working groups of adjacent regions with interest in the RFMP; environmental interests, tribes, and any other interested parties; State and Federal Agencies with ongoing studies, projects, and regulatory responsibilities that could affect the RFMP.
Emergency Response	Gather and organize the information needed to prioritize and recommend improvements to Flood Emergency Preparedness, Response, and Recovery capabilities.
Project Categorization	Determine the criteria to categorize recommendations for both structural and non-structural improvements.
Other Initiatives	Review ongoing studies/projects in the Region such as: BDCP, USACE Studies, etc. and describe and determine their impacts/benefits to the RFMP.
Yolo Rail Relocation	Address ongoing efforts to relocate a portion of the Sierra Northern Rail line that currently runs between Yolo County Road (CR) 102 west of the Cache Creek Settling Basin (CCSB) through the Yolo Bypass (Freemont Trestle) to the City of West Sacramento.
Cache Creek Settling Basin	Develop strategies/approaches to address the deficiencies in the CCSB, and to engage with the CVFPB, USACE, and DWR in complying with the milestones set forth in the RWQCB Central Valley Basin Plan.

2.1.4 Deliverables

As the RFMP was developed, a series of interim deliverables were produced to document the planning process to date, show progress, and gather input from stakeholders and plan participants. The deliverables included:

- Problem Definition Report – This report described the regional setting and the current problems in the Region related to flood management.
- Regional Improvements Report – This report documented all of the proposed improvements, projects, and other non-structural actions recommended for addressing the problems identified in the Problem Definition Report.
- Regional Flood Management Plan – The final RFMP documents the entire planning process and incorporates all of the information presented in the previously mentioned deliverables. The RFMP also includes:
  - Potential Conservation Sites Report – This report is attached as an Appendix to the RFMP (Appendix A) and describes potential conservation sites in the Region.
  - Prioritized List of Regional Improvements – These summary tables present the prioritized list of regional improvements (Appendix B).
  - Regional Financial Plan – This financial plan (Appendix C) was developed and incorporated into the final RFMP to document financial strategies for funding the proposed regional improvements.

- Regional Atlas – The Regional Atlas, which is included in this RFMP, is a graphical depiction of the region, its assets and resources, flood management agencies, the flood risk characteristics of each region, and CVFPP information as they relate to the region.

2.1.5 Stakeholder Outreach

Under DWR's guidelines, each RFMP Region was to include representatives of flood management implementing, operating, and maintaining agencies; local land use agencies (cities and counties); flood emergency responders; permitting agencies; and agricultural, tribal, and environmental interests that are knowledgeable about the flood risks and potential solutions within their flood region. The development of the RFMP included a robust outreach program to facilitate two-way communication. The outreach efforts included focused meetings, public workshops held at key project milestones, branding with the FloodProtect identity, and briefings to governing boards. FloodProtect also developed a dedicated website, www.floodprotectplan.com. The website is a way to disseminate information to stakeholders regarding plan development, planning progress, upcoming meetings, and other coordination.

The outreach efforts:

- Build on prior and ongoing activities of member agencies.
- Identify and include a broad range of stakeholder groups and interests.
- Use existing stakeholder groups and technical advisory committees as an efficient means to communicate with stakeholders while minimizing the number of additional meetings stakeholders will be asked to attend.
- Maximize opportunities for collaboration.
- Recognize that not all stakeholders have time to be involved in extensive processes, so stakeholder involvement must be tailored to ensure significant input with limited time commitments.

3.0 Regional Setting

By providing the region's flood history, natural resources and assets, demographics, land use, economy, and other region-specific information, the regional setting intends to set the stage for characterizing flood system problems and risks within the region. This section also identifies the Regional Partners and their respective jurisdictions, roles, and responsibilities with respect to reducing both the risks and consequences of flooding within the region.

3.1 Flood History in the Region

Catastrophic floods in the Sacramento River Basin have caused inundation to farms, businesses, and communities since at least the mid-1800s. The following flood history includes major events beginning from 1955, after which substantial flood management infrastructure was completed. This history was compiled and referenced from the Draft DWR Atlas for the Lower Sacramento and Delta North Regions (DWR 2013).

In 1955, widespread flooding occurred in Sacramento County including: Arcade Creek, Dry Creek and Robla Creek near the Natomas East Drainage Canal, the Morrison Stream Group, Elder Creek, Florin Creek, Unionhouse Creek, and Laguna Creek.

In October 1962, Dry and Robla Creeks spread from 800 feet to approximately one mile. High water was within 2-feet of the top of the levee on the southern side of Robla Creek and along the Magpie Creek Diversion channel. Floodwaters from Magpie Creek bypassed the upper portion of the diversion levee and flowed into lower Magpie Creek. Arcade and Cripple creeks flooded. Later that year, flooding occurred on Arcade Creek, Dry Creek and Robla Creek in the vicinity of Natomas East Main Drainage Canal, Magpie Creek, and the Morrison Creek Stream Group. There was also flooding on Strong Ranch and Chicken Ranch Sloughs.

Andrus Island experienced a levee failure in 1972, which was the only event ever to result in significant seawater intrusion.

In 1980, high tides and flood-level flows caused breaches in and rapid deterioration of private levees, which caused flooding of agricultural lands on Prospect Island. Heavy storms raised river levels, leading to another failure of the Prospect Island levee in December 1981.

A Federal flood disaster was declared in 1982 brought on by El Niño weather conditions. Extremely wet conditions, coupled with voluminous Sierra Mountain runoff, led to very high river stages throughout the system. This event caused extensive damage to the flood management system of the Sacramento Valley. A levee failure near CR 102, in Yolo County caused flooding in the western extent of the Region which is now Woodland's industrial area. In 1983, levees failed at Prospect Island.

In 1983, the right bank levee of Cache Creek near the inlet to the CCSB failed and flooded Interstate 5 and east portion of the City of Woodland.

Releases from Folsom Reservoir during the 1986 floods caused extensive erosion along the toe of the north and south levees of the American River near California State University, Sacramento. The flood resulted in the largest peak flow recorded on Morrison Creek. Significant flooding resulted from overflows along Arcade Creek. A flood fight prevented the collapse of the east levee of the Sacramento River, located five miles north of downtown Sacramento. Record high tides and record Sacramento River inflow both occurred leading to failure of Tyler Island and other nearby tracts.

Over 120,000 people had to be evacuated in Northern California because of flooding in 1997. Several levee breaks were reported across the Sacramento and San Joaquin Valleys. The 1997 flood was considered to be the perfect storm as 100-year peak flows from multiple major rivers collided and flowed into the Yolo Bypass and down to the Sacramento River Delta. A major flood fight at Andrus Island was successful at protecting the City of Isleton from potential inundation.

3.2 Regional Characteristics

Over the last century, the Central Valley has experienced intensive development to meet the needs of a growing population. A complex water supply and flood risk management system supports and protects a vibrant agricultural economy, several cities, and numerous small communities. Figure 3-1 shows the boundary and map extent for the region.

3.2.1 Demographics

The Region consists of large portions of the Cities of Sacramento, Davis, Woodland, West Sacramento, Rio Vista, and Isleton, as well as significant open space and rural agricultural land. Based on Department of Finance and 2010 census data, Table 3-1a shows the populations of the principal cities in the Region (DOF 2012). Table 3-1b shows the population projection for various years in Sacramento, Solano, Sutter, and Yolo Counties (DOF 2013).

Table 3-1a 2012 Populations of Cities in the LSDN Region

City	County	2012 Population
Sacramento	Sacramento	470,956
Davis	Yolo	65,052
Woodland	Yolo	55,646
West Sacramento	Yolo	49,292
Rio Vista	Solano	7,418
Isleton	Sacramento	810
Total Population		649,174

Table 3-2b Projected Populations of Counties in the LSDN Region

County	2015	2025	2035	2045	2055
Sacramento	1,477,479	1,617,175	1,817,718	1,995,141	2,128,179
Solano	424,494	467,130	526,213	572,623	613,717
Sutter	98,833	119,413	151,452	191,445	233,552
Yolo	209,198	237,322	266,653	291,526	301,569

3.2.2 Economy

The SPFC protects a population of over one million people, major freeways, railroads, airports, water supply and wastewater treatment/disposal systems, utilities, and other infrastructure of statewide importance, including $69 billion in assets (which includes structural and content value and estimated annual crop production values).

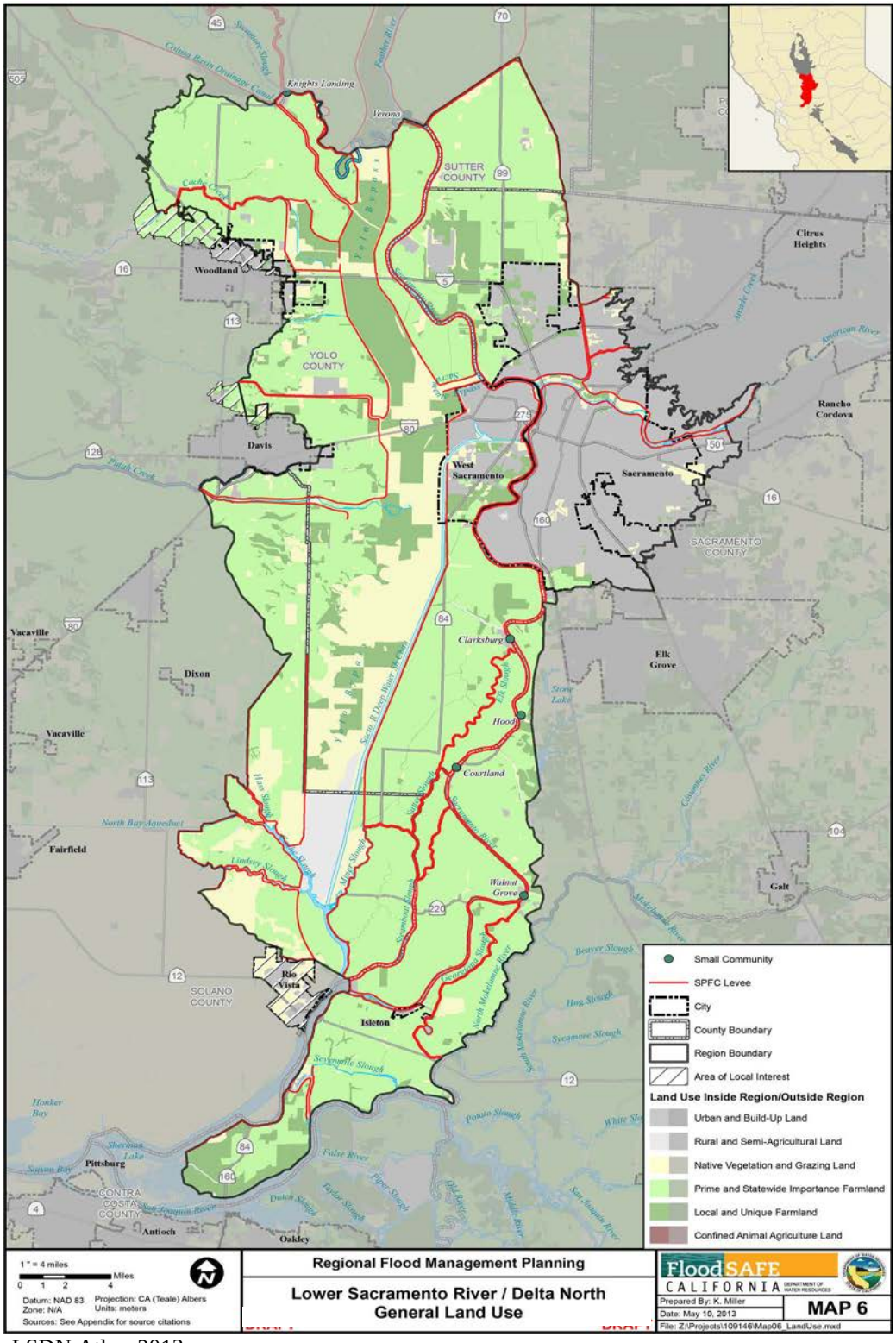
The Region is working to become a leader in economic sustainability, focusing on agricultural advancement, emerging green technology expertise, and eco- and agri-tourism opportunities. The agricultural industry in the Region is rapidly evolving with new crop types, farming practices, technologies, distribution networks, and organizational structures. Though the Region still relies heavily on large-scale commodity crops such as tomatoes, alfalfa, and rice, traditional large-scale food processing capacity has diminished (Yolo County 2010).

Nearly 40 different commodities are grown within the region. Milk and cream, grapes, nursery products, almonds, and cattle are the top five grossing commodities in California; all of these commodities are prominent throughout the Sacramento and San Joaquin Valleys (DWR 2012). Yolo County's core values are agriculture and open space. Ninety-seven percent of the land surface of unincorporated Yolo County is currently set aside for agriculture or open-space preservation. Sixty-nine percent of the unincorporated area of Yolo County is further protected under Williamson Act contracts.

Land use

Figure 3-1 presents recent general land use based on the California Department of Conservation (DOC) Farmland Mapping and Monitoring Program (FMMP) Land Use Data. The FMMP land use surveys for Sacramento (2010), Sutter (2010), Solano (2010), and Yolo (2010) Counties were used to represent the land use conditions in the Region.

Figure 3-1 LSDN General Land Use



-LSDN Atlas, 2013

Land use is described by the following categories:

- Urban and Build-Up Lands – Urban and Built-Up land is occupied by structures with a building density of at least 1 unit to 1.5 acres, or approximately 6 structures to a 10-acre parcel. Common examples include residential, industrial, commercial, institutional facilities, cemeteries, airports, golf courses, sanitary landfills, sewage treatment, and water control structures.
- Rural and Semi-Agricultural Lands – This includes residential areas of one to five structures per ten acres. This includes semi-agricultural lands such as farmsteads, agricultural storage and packing sheds, unpaved parking areas, composting facilities, equine facilities, firewood lots, and campgrounds.
- Native Vegetation and Grazing Land
  - Land on which the existing vegetation is suited to the grazing of livestock. This category is used only in California and was developed in cooperation with the California Cattlemen's Association, University of California Cooperative Extension, and other groups interested in the extent of grazing activities.
  - Land which does not meet the criteria of any other category. Typical uses include low density rural development, heavily forested land, mined land, or government land with restrictions on use. This category was subdivided into Rural Residential Land, Vacant or Disturbed Land, Confined Animal Agriculture, and Non-agricultural, and Natural Vegetation beginning with the 2004 data. Subsequently, Rural Residential Land was subdivided into Semi-Agricultural and Rural Commercial Land and Rural Residential Land beginning with the 2006 data.
  - Land which consists of open field areas that do not qualify for an agricultural category, mineral and oil extraction areas, and rural freeway interchanges.
- Prime and Statewide Importance Farmland
  - Prime Farmland - Irrigated land with the best combination of physical and chemical features able to sustain long term production of agricultural crops. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for production of irrigated crops at some time during the four years prior to the mapping date.
  - Farmland of Statewide Importance - Irrigated land similar to Prime Farmland that has a good combination of physical and chemical characteristics for the production of agricultural crops. This land has minor shortcomings such as greater slopes or less ability to store soil moisture than Prime Farmland. Land must have been used for production of irrigated crops at some time during the four years prior to the mapping date.

- Local and Unique Farmland
  - Farmland of Local Importance - All farmable lands that do not meet the definitions of Prime, Statewide, or Unique. This includes land that is or has been used for irrigated pasture, dryland farming, confined livestock and dairy, poultry facilities, aquaculture and grazing land.
  - Unique Farmland - Lesser quality soils used for the production of the State's leading agricultural crops. This land is usually irrigated but may include non-irrigated orchards or vineyards as found in some climatic zones in California. Land must have been cropped at some time during the four years prior to the mapping date.
  - Confined Animal Agriculture Land - This includes aquaculture, dairies, feedlots, and poultry facilities. Confined Animal Agriculture qualifies for Farmland of Local Importance in some counties.

The Region has large areas of urban land use located within the City of Sacramento, County of Sacramento, and the City of West Sacramento. Only portions of the City of Woodland, City of Davis, and City of Rio Vista are located within the region. Prime and Statewide Important Farmland and Local and Unique Farmland are a significant portion of the non-urban planning area followed by rural and semi-agricultural land. Solano County contains Native Vegetation and Grazing Land. Table 3-2 shows the acres of land type by category for the region.

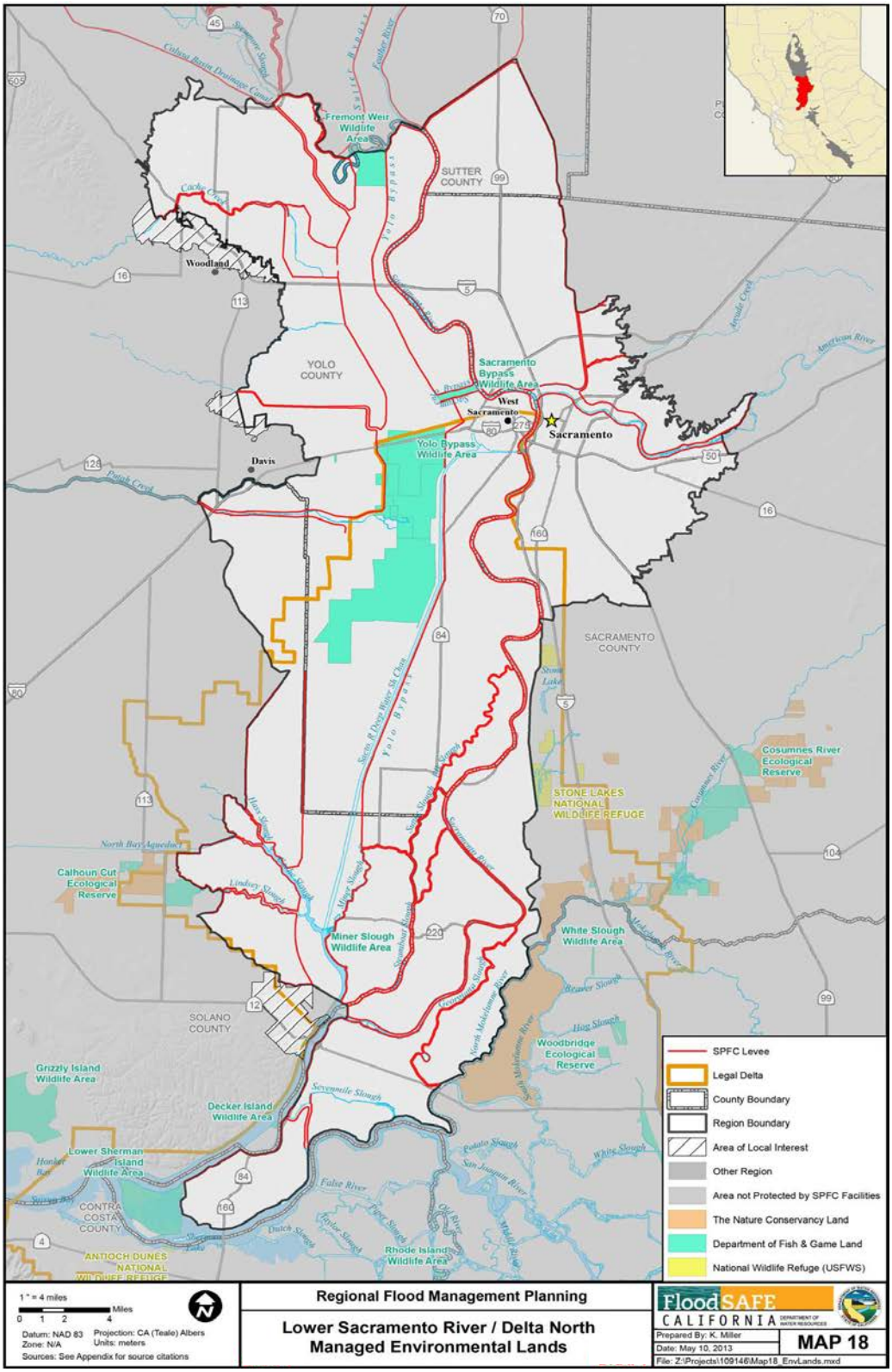
Table 3-3 Land Use Area in LSDN Region

Land Type Category	Acres of Land Type	Total % of Region
Urban and Build-Up Land	73,930	18.2%
Native Vegetation and Grazing Land	63,870	15.7%
Local and Unique Farmland	53,320	13.1%
Prime and Statewide Importance Farmland	214,770	52.9%
Confined Animal Agricultural Land	0	0%
Rural and Semi-Agricultural Land	0	0%
Total	405,890	100%

3.2.3 Natural Resources

This Region has significant natural resources such as: aquatic habitats, wetlands, riparian habitats, and wildlife foraging areas. 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 the Region. Many of the habitat resources are located within wildlife refuge areas within the Region. A diversity of habitat resources are also located outside of the wildlife refuge area boundaries. Examples include the remnant riparian vegetation located along the banks of the Sacramento and American rivers, and along the tributaries of these major rivers. Agricultural areas within the Region also provide valuable habitat including wintering waterfowl within flooded rice fields and Swainson's hawk foraging habitat within alfalfa fields. Figure 3-2 identifies the wildlife refuge areas and critical habitat areas within the Region.

Figure 3-2 LSDN Managed Environmental Lands



-LSDN Atlas, 2013

Decker Island Wildlife Area

The California Department of Fish and Wildlife (DFW) own the northernmost 33 acres of Decker Island. Since 1999, the DFW and DWR have been working together to re-establish and enhance wetland and upland habitats to benefit various species of fish and wildlife.

Miner Slough Wildlife Area

Miner Slough Wildlife Area, managed by the DFW, is located about 10 miles north of Rio Vista at the junction of Miner Slough and Cache Slough. The wildlife area is 37 acres in size and makes up one small island and a narrow peninsula extending from Prospect Island. The wildlife area has riparian vegetation of willows, cottonwoods, tules, and blackberries. This habitat supports a variety of wildlife species, including beaver, black-crowned night heron, and a variety of waterfowl.

Yolo Bypass Wildlife Area

The 16,000-acre Yolo Wildlife Area, managed by DFW includes 3,700-acres of land in the Yolo Bypass floodway restored to wetlands and other associated habitats. The wildlife area is located within the boundaries of the Yolo Bypass.

Fremont Weir Wildlife Area

The Fremont Weir Wildlife Area is located in the northern part of the Yolo Bypass. It consists of 1,461 acres of tall weedy vegetation, brush, valley oaks, willows and cottonwood trees.

Sacramento Bypass Wildlife Refuge

The Sacramento Bypass Wildlife area is a 360 acre area preserve managed by the DFW. This area is an important cover and feeding area for wildlife during late fall, winter, and early spring. Vegetation varies throughout the area from mature cottonwood trees to willows and valley oaks.

Stone Lakes National Wildlife Refuge

Stone Lakes National Wildlife Refuge, located east of the Region, is managed by the USFWS. This area contains multiple habitat types. Wetland habitats include seasonal wetlands, perennial wetland, vernal pools, and some artificial seasonal wetlands. It also includes riparian habitat as well as grasslands and oak woodlands.

3.2.4 Hydrology and Hydraulics

The northern part of the LSDN Region begins at the Fremont Weir at the north end of the Yolo Bypass. Water spills over the weir from the Sacramento River when flows in the river exceed approximately 70,000 cubic feet per second (cfs) (LWA 2005). The weir is located near the River's confluence with the Sutter Bypass, which contains water from the Sacramento Slough and Feather River. The Sacramento Weir allows additional flood flows to drain into the Bypass from the Sacramento and American Rivers near their confluence. Additional water comes from

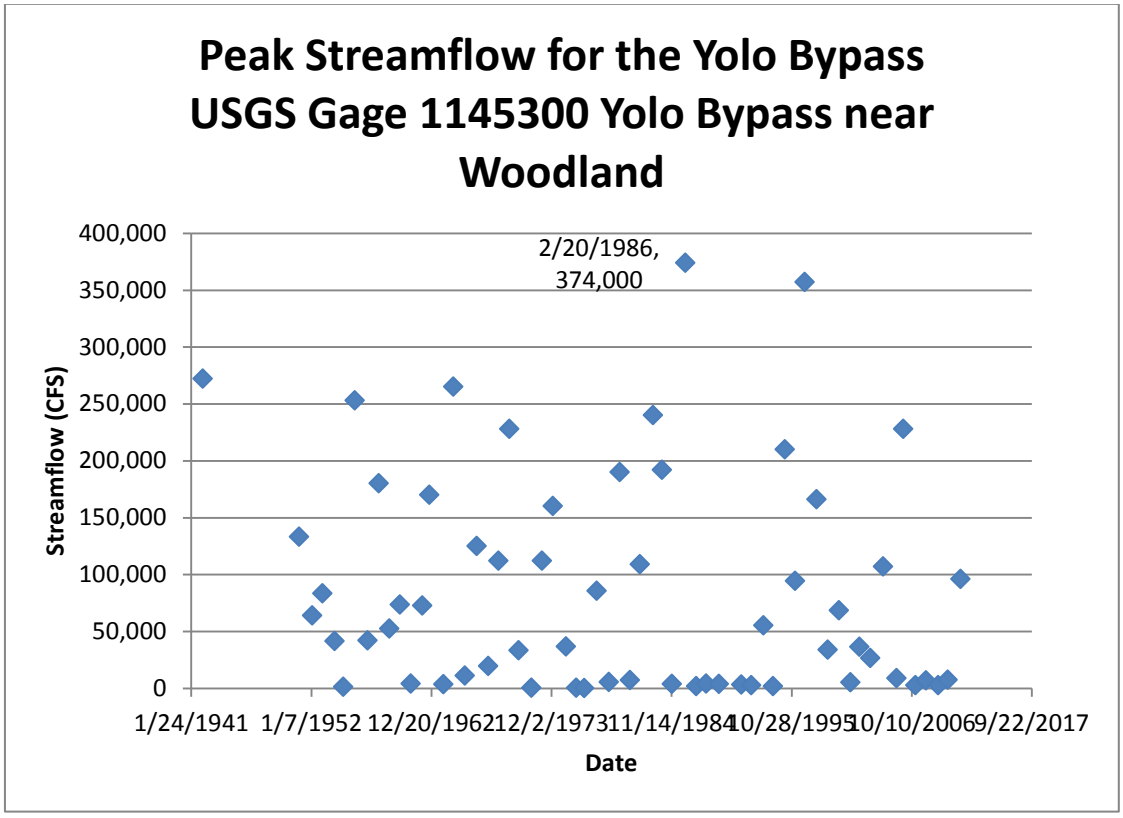
the Knights Landing Ridge Cut, Cache Creek, Willow Slough, and Putah Creek. Table 3-3 shows the design and actual capacity of the Yolo Bypass.

Table 3-4 Yolo Bypass Capacity

River Reach	Design Flows from Senate Document No. 23	Design Capacity from O&M Manual (cfs)	Design Flow from 1957 Revised Profile Drawings (cfs) (Basis of State Operations)	Estimated Current Channel Conveyance Capacity (cfs)
Fremont Weir to Knights Land Ridge Cut	343,000	343,000	343,000	290,000
Knights Landing Ridge Cut to Cache Creek	362,000	362,000	362,000	276,000
Cache Creek to Sacramento Bypass	377,000	377,000	377,000	201,000
Sacramento Bypass to Putah Creek	480,000	480,000	480,000	334,000
Putah Creek to RM 29	490,000	490,000	490,000	322,000
RM 29 to Miner Slough	500,000	490,000	500,000	No data
Miner Slough to Sacramento River	500,000	490,000	500,000	N/A
Notes: Data source is Flood Control System Status Report (Table B-1 on Page P-16)				

This Yolo Bypass capacity information, compared to historical peak streamflows near Woodland, is shown in Figure 3-3. This gage is located in the reach between Cache Creek and the Sacramento Bypass. It should be noted that even at the highest peak streamflow, 374,000 cfs, in 1986, the flow in the Yolo Bypass did not exceed the design capacity, 377,000 cfs. However, to the current capacity of 201,000 cfs was exceeded in nine of the 62 years on record.

Figure 3-3 Peak Streamflow for the Yolo Bypass



The Sacramento River runs parallel to and slightly to the east of the Yolo Bypass. In more than half of all water years, the Yolo Bypass is inundated. Water depths during flood discharges average 5-10 feet. During non-flood discharge periods (i.e. for flows less than approximately 3,500 cfs), water in the Bypass is conveyed entirely in the Tule Canal north of I-80 and the Toe Drain south of I-80. The Toe Drain parallels the Sacramento River Deep Water Ship Channel.

Because of the control structures and frequent water management decisions, the Yolo Bypass watershed is a complex and ever-changing drainage area. During the dry season, the Bypass' main water sources are municipal wastewater and the west side tributaries of Cache and Putah Creeks. Diversions of irrigation return flows from the Colusa Basin Drain and the lower Sacramento River can also be significant. During the wet season, local and west side runoff is dwarfed by flood flows from the Sacramento, Feather, and American Rivers.

Cache Creek discharges into the Yolo Bypass through the CCSB. The CCSB directs water from Cache Creek into the Bypass through a low-flow channel passing on the west and south side of the basin area. When the low-flow culvert's discharge capacity is exceeded (approximately 400 cfs), the basin begins to fill. When the outlet weir height is reached, water spills over the weir into the Yolo Bypass.

The Willow Slough watershed drains most of the central part of Yolo County between Cache Creek and Putah Creek. Local runoff flows away from the main Cache Creek and Putah Creek channels and enters numerous sloughs and small drainage channels that flow eastward and eventually collect into Willow Slough before discharging into the Yolo Bypass. Landowners have realigned and reconfigured many of the sloughs to accommodate agricultural activities. The northeast-trending natural channel of Willow Slough has been blocked off and replaced with a flood bypass channel, the Willow Slough Bypass, which flows directly east to the western edge of the Yolo Bypass. Water in the Slough during the dry season is entirely irrigation tailwater and field drainage.

Putah Creek drains a large watershed originating in Lake and Napa Counties and is impounded by Monticello Dam. Putah Creek discharges into the Yolo Bypass. Flood flows are captured by Monticello Dam in Lake Berryessa unless the reservoir is full. Spills from the dam flow through a glory hole outlet into Putah Creek. The Dam is not operated for flood management purposes. Even with the reservoir not full, there can be substantial flows into the Bypass during the rainy season from the watersheds downstream of the dam.

The Ulatis Flood Control Project drains a large part of Northern Solano County, including all of the city of Vacaville. The Project discharges into Cache Slough. The project was designed for a 10 year flood recurrence level to protect the largely agricultural area, but has been improved to a 100 year protection level in some parts of Vacaville. There is no significant storage associated with the Ulatis Project.

Climate change and its subsequent effects on sea-level rise are further discussed in Section 4.1.6 Climate Change.

3.2.5 Water Quality

There are several important connections between flood management and water quality. Most importantly, floods are capable of mobilizing enormous sediment loads and their contaminants, carrying them downstream, and then sorting and re-depositing them. Mercury can pose a major problem for sediment management and ecosystem restoration where it occurs in concentrations that will methylate in the wetland systems. The potential for mobilization of mercury is a consideration for channel modification or levee construction project in the region if the modifications remobilize sediments.

Dozens of organizations and agencies perform regular water quality monitoring in the region. Boron, diazinon, mercury and unknown toxics are pollutants that are found in the region's waterways. Studies on the physical and chemical characteristics of the Sacramento River and its tributaries have found high concentrations of nutrients and contaminants, particularly after major storms (Yolo 2009). Water quality parameters of concern in the lower Sacramento River between Knights Landing and the Delta consist of chlordane, DDT (dichlorodiphenyltrichloroethane), dihedron, mercury, PCBs (polychlorinated biphenyls), and unknown sources of toxicity. Water quality in Clear Lake, Indian Valley Reservoir, and Cache

Creek is impaired by mercury from historical mining activities and the natural occurrence of mercury in the watershed. American River water is generally characterized as high-quality surface water that is low in alkalinity, mineral content, and organic contamination (DWR 2012).

3.2.6 Groundwater

For many water users, groundwater is the only readily accessible supply source. Many groundwater wells exist within the Region, and most are used to supply individual domestic demands or small agricultural operations. Some of the larger towns and cities also operate municipal wells to meet or help meet urban, municipal, and industrial demands. Some of the communities within the Region such as Davis, Woodland, Rio Vista, and other communities currently rely on groundwater as their sole supply source (Kennedy Jenks 2013).

The Sacramento and Sutter County portion of the Region lies over the north central portion of California's Great Valley Groundwater Basin, a complex system of groundwater aquifers generally composed of marine sediments and stratified sand, silt, and clay layers many thousands of feet thick. The portion of the Great Valley basin that lies beneath Sacramento and Sutter County is comprised of three hydraulically continuous sub-basins with a combined fresh water storage volume estimated at more than 30,000,000 acre-feet; the average depth to groundwater is about 100 feet. The most significant recharge of the groundwater basins occurs along the American and Cosumnes Rivers, with additional recharge from the Sacramento River and local streams. Groundwater provides more than one-half the water supply for municipal and agricultural water uses in Sacramento County (Sacramento County 2011). Intensive use of the groundwater basin has resulted in a general lowering of groundwater elevations near the center of the basin away from the sources of recharge.

Yolo County has an extensive system of shallow and deep aquifers, which the county depends on for domestic and agricultural water supply. Wells in Yolo County are increasingly tapping deeper aquifers due to issues of subsidence and contamination. The County has six groundwater sub-basins. The East Yolo sub-basin, which covers the eastern portion of the county from south of Dunnigan to Davis, provides the greatest supply of residential water extraction. The other five sub-basins are the Capay Valley, Buckeye Creek, Dunnigan Hills, West Yolo and Sacramento River sub-basins (Yolo 2009).

The primary source of groundwater recharge is applied irrigation water and direct rainfall. Recharge of aquifers typically occurs along the streambeds of creeks and canals. Recharge occurs naturally, and also through reservoir releases, such as the release of stored water from the Indian Valley Reservoir into Cache Creek during low flows periods. The Indian Valley Reservoir was built and is managed by the Yolo County Flood Control and Water Conservation District to sustain an effective conjunctive water use operation in western Yolo County thereby reducing groundwater overdraft and land subsidence.

The groundwater basin in Solano County starts from the foothills above Vacaville and goes to the Sacramento River. The groundwater basin goes from Putah Creek to the north to the boundaries of Fairfield to the south. There are two basic levels to the groundwater basin. The shallower aquifer provides agricultural water and local domestic supplies. The shallower aquifer is underlain by the Tehama Formation aquifer. This aquifer is quite deep (over 1,000 feet) under Vacaville, but surfaces in the English Hills area north and west of Vacaville. Vacaville's wells draw from the Tehama Formation for its groundwater supply.

3.2.7 Recreation

There are numerous recreation opportunities in the Region, including bird watching, educational programs, nature exploration, bike trails, hunting, fishing, agri-tourism, RV/tent/group camping, boating and hiking.

The Yolo Bypass Wildlife Area has more than 17,770 acres of wildlife area for hunting and recreational activities. Hunting is permitted seasonally. When the bypass is dry, designated areas are open for hunting upland game birds such as pheasant, quail, and mourning dove and small mammals such as rabbits. Deer are also hunted in some areas. When the bypass is flooded, designated areas are open to waterfowl hunting. Fishing, bird-watching, and other types of wildlife viewing are also popular in the bypass (DWR 2012).

Also, the Cache Creek Nature Preserve is 130-acres of restored environment located 3 miles west of Woodland in the lower Cache Creek watershed in Yolo County. It has approximately 3 miles of trails for hiking, bird-watching and wildlife viewing. Cache Creek Conservancy operates many environmental education programs there throughout the year.

The rivers and creeks within the region provide excellent recreation opportunities. The Dry Creek Parkway provides a cycling and walking corridor through northern Sacramento County and southern Placer County that includes trails, parks and open space along Dry Creek. The American River Parkway is a 23-mile parkway that runs along the American River throughout Sacramento County and consists of many smaller parks and boat launching points.

3.2.8 Cultural Resources

The Region includes a long history of inhabitation by diverse native cultures including such groups as the Patwin, Maidu and Miwok peoples, with various smaller groups within each area. The Region also includes a complex history of non-native inhabitation that is evident from historical cultural resources. Prehistoric archaeological sites and historic cultural sites are present within all portions of the Sacramento and San Joaquin Valley and foothills, and all site types are represented. Sites within the Central Valley are generally associated with mounds and natural levees along the major rivers, streams, and sloughs. Identifying sites in the Sacramento and San Joaquin Valley is also complicated by the high degree of sedimentation in those areas. As a result, not all sites have visible evidence on the ground surface and may be buried under many feet of alluvium. Resource procurement or processing sites might be anywhere on the

landscape where important resources (e.g., acorns and pine nuts; other botanical resources used for food, basketry, or medicine; and a variety of game animals) are present.

3.2.9 Regulatory Setting

3.2.9.1 Federal and State

Responsibility for flood management in California is shared between agencies. The USACE and the State of California share ownership of the levees in much of the Sacramento River Basin Flood Control System. CVFPB regulates all activities on or adjacent to levees that have the potential to impact the operation and efficacy of the levees. Permits must be obtained from the CVFPB for any encroachments into levee right-of-way.

The USACE provides written instructions on the operation of the major flood management reservoirs. The USACE monitors the operation of the reservoirs to assure they are operated in accordance with USACE regulations. The USACE regulates alterations to federal levees through 33 United States Code, Section 408. The USACE also permits actions or alterations on navigable waters, such as the DWSC and Sacramento River. And USACE is responsible for administering Section 404 of the Clean Water Act (CWA). The CWA may impact operation and maintenance activities concerning the levees and flood management channels.

FEMA is responsible for regulating development in floodplains and floodways, and for administering the national flood insurance program.

The Central Valley Regional Water Quality Control Board (RWQCB) has established TMDLs for mercury for both Cache Creek and the Delta that can influence operation of facilities of the Sacramento Flood Control System.

3.2.9.2 Regional and Local

Regional levees are operated and maintained by local levee and reclamation districts, and in some cases DWR. These maintenance activities are monitored by the DWR, USACE, and CVFPB to assure compliance with federal regulations.

3.2.10 Risks

There is inherent flood risk to the Region's lands, citizens, infrastructure and environment, due to the proximity of the Sacramento River and its tributaries. Levees reduce the frequency of flooding on lands along these rivers. Since their construction, these levees and associated facilities have helped provide public safety and prevent billions of dollars of flood-related damages that would have occurred if the levees were not in place. However, portions of these levees have occasionally failed, resulting in significant property damage and loss of life. New development behind the levees places more lives and property in areas that face flood hazards, leading to higher flood risk because of higher consequences that would result if a flood occurs. Also, the levees have greatly constricted the river channel and impeded the ability of natural river processes to occur.

Flood risk is defined as the long-term average consequences of flood inundation within an identified area given a specified climate condition, land use condition, and flood management system (existing or planned) in place (CVFPP, 2012). The consequences may be direct or indirect economic cost, loss of life, environmental impact, or other specified measures of flood effect. Flood risk is a function of flood hazard, loading, exposure, and consequences. Elements of flood hazard, loading, exposure, and consequences include: hydrology, hydraulics, levee performance (or fragility) curves, and economic and life safety consequences. Regardless of how well flood facilities are designed, constructed, maintained, and operated, there is always a residual chance of failure. Improvements to existing flood facilities can reduce the probability of flooding, but not eliminate it.

Protected assets and their locations often determine the capability of a Region and its special districts ability to respond to emergencies. The location of these protected assets can also impact potential losses when a disaster occurs. An inventory of the protected assets is shown on Figure 3-4 and listed in general detail below.

State and Federal Facilities

- State and Federal Highways (5, 12, 50, 80, 84, 99, 113, 160, 220)
- State and Federal Highway Bridges
- Courthouses
- Post Offices
- Prisons
- Military Facilities
- Water Infrastructure
- Canals
- SPFC Levees

Local / County Facilities

- Jails and Detention Centers
- Government Buildings
- Roadways / Bridges
- Transit Centers
- Water Supply/ Wastewater treatment and disposal facilities
- Airports
- Ferry Crossings and access
- Reservoirs / Aqueducts

- Parks / Zoos
- Local “Non-Project” Levees

Health and Public Safety

- Hospitals
- Convalescent Facilities
- Medical Facilities / Clinics
- Police
- Fire
- Highway Patrol

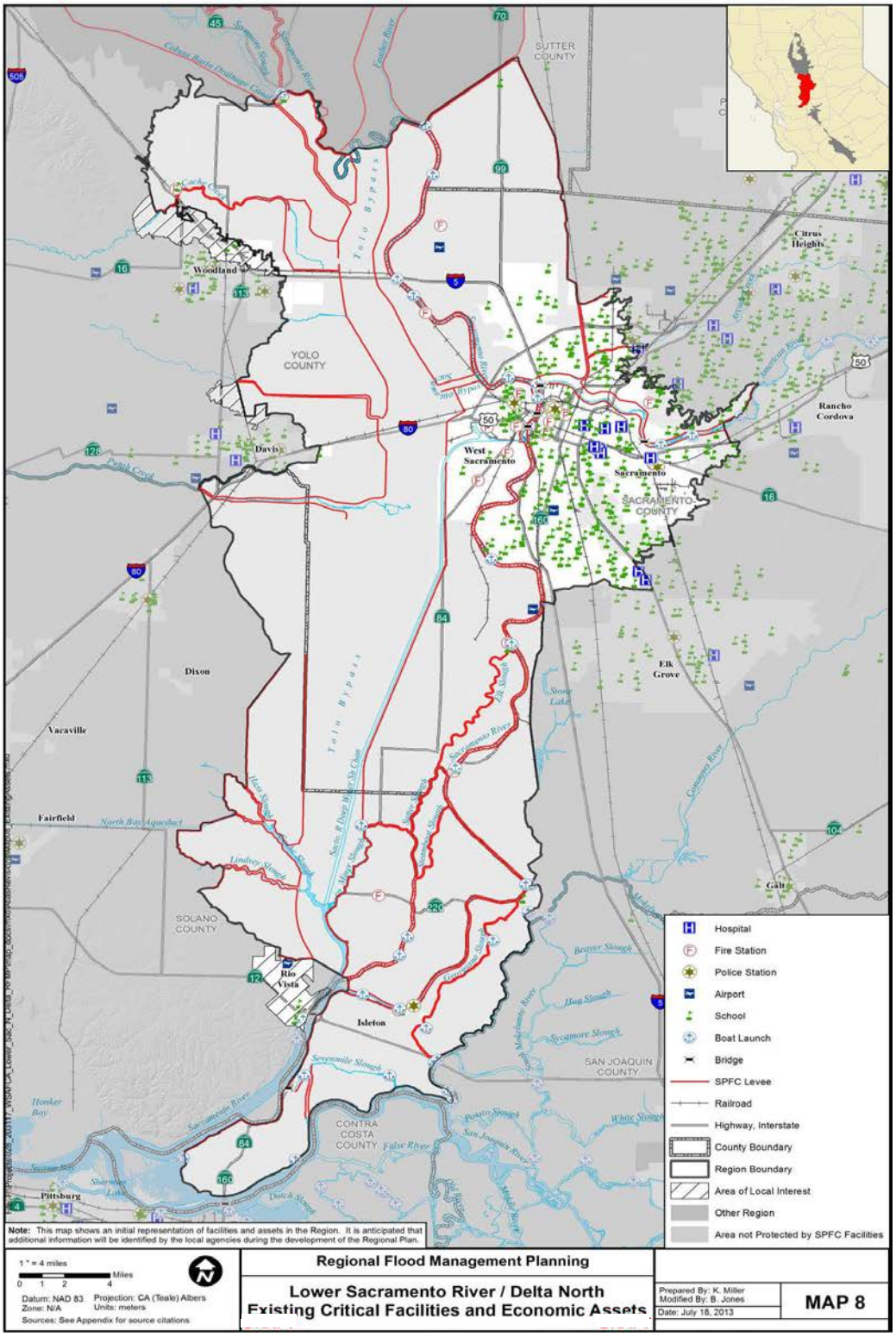
Education

- Public Schools
- Libraries
- Colleges / Universities

Other Critical Public Assets / Infrastructure

- Bus Terminals
- Railroad Stations
- Railroad Tracks / Yards
- Power Facilities / Substations
- High Voltage Transmission Facilities
- Pipelines
- Stadiums / Arenas / Entertainment
- Venues
- Regional Shopping Malls
- Underground Gas Fields and Storage Areas
- Hazmat Storage Areas
- Docks / Harbors / Launching Facilities

Figure 3-4 LSDN Region Critical Facilities and Economic Assets



-LSDN Atlas, 2013

3.3 Regional Partners

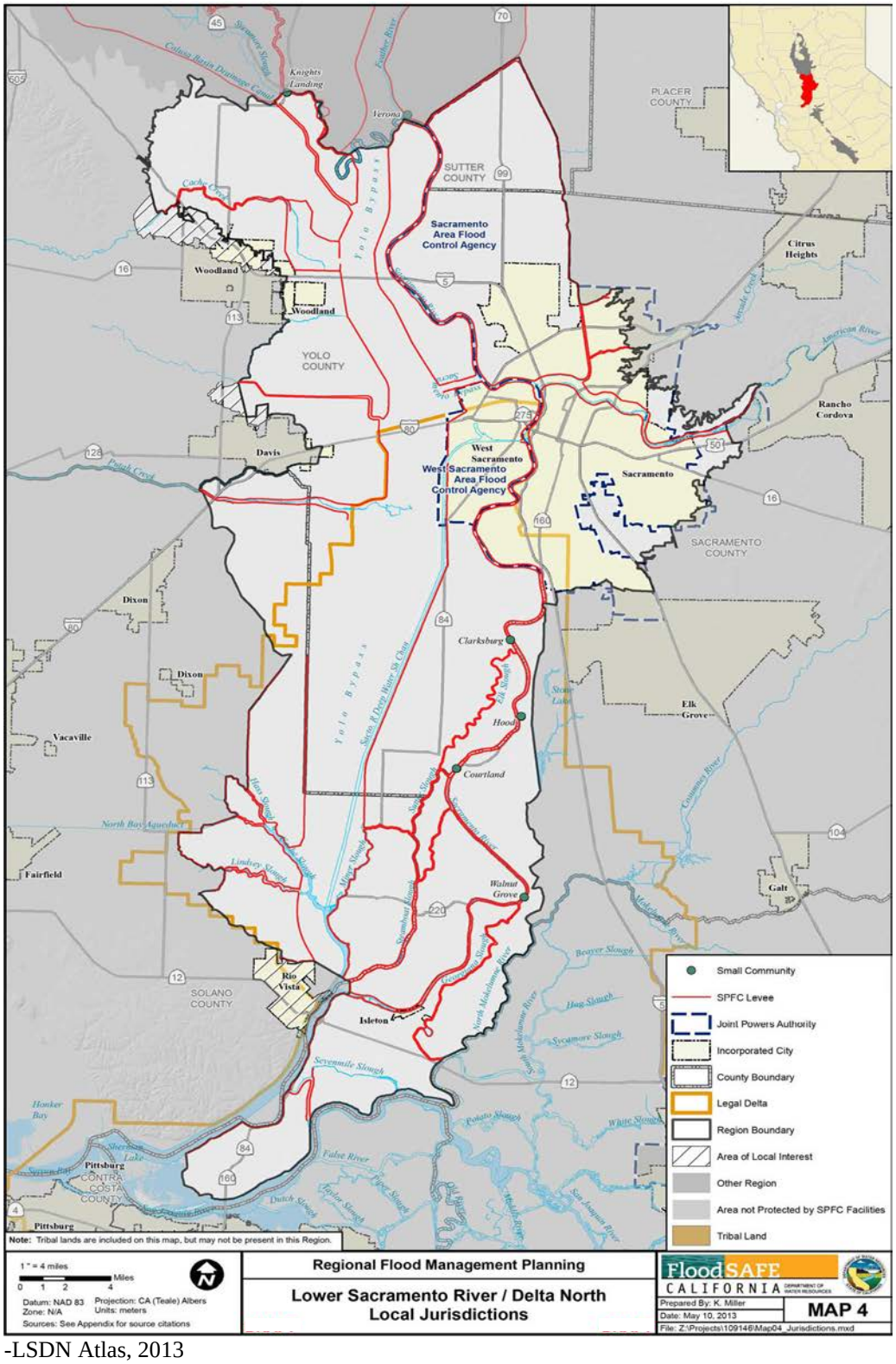
3.3.1 Jurisdictions

As stated previously, the Region extends from the Fremont Weir along the Sacramento River to near the western side of the Sacramento – San Joaquin River Delta. At its northern end, the Region receives flood flows from both the Upper Sacramento River/Mid-Sacramento River Region and the Feather River Region. The Yolo Bypass and levees along the Sacramento River and tributaries serve as the backbone of the flood management system in this Region.

The Region crosses four counties and six cities; Sacramento County, Solano County, Sutter County, Yolo County, the City of Davis, the City of Sacramento, the City of West Sacramento, the City of Woodland, the City of Isleton and the City of Rio Vista.

The SAFCA, WSAFCA, and FloodSAFE Yolo are located within the Region. Figure 3-5 shows the city and county boundaries.

Figure 3-5 LSDN Region Jurisdiction Boundaries



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3.3.2 Roles and responsibilities

Historically, major flood management initiatives in California have been undertaken by local, State, and Federal agencies in an evolving cooperative relationship. Beginning in the 1850s, levee improvements were initiated as entirely local undertakings, with sporadic efforts to provide State coordination and oversight.

State oversight of flood management efforts in the Sacramento Valley began in 1911, with the creation of the CVFPB (formerly the State Reclamation Board). Federal participation in California flood management, which was first authorized in the Caminetti Act of 1893, was firmly established with authorization of the Sacramento River Flood Control Project in 1917. From 1917 to 2006 USACE has played a lead role in planning, authorizing, financing, constructing, and inspecting flood system improvements in the Sacramento Valley, incorporating and improving upon the levee system originally constructed by local agencies (Kelley, 1989).

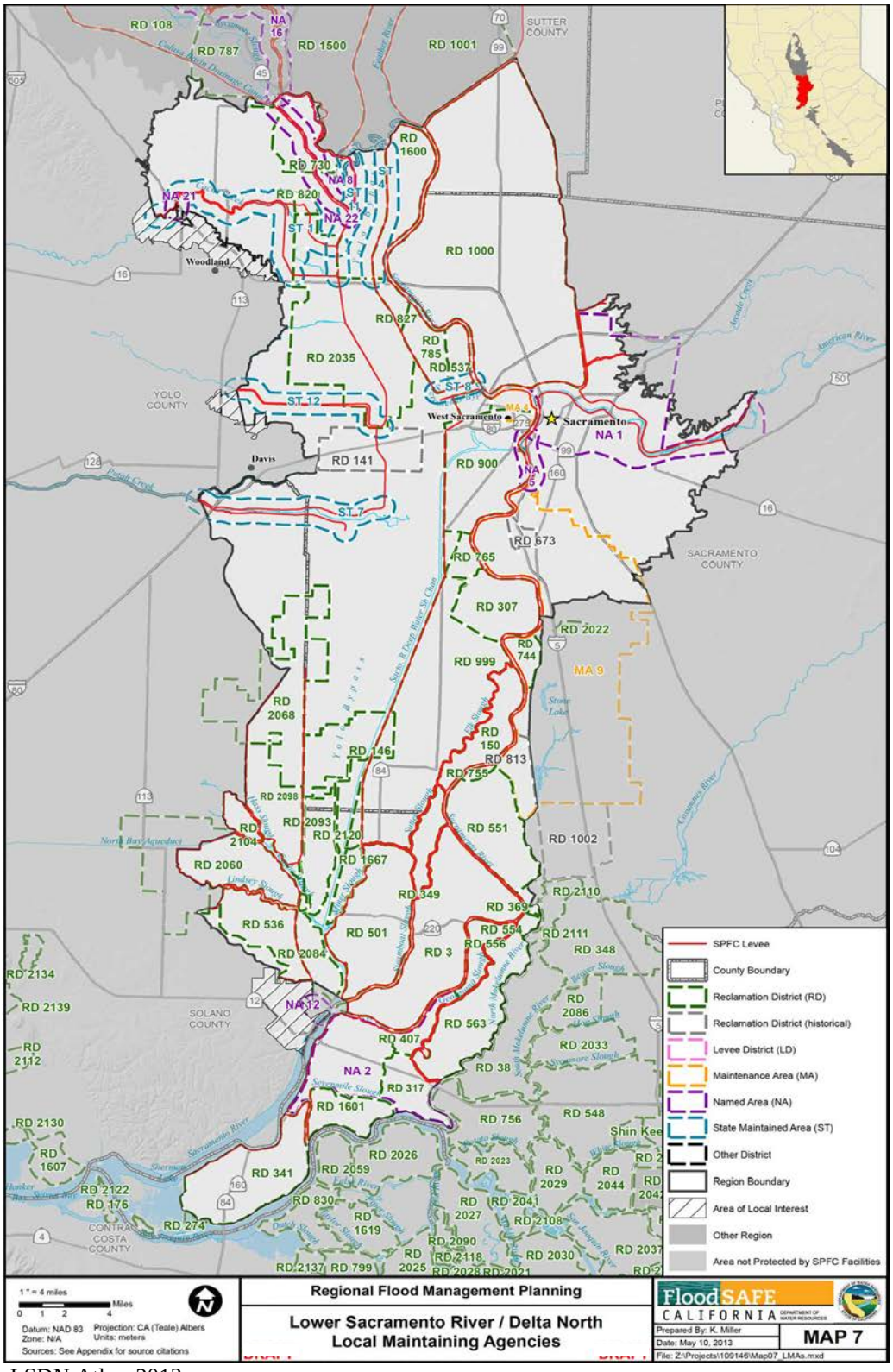
3.3.2.1 Local Agencies and their Responsibilities

Since 2006, DWR and local agencies have played more prominent roles in providing leadership and executing major levee improvement projects in the Region. The various roles of the involved agencies can be expected to continue to shift in response to political and policy changes, funding availability, interest, and leadership. The roles of the key local, State, and Federal agencies involved in providing and permitting flood management projects and programs are summarized below.

Local Maintaining Agencies

Local levee districts and reclamation districts, known collectively as LMAs, regularly patrol, maintain, repair, and conduct flood fights as needed on the levees within their jurisdictions. The LMAs have given assurances to the CVFPB that they will operate and maintain the SPFC levees within their respective jurisdictions in perpetuity, in accordance with criteria established by the USACE. Figure 3-6 identifies the LMA boundaries within the Region.

Figure 3-6 LSDN LMA Boundaries



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Counties, Cities, and Special Districts

There also counties, cities, and special districts like water agencies and water districts that also provide flood management O&M and drainage. The special districts include Solano County Water Agency, Sacramento County Water Agency, Yolo County Flood Control and Water Conservation District, and Sutter County Water Agency.

West Sacramento Area Flood Control Agency

The WSAFCA operates under a board-manager form of government and provides flood protection to the City of West Sacramento's residents, businesses and assets. The Agency provides services related to the construction, maintenance, and regulation of West Sacramento's levee system. Services include the capital expansion and improvement of levee facilities, regulatory services to fulfill legal requirements associated with Federal and State programs that relate to the Agency's activities, surveying and mapping services, and planning services that relate to and provide for the public's health and safety in regard to flood prevention, control, and emergency response.

WSAFCA is a joint powers authority created by an agreement made between the City of West Sacramento, RD 900, and RD 537. The three member WSAFCA Board formulates and enacts policy for the Agency. The elected boards of RD 900, RD 537, and the West Sacramento City Council each appoint a director and alternate director to serve as a member of the WSAFCA Board.

Sacramento Area Flood Control Agency

The SAFCA is a Joint Powers Agency which was formed in October 1989 by the SAFCA Act, to lead flood management improvement efforts for the Sacramento Area in the aftermath of the February 1986 flood. SAFCA's structure, powers, and procedures are primarily defined by the SAFCA Joint Powers Memorandum of Agreement, first signed in October 1989, and most recently updated January 17, 1991. The SAFCA Act was amended by AB 930 (Jones) which was signed into law on October 13, 2007.

Federal and State authorizations and appropriations, as well as a framework of Federal and State laws dictate to a large extent how SAFCA's flood management system improvements are planned, permitted, designed, constructed, and operated.

Improvements to the flood management system are typically cost-shared with both the Federal government and the State in an evolving partnership framed by Federal and State laws. Under current laws, the Federal government contributes up to 65 percent of project costs, leaving the remaining 35 percent to the non-Federal sponsor, which in the Lower Sacramento River/Delta North Region, is usually the CVFPB. The State contributes up to 70 percent of the non-Federal share, leaving 30 percent for the local sponsor, such as SAFCA. Thus, SAFCA's cost sharing obligation for Federally authorized and State authorized projects is typically about 10.5 percent (30 percent of the 35 percent non-Federal share).

3.3.2.2 Relevant State Agencies and their Responsibilities

The local agencies are supported in their flood management missions by key State agencies.

Central Valley Flood Protection Board

The CVFPB, with regulatory authority over the SPFC levees, has given assurances to the USACE that the Federally authorized Project levees will be operated and maintained in accordance with USACE criteria. It can serve as the non-Federal sponsor for capital improvement projects for levees in the Region, regulate encroachments, and provide that the various components function as a system.

California Department of Water Resources

DWR, primarily acting through the Division of Flood Management, is responsible for State-level flood management in the region, including: cooperating with USACE in project planning, design and funding, cooperating with the National Ocean and Atmospheric Administration (NOAA) in flood and water supply forecasting, operating the Flood Operations Center, providing flood fight assistance for local agencies, and maintaining portions of the system. DWR's levee maintenance responsibilities include portions of the system designated for State maintenance in the California Water Code (CWC §8361(f)), and operating Maintenance Areas when local agencies cannot, or choose not to meet the maintenance obligations established under the assurances given to the CVFPB and USACE (CWC §12878 et. seq.). Under these authorities DWR's Maintenance Yard maintains MA 4 and 9 in the region. The Sacramento Maintenance Yard is responsible for the State-maintained portion of the Sacramento River Flood Control Project from Knights Landing on the Sacramento River southward to Collinsville. The Sacramento Maintenance Yard ensures that the channels, levees, and structures of flood management projects in this Region are maintained in accordance with Federal regulations and the State water code.

California Office of Emergency Services

The California Office of Emergency Services (Cal OES) has overall State emergency response management authority which, among other things, includes assuring that State and local agencies operate in accordance with the Standardized Emergency Management System (SEMS).

California Department of Fish and Wildlife

The DFW administers State laws and regulations regarding the protection of fish and wildlife resources, and as such exerts permitting authority over flood management project construction, operation, and maintenance activities, as well as managing State wildlife areas in the region.

State Water Resources Control Board and the Central Valley Regional Water Quality Control Board, Central Valley Region

The State Water Resources Control Board (SWRCB) and the CVRWQCB, administer State water rights and water quality laws and regulations. The SWRCB, given its authority over

water rights, including stream diversions, may exert regulatory authority over flood management or environmental restoration projects that result in new diversions from existing channels. The RWQCB requires that construction projects, such as levee improvement projects, avoid injurious discharges from worksites to streams by preparing and adhering to Stormwater Management Plans and following Best Management Practices for chemicals, diesel fuel, drilling fluid, and other typical construction fluids. The RWQCB also works closely with USACE when it issues Section 404 permits, which must include a certification by the RWQCB that water quality will not be impaired (Section 401 permit). As noted previously, the RWQCB has adopted TMDLs for mercury for Cache Creek and the Delta and outlined milestones in its Basin Plan for the compliance by CVFPB, Corps, and DWR.

California Department of Conservation

The California Department of Conservation is responsible for administering the California Surface Mining and Reclamation Act (SMARA) of 1975. It assures that local governments, such as cities and counties, adopt and administer ordinances compliant with the law. SMARA is an important consideration for most flood management projects, as it applies to any projects which disturb more than one acre of land or move more than 1,000 cubic yards of material. SMARA compliance involves formulating projects which do not result in injurious discharges from the disturbed area during the mining operation, followed by a reclamation plan which restores the mined land to beneficial use (DOC, 2013).

DOC also administers the Williamson Act, enacted in 1965, designed to help preserve agricultural land through property tax incentives and long-term contracts. It was enhanced in 1998 with the addition of Farmland Security Zone (FSZ) provisions, which offers additional incentives to extend the contract period from the normal ten-year period to twenty years. Sacramento County, Yolo County, Sutter Country and Solano County participate in the Williamson Act program. Yolo County also participates in the FSZ provisions.. The DOC also administers various grant programs for the acquisition of agricultural and open space preservation. Such programs may work synergistically with non-structural flood management projects, which may improve flood system capacity, reduce long-term risks to life and property, and improve resiliency through actions such as agricultural conservation easements, open space easements, levee setbacks and floodplain restoration, where locally supported and feasible.

California Air Resources Board

The California Air Resources Board established in 1967 with the passage of the Mulford-Carrell Act, has consistently set air quality standards for California which are more stringent than the national standards. It oversees 35 local and regional air pollution control districts, which are responsible for regulating air quality within their districts. Within the Region, the Butte County Air Quality Maintenance District, the Feather River Air Quality Maintenance District, and the Placer County Air Pollution Control District regulate air quality. These districts review and exert permitting authority over flood management project construction activities. In practice, the primary constituents of concern are fugitive dust and diesel exhaust,

which can be limited through the application of best management practices (Air Resources Board, 2013).

State Historic Preservation Office

The extensive ground disturbing activities associated with levee reconstruction may affect archaeological and cultural resources, which are protected by both Federal and State law. The State Historic Preservation Office must approve construction activities which have the potential for disturbing such resources. Mitigation for the potential impacts on archaeological and cultural resources include pre-construction surveys, designing projects to avoid impacts where feasible, construction monitoring, and protection or such resources if discovered during the course of construction. It is very important to coordinate with the most likely descendants of resources in the project area throughout the planning and construction process.

California Department of Transportation (Caltrans)

For more than 100 years, Caltrans and its predecessors have been responsible for planning, designing, building, operating and maintaining California's state highway system. Caltrans manages more than 50,000 miles of California's highway and freeway lanes, provides inter-city rail services, permits more than 400 public-use airports and special-use hospital heliports, and works with local agencies. Caltrans carries out its mission of improving mobility across California with six primary programs: Aeronautics, Highway Transportation, Mass Transportation, Transportation Planning, Administration and the Equipment Service Center.

Delta Protection Commission

The mission of the Delta Protection Commission is to adaptively protect, maintain, and where possible, enhance and restore the overall quality of the Delta environment consistent with the Delta Protection Act, and the Land Use and Resource Management Plan for the Primary Zone. This includes, but is not limited to, agriculture, wildlife habitat, and recreational activities. The goal of the Commission is to ensure orderly, balanced conservation and development of Delta land resources and improved flood protection.

Delta Stewardship Council

The Delta Stewardship Council was created in legislation to achieve the State-mandated coequal goals for the Delta of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place. State and local agencies proposing to undertake a qualifying action, called a “covered action” in the Act, must submit to the Council, a written certification of consistency with detailed findings as to whether the covered action is consistent with the Delta Plan.

3.3.2.3 Federal Agencies and their Responsibilities

U.S. Army Corps of Engineers

At the Federal level, USACE is primarily responsible for planning, designing, and constructing Federally authorized flood management facilities including dams, levees, and other structures. It also develops the operational rules for federally funded flood management reservoirs, which includes most of the major reservoirs on Central Valley streams. Following the Hurricane Katrina Gulf Coast disaster of 2005, USACE implemented a National Levee Safety Program, promulgated strict vegetation management guidelines, and strengthened its national levee inspection program.

National Weather Service

The National Weather Service (NWS), a part of the NOAA, operates centers throughout the United States which monitor and forecast climate, weather, severe storms, and runoff. In California the NWS weather forecasting centers are supplemented by the California Nevada River Forecast Center (CNRFC), which cooperates with DWR to issue flood and water supply forecasts (CNRFC, 2013). These forecasts are critically important to the Region, because under winter storm conditions, the Feather, Yuba, and Bear rivers can rapidly generate enormous flows, creating conditions of extreme peril for residents and damageable property in the levee-protected areas of the Region. Accurate and timely flood forecasts are an important component of the Region's flood risk management system.

NOAA Fisheries

NOAA Fisheries is responsible for the protection of anadromous fisheries, including salmon and steelhead, which migrate through and spawn in channels of the Sacramento, Feather, Yuba, and Bear Rivers, as well as some local creeks. NOAA Fisheries plays an important role in the flood project planning process, providing guidance on ways to design and operate flood management works to minimize impacts and enhance fisheries habitat. USACE and other project proponents must consult with NOAA fisheries in all phases of Federal flood management project planning, design, and construction which have the potential for impacting the species of concern which NOAA Fisheries administers. In administering various Federal statutes and regulations protecting migratory species of concern, NOAA fisheries may also impose conditions on the operation of multi-purpose dams and reservoirs with Federal participation, including the major reservoirs protecting the Region (NOAA Fisheries, 2013).

U.S. Fish and Wildlife Service

The USFWS plays a similar role as that of NOAA Fisheries, with a focus on terrestrial, avian, and resident fish species and their habitats. In the Region some of the key species of concern are the giant garter snake, the Swainson's hawk, and the Valley elderberry longhorn beetle. USFWS plays an important role in the flood project planning process, providing guidance on ways to design and operate flood management works to minimize impacts and enhance fish and

wildlife habitats. USACE and other project proponents must consult with USFWS in all phases of Federal flood management project planning, design, and construction.

Federal Emergency Management Agency

FEMA plays a multitude of flood management roles, including managing the National Flood Insurance Program (NFIP), which includes mapping of and classification of flood hazards in the Region. FEMA administers the Disaster Mitigation Act of 2000 (DMA 2000), which requires that local communities evaluate the natural hazards within their boundaries and develop mitigation plans for those hazards in order to maintain eligibility for its Pre-Disaster Mitigation and Hazard Mitigation Grant Programs. FEMA also provides Federal disaster recovery assistance in the event of Federal emergency declarations or disaster declarations.

Federal emergency management efforts are structured in accordance with the National Incident Management System.

U.S. Department of the Interior, Bureau of Reclamation

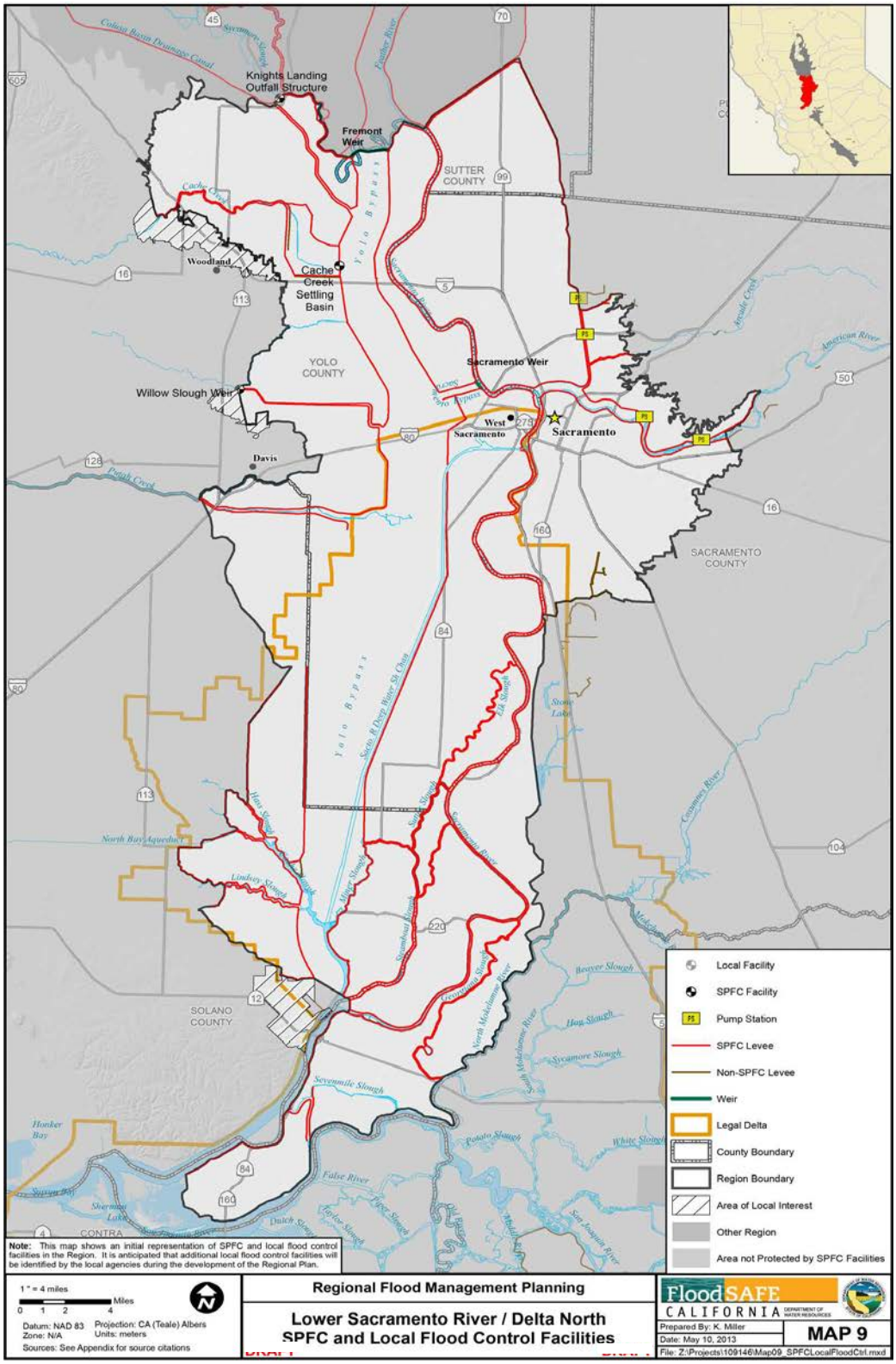
The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public. The USACE completed construction of Folsom Dam in 1956 and then transferred the dam to the Bureau of Reclamation for coordinated operation as an integral part of the Federal Central Valley Project. Folsom Dam regulates flows in the American River for flood management. Releases from Folsom Reservoir are used for municipal and industrial water supply, agricultural water supply, power, fish and wildlife management, recreation, navigation and water quality purposes.

3.4 Existing Infrastructure and Programs

3.4.1 Structural

The Region contains a number of flood management facilities both locally owned and operated as well as State owned and operated through the SPFC. The main purpose of these facilities is to control storm water runoff and protect the local population in the Region from flood risks. Some SPFC facilities also serve the purposes of creating hydroelectric power and managing and conveying the State's potable water supply. SPFC facilities in the Region are listed and briefly explained below. Information on local flood management facilities may be provided by local entities during the regional flood management planning process. Major flood management facilities are shown on Figure 3-7.

Figure 3-7 LSDN Flood Management Facilities



-LSDN Atlas, 2013

Willow Slough Weir – Located on the Willow Slough in Yolo County, this weir is seated at the bifurcation point for water from the original water course, to the relocated man-made bypass channel which conveys it to the Yolo Bypass. The added capacity of the Willow Slough Bypass protects the City of Davis from flooding.

Knights Landing Ridge Cut – The Knights Landing Ridge Cut provides drainage of the Colusa Basin Drain to the Yolo Bypass. Based on the O&M manual, the design capacity of the cut is 20,000 cfs with 3 feet of freeboard at the upstream end, and 6 feet of freeboard at the Yolo Bypass. The channel and its right- and left-bank levees are each about 6.4 miles in length. Maintenance is conducted by the Knights Landing Ridge Drainage District.

Cache Creek Settling Basin – Located along the Yolo Bypass near Cache Creek, this settling basin is an area where water from Cache Creek collects before entering the Yolo Bypass flood management feature. Allowing water to settle controls flow rates and reduces sediment transport into the Yolo Bypass. This helps to maintain the flood conveyance integrity of the Yolo Bypass.

Fremont Weir – Located just south of Knights Landing Outfall Structure at the junction of the Sacramento River and the joint Feather River/Sutter Bypass channel, the Fremont Weir controls the hydraulic energy of flowing water from the Sacramento River, Sutter Bypass, and Feather River as it enters into the Yolo Bypass. Acting as a barrier for water within the bypass, the weir is designed to alter the flow characteristics of the water as it passes over the weir. Water pools behind the weir and is released slowly once the water level has risen to the top of the barrier. Altering the hydraulic energy of the flowing water can prevent damage to the flood management system downstream.[2]

Sacramento Weir – Located just upstream of the confluence of the Sacramento and American Rivers, this structure is a series of weirs which diverts water from the Sacramento River into the Sacramento Bypass, which discharges into the Yolo Bypass. This weir requires manual operation for flow release and is composed of 48 sections, for a total width of 1,920 feet.

Yolo Bypass – Located between Yolo and Sacramento Counties, south of the Fremont Weir, this bypass protects Sacramento, West Sacramento, and other riverside communities by conveying approximately 80 percent of flood flows through the greater Sacramento Area. According to the 2009 Yolo County Agricultural Commissioner's Report, of the 59,000 acres in the Yolo Bypass, 28% consists of habitat, and 61% consists of agricultural lands.

Storm Water Pump Stations – Storm water pump stations are located along many of the levees and stream channels in the Region. These facilities are used to drain the areas adjacent to the channels protected by levee systems.

[2] FloodProtect is limiting discussion of the Fremont Weir to existing O&M issues and will not address any modifications to the weir.

Most of the lowlands in the Delta are protected by non-SPFC levees. These levees are in the charge of local agencies, the majority of which are reclamation districts or private entities, which levy taxes on landowners for the local cost share of flood protection. Information on local flood management facilities within the Delta may be provided by local entities during the regional flood management planning process.

3.4.1.1 Condition of Existing Infrastructure

There are various studies and efforts that are currently being developed or have been recently completed to evaluate the condition and status of the Region's flood management infrastructure. The following sections provide a summary of many of these efforts. Where available, data is presented to show the current status of the Region's flood management infrastructure.

Flood Control System Status Report (DWR, 2011)

Prepared in 2011, the FCSSR described the current status (physical condition) of SPFC facilities at a systemwide level.

The FCSSR is primarily intended to present information on the physical condition of SPFC facilities, and to help guide future inspection, evaluation, reconstruction, and improvement of the facilities. Information contained in the FCSSR should not be used to predict how a levee or associated facilities may perform in a specific flood event. More detailed information (such as additional geotechnical explorations and analyses at a greater frequency) would be necessary to meet other purposes, such as assessing whether a levee could be certified under FEMA standards to provide base flood protection under the NFIP.

The overall condition of urban levees, nonurban levees, channels, and flood management structures of the SPFC can be summarized as follows:

- Urban levees – Approximately half of the 300 miles of SPFC urban levees evaluated do not meet current levee freeboard, stability, or seepage design criteria[3] at the design water surface elevation (WSE).
- Non-urban levees – Approximately three-fifths of the 1,230 miles of SPFC non-urban levees evaluated are susceptible to failure from under-seepage, through-seepage, structural instability, and/or erosion at the assessment water surface elevation[4]. Four non-urban levees were evaluated based on systematic, consistent, repeatable analyses

[3] The design criteria used were based on the USACE 2000 *Design and Construction of Levees Engineering Manual 1110-2-1913* and DWR 2010 *Interim Levee Design Criteria for Urban and Urbanizing Areas in the Sacramento Valley, Version 4*.
[4] Where available, 1955/57 design water surface elevations were used as the assessment water surface elevation. In the absence of 1955/57 design water surface elevations, the assessment water surface elevation was based on freeboard requirements for each levee segment (i.e., generally 3 feet below the levee crest).

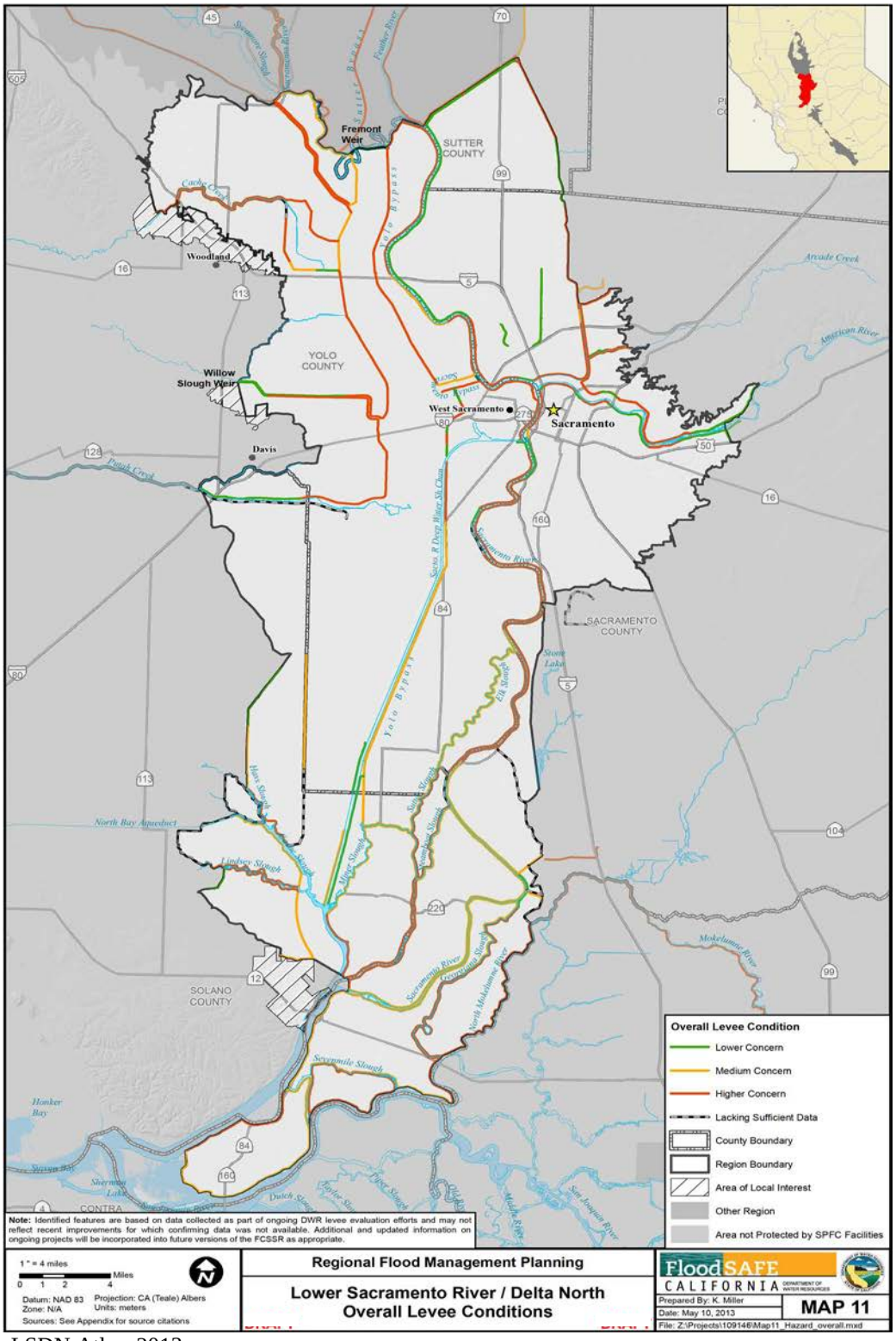
that correlated geotechnical data with levee performance history, not relative to any current design criteria[5].

- SPFC channels – Approximately half of the 1,016 miles of channels evaluated in the SPFC have a potentially inadequate capacity to convey SPFC design flows, and require additional evaluation to confirm conditions.
- SPFC flood management structures – None of the 32 hydraulic structures or 11 pumping plants inspected by DWR for the SPFC were rated "Unacceptable" during the 2009 inspections. Of the 10 SPFC bridges inspected by the DWR in 2009, 2 were in need of repairs.

Based upon the available data, assessment (judgment) was made as to whether each Reach of a given Study Area "met", "did not meet", or "marginally met the existing evaluation criteria for: Freeboard, Geometry, Seepage and Landside Steady State Stability. In certain areas, insufficient information was available to make an assessment; these areas have been classified as "insufficient data." The condition of levees, as determined by FCSSR, is shown graphically on Figure 3-8.

[5] This approach was selected because the extent of the NULE Project is significantly greater than the ULE Project, making it difficult to conduct the same level of field explorations and geotechnical data collection performed for ULE levees.

Figure 3-8 Overall Levee Conditions (2011 Flood Control System Status Report)



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Annual Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Protection System

The Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System is the annual report on the effectiveness of facility maintenance activities of the maintaining agencies. The report covers levees, channels, and other structures, such as pumping plants. Deficiencies or problems are noted and each agency receives a rating for the facilities within its maintenance responsibilities based on the inspections. This annual report is intended for use by the USACE, DWR, CVFPB, LMAs, and other interested parties.

The DWR's Flood Project Integrity and Inspection Branch conducts two comprehensive levee inspections and one channel and structure inspection each year. DWR documents the location, size, type, and rating of maintenance deficiencies while working with the LMAs to assist in planning maintenance activities prior to the flood season. Each inspection was rated accordingly:

- Acceptable (A) – No immediate work required, other than routine maintenance. The flood protection project will function as designed and intended with a high degree of reliability, and necessary cyclical maintenance is being performed adequately.
- Minimally Acceptable (M) – One or more deficient conditions exist in the flood protection project that needs to be improved or corrected. However, the project will essentially function as designed with a lesser degree of reliability than what the project could provide.
- Unacceptable (U) – One or more deficient conditions exist that may prevent the project from functioning as designed, intended, or required.

The overall maintenance rating for each LMA in the Region will be presented in Section 4.

USACE Levee Safety Program

The USACE conducts two types of inspections under its Levee Safety Program: 1) continuing eligibility (or routine) inspections and 2) periodic inspections. Both of these inspections look at the condition of the levee less frequently than DWR does, but the USACE is able to take more time and do a more thorough inspection. The USACE also determines overall ratings differently than the DWR. Both continuing and periodic inspections incorporate a consistent inspection checklist and result in a levee system rating for operation and maintenance. This rating determines if a levee system is active in the USACE Levee Safety Program. Levees damaged by a flood event are eligible for Federal rehabilitation funds (authorized by Public Law (PL) 84-99) through the Rehabilitation and Inspection Program (RIP).

DWR's Inspection and Local Maintaining Agency Report, described in the previous section, includes the ratings and eligibility in the RIP for systems inspected by the USACE. The Levee Safety Program also communicates flood risk to local communities and provides assistance in flood fighting through information and direct assistance.

Non-Urban Levee Evaluations

The primary purpose of the Non-Urban Levee Evaluation (NULE) Project, as established by DWR, is to evaluate non-urban/State-Federal Project levees and pertinent non-project levees to determine whether they meet defined geotechnical criteria and, if appropriate, identify remedial measure(s) to meet those criteria in the Central Valley. The geotechnical engineering performed through the NULE projects helps flood managers understand the overall flood risks in the Central Valley and evaluate alternative changes to the flood management system to better manage the risks.

Data presented in the NULE Geotechnical Assessment Report described the work performed and results of Phase 1 assessments addressing over 900 miles of non-urban levees in the North NULE study area. Phase 1 assessments were based on non-intrusive studies and readily-available data. Phase 1 assessments were discretized based on levee segments (typically, levee maintenance units). Hazard categories were assigned to each segment for four geotechnical potential failure modes, underseepage, slope stability, through seepage, and erosion.

The NULE team developed the Levee Assessment Tool (LAT) which allowed for methodical assessments of levee information to develop hazard indicator scores. The hazard indicator score is then compared to documented past performances. The LAT implements a consistent, repeatable process for categorizing levee conditions based on their level of hazard.

The hazard indicator scores for each of the four potential failure modes were then evaluated collectively to assign an overall hazard category to each segment. Phase 1 assessments also included a review of levee geometry, freeboard, and the segment's history of overtopping.

The hazard categories are defined as:

- Hazard Level A – When water reaches the LAT assessed WSE, there is a low likelihood of either levee failure or the need to flood-fight to prevent levee failure.
- Hazard Level B – When water reaches the LAT assessed WSE, there is a moderate likelihood of either levee failure or the need to flood-fight to prevent levee failure.
- Hazard Level C – When water reaches the LAT assessed WSE, there is a high likelihood of either levee failure or the need to flood-fight to prevent levee failure.
- Lacking Sufficient Data (LD) – There is currently insufficient data about past performance or hazard indicators to assign a hazard level, or there is poor correlation between past performance and hazard indicator scores.

As used in these definitions, the term flood-fight refers to actions associated with geotechnical failure modes, not flood-fighting to prevent levee overtopping. Data for each of the NULE assessments in the Region will be presented in Section 4 of this report.

Parametric Cost Estimating Table

The Parametric Cost Estimate Template (PCET), used for the NULE project, is a program driven spreadsheet that can estimate costs to remediate seepage, stability, and erosion deficiencies for levees. The alternative remediation includes: drained stability berm, seepage berm, rock slope protection and geometry, and freeboard repairs. In addition to the direct civil construction costs for major work items, the PCET also includes percentage allowances for significant indirect cost items, such as engineering and design, construction management, site restoration, environmental mitigation, temporary and permanent real estate acquisitions, owner legal costs, escalation, and contingency.

Urban Levee Evaluations

Through the Urban Levee Evaluations (ULE) Program, DWR is performing geotechnical evaluations of approximately 40 miles of SPFC and non-project levees protecting populations of 10,000 people or more. Data from this program is still under development, but points of past performance problems (PPP) are shown on Figures 3-9, 3-10, 3-11, and 3-12 for seepage, slope instability, erosion, and other problems, respectively.

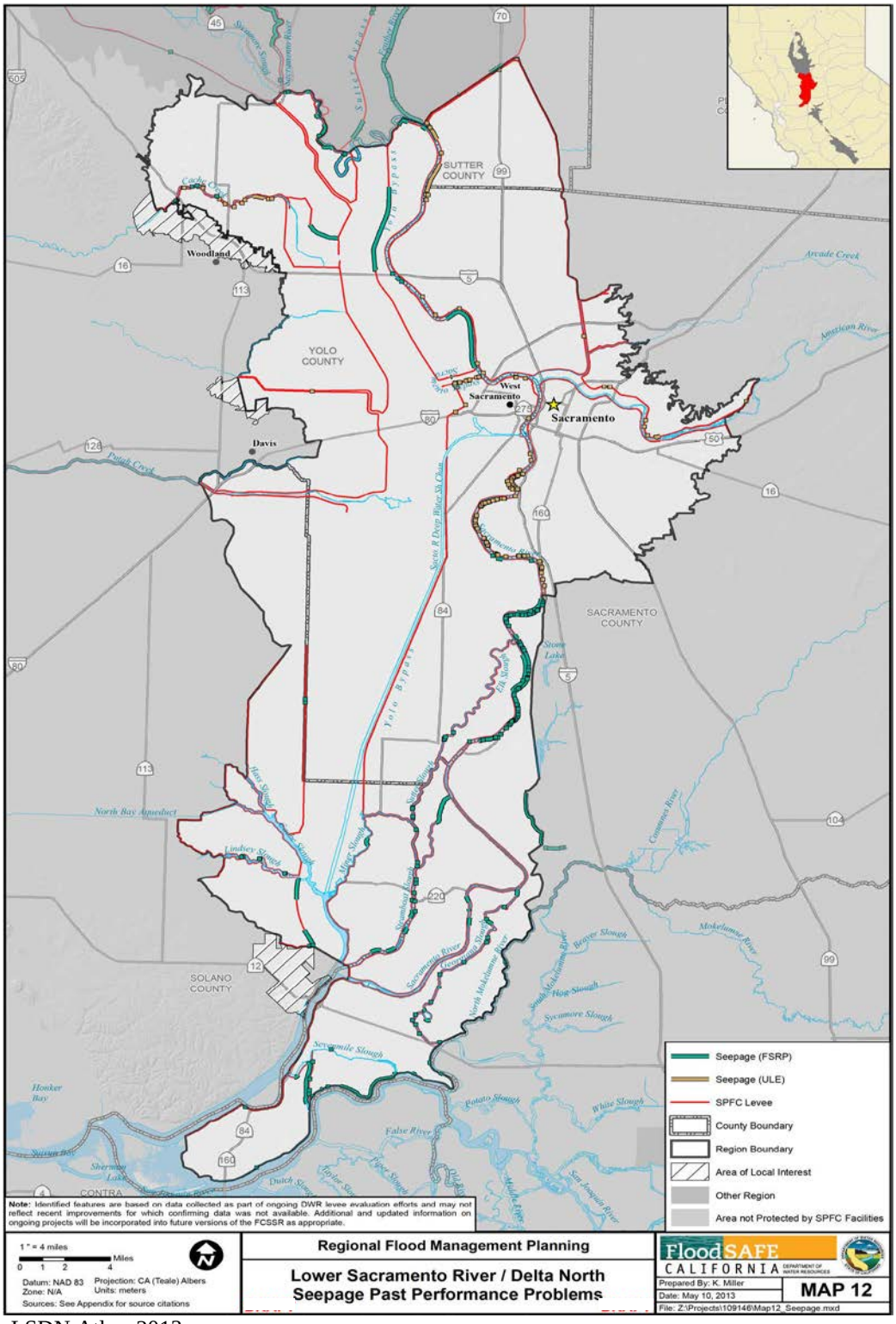
Flood System Repair Project

Another source of flood management problem identification is the master database from the 2012 Flood System Repair Project (FSRP). DWR developed FSRP to help LMAs reduce flood risks in non-urban areas by providing technical and financial support to repair documented critical or serious problems with flood protection. The master database from the FSRP contains a list of PPPs for seepage, slope instability, erosion, and other problems. The locations of these problems are shown on Figures 3-9, 3-10, 3-11, and 3-12, respectively. PPPs are represented as points or lines depending upon the extent of the problem. In implementing the FSRP, a copy of the NULE database became the starting point for the Master Databases.

DWR also added the following PPP categories to the Master Databases from other sources:

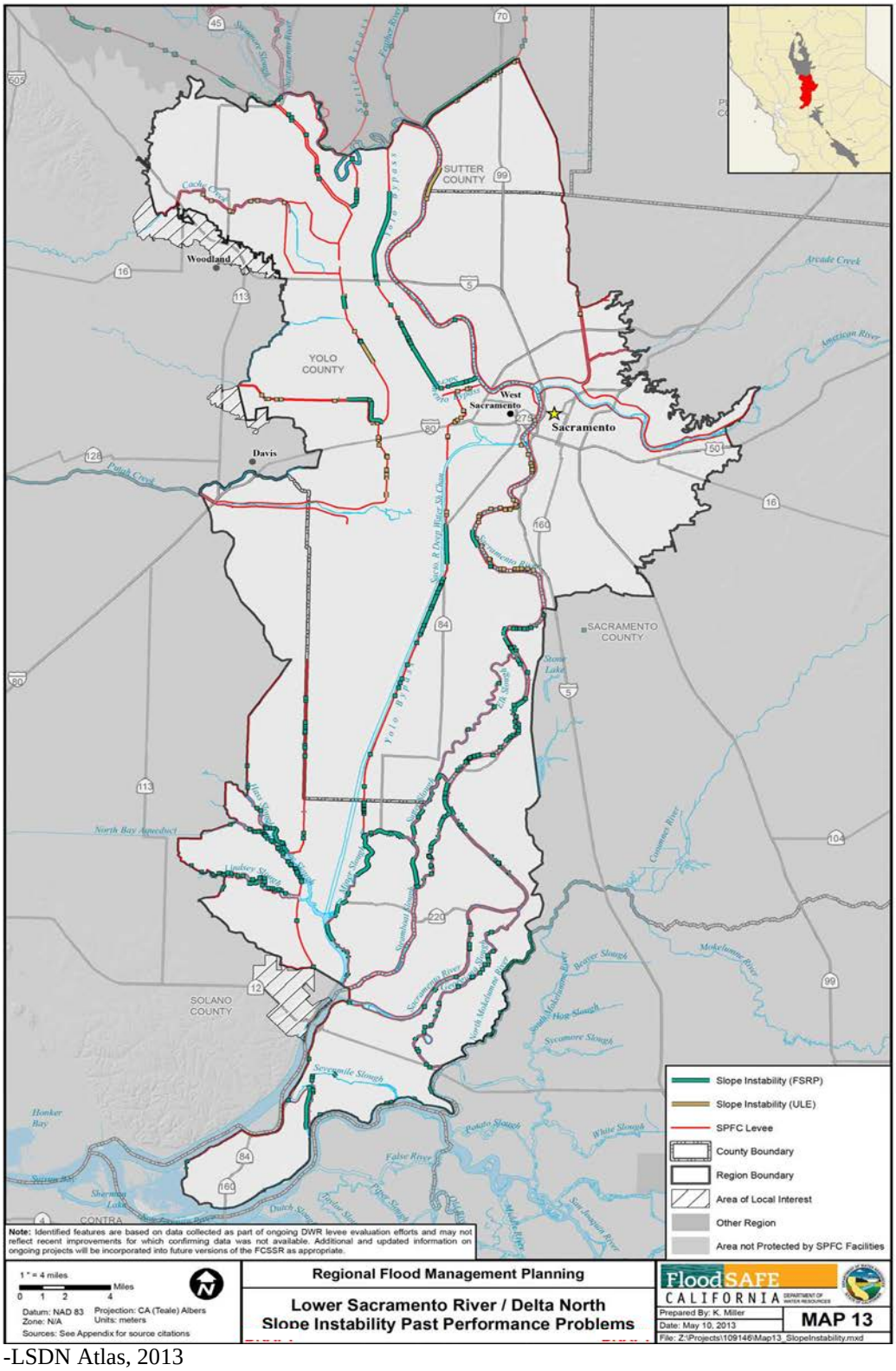
- Erosion sites from DWR's Flood Protection Inspection Branch's 2011 and 2012 erosion site inventories.
- Documented PPPs from USACE's available periodic inspections.
- Freeboard deficient levee sites less than approximately 500 feet long or freeboard deficient sites located based upon available light detection and ranging (LiDAR) survey data.
- Recent reported PPPs from the DWR Flood Operations Center. Reducing and expanding upon the original NULE past performance problem data set as described above produced a final list of past performance problems used for the 2012 field reconnaissance.

Figure 3-9 Seepage Past Performance Problems (FSRP and ULE)



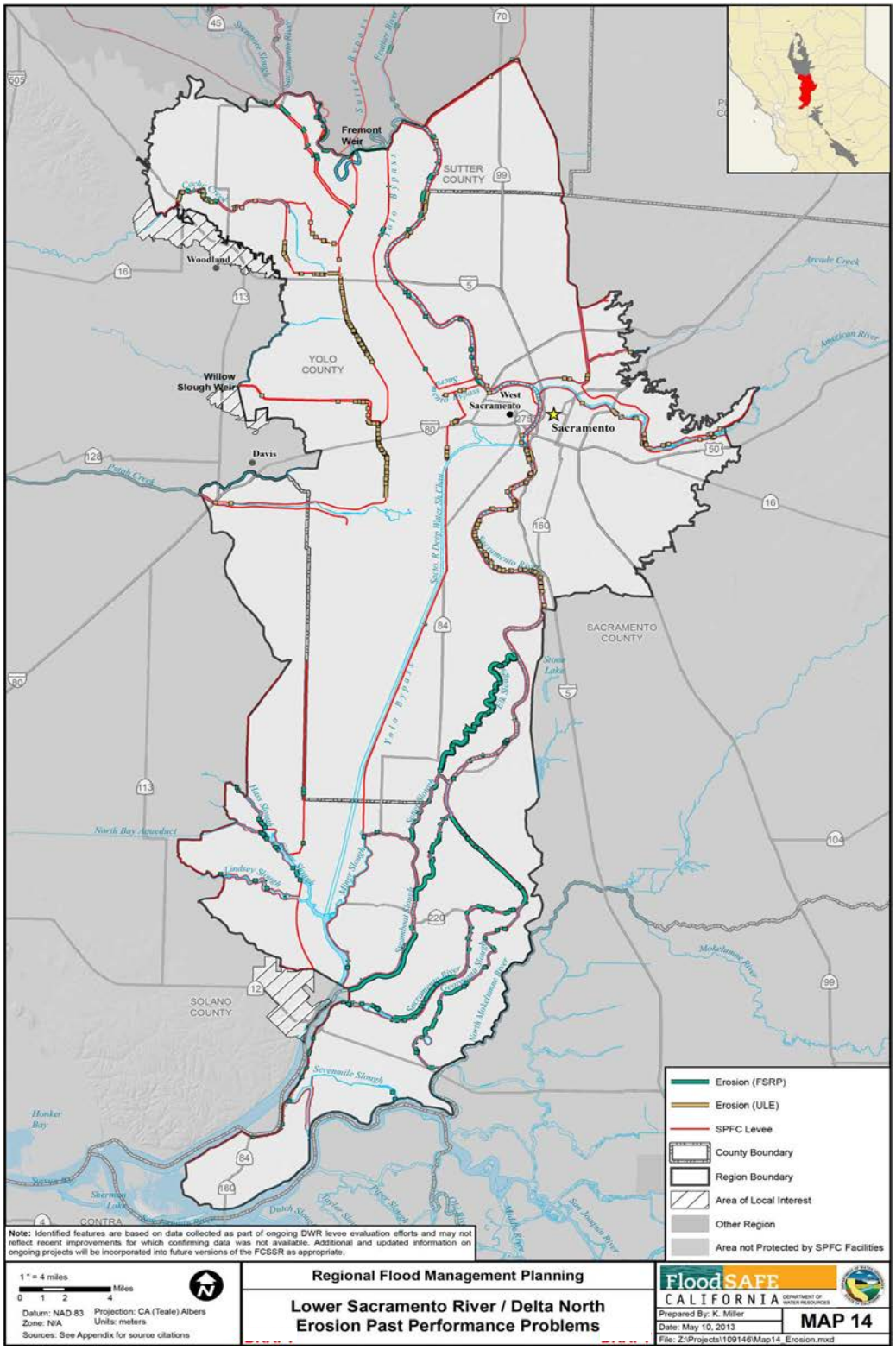
-LSDN Atlas, 2013

Figure 3-10 Slope Instability Past Performance Problems (FSRP and ULE)



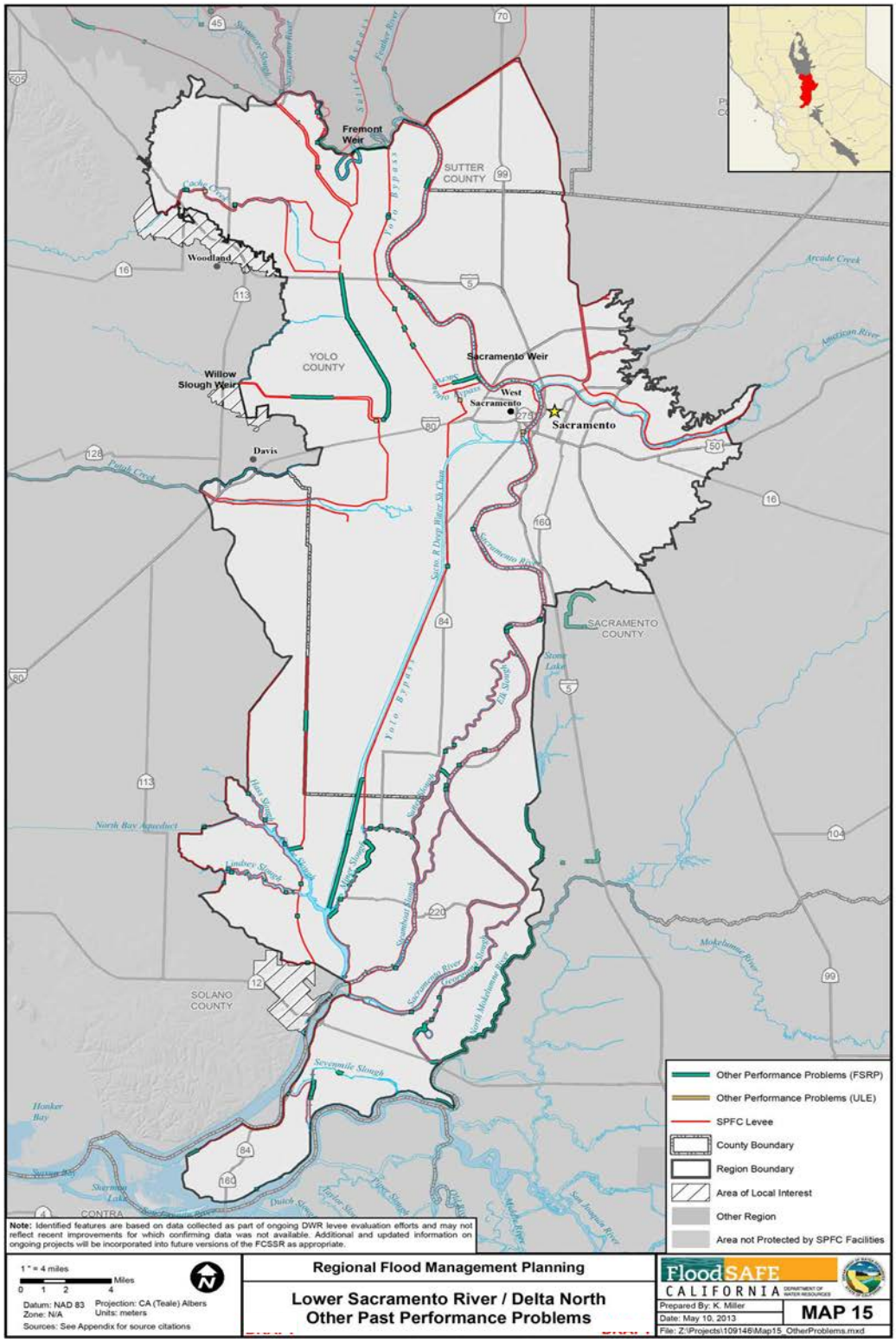
-LSDN Atlas, 2013

Figure 3-11 Erosion Past Performance Problems (FSRP and ULE)



-LSDN Atlas, 2013

Figure 3-12 Other Past Performance Problems (FSRP and ULE)



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Sacramento River Bank Protection Project

Another on-going project in the Region is the Sacramento River Bank Protection Project (SRBPP), which is designed to enhance public safety and help protect property along the Sacramento River and its tributaries and sloughs. The goal of the SRBPP is to evaluate the levees bordering the river and reduce stream bank erosion along them to minimize the threat of a flood along the Sacramento River. Repairs may consist of armoring banks with stone protection, the installation of waterside berms, or the construction of setback levees.

While the original authorization approved the rehabilitation of 430,000 linear feet of levee, the 1974 Water Resources Development Act added 405,000 linear feet to the authorization and a 2007 bill authorized another 80,000 linear feet for a total of 915,000 linear feet of project. USACE is currently developing a Limited Reevaluation Report, including an Environmental Impact Statement, to address the effects of the latest authorization. The report is scheduled to be completed in 2015.

The SRBPP is limiting bank repairs to those that can be shown to be economically justified. For instance, in the lower Sacramento region, erosion protection is justified on banks and levees that protect Sutter Island, Sacramento, West Sacramento, the Natomas Basin, and the town of Yolo. Other reaches may become justified with further study.

The USACE, Sacramento District is responsible for implementation of the project in conjunction with its non-Federal partner, the CVFPB.

3.4.2 Non-Structural

Non-structural flood risk management elements include a wide range of measures which limit the risk of flood damage primarily by avoiding or reducing the exposure to damaging flood waters rather than by confining those flood waters with larger and stronger hydraulic structures. These elements include raising and waterproofing structures so that they will be above anticipated flood levels or unharmed by flood waters, purchasing and relocating at-risk structures, limiting development in floodplains through the acquisition of agricultural conservation easements, open space easements, regulatory constraints, and incentive programs. Floodplain restoration provides additional flood channel storage and conveyance capacity and is often regarded as a non-structural element because it reduces, rather than increases, the confinement of floodwaters in existing channels.

The most significant non-structural flood risk reduction program is the NFIP which is administered by the FEMA. The NFIP focuses on mapping flood hazard areas nationwide, and requires that homes and other structures, with Federally backed mortgages, must carry flood insurance if the mapped area has less than 100-year flood protection.

Senate Bill 5 and companion legislation passed by the State Legislature in October 2007 establishes flood protection requirements for urban areas that complement the NFIP. Under

these requirements, levees and facilities must provide at least 200-year level of protection to permit new development.

3.4.2.1 Environmental Enhancements

Riparian Vegetation

Riparian vegetation is a habitat type that is characterized by trees, other vegetation and physical features normally found on the stream banks and floodplains associated with streams, lakes, or other bodies of water. Riparian systems provide several important functions to both the aquatic and terrestrial ecosystems associated with them. These include, but are not limited to, stream bank stabilization, flow moderation and flood management, sediment control, organic matter necessary to support aquatic communities, water quality improvement by filtration, temperature moderation by shading, and stream structural diversity. Riparian habitats support a great diversity of wildlife, including sensitive invertebrates, amphibians, reptiles, birds, and mammals.

Riparian vegetation occurs throughout the Lower Sacramento River region. Within the Regional Boundary areas, riparian vegetation is concentrated and occurs intermittently around waterways including, the American River, Sacramento River, and their tributaries.

Designated Critical Habitat

Designated Critical habitat is a term defined in the Endangered Species Act and used by USFWS and the NMFS. Designated Critical Habitat is a geographic area that is essential for the conservation and recovery of a Federally threatened or endangered species that requires special management and protection. It may include an area that is not currently occupied by the species but that will be needed for its recovery. Critical habitats are designated to ensure that actions authorized by Federal agencies will not destroy or adversely modify critical habitat, thereby protecting areas necessary for the conservation of the species. Not all federally listed species have designated critical habitat.

Endangered and Threatened Species

Species in the Region which have been listed as threatened or endangered include the giant garter snake (Thamnophis gigas), Delta smelt (Hypomesus transpacificus), Valley elderberry longhorn beetle (Desmocerus californicus dimorphus), Central Valley steelhead (Anadromous O. mykiss), Central Valley Chinook salmon (Oncorhynchustshawytscha), and Green sturgeon (Acipenser medirostris).

3.4.2.2 Operation and Maintenance

The flood management system is operated to safely convey flood flows, through the coordinated efforts of local, State, and Federal agencies. Flood management system operations include the operation of the multi-purpose reservoirs; operating and maintaining the levee system, hydrologic monitoring and flood forecasting, and coordinated flood operations under the SEMS.

Under this program, LMAs, such as RDs, are responsible for patrolling and maintaining their levee systems. The LMAs are responsible for initiating flood fights when necessary, and requesting assistance from higher authorities, such as the county Operational Areas (OAs). These OAs provide assistance and support during flood emergency situations. When resources are depleted, OAs can request assistance from the Cal OES Inland Regional Operations Center in Rancho Cordova, which can request additional flood fighting support from the DWR Flood Operations Center (FOC). The FOC would respond to these requests by allocating State emergency supplies, crews, and support staff. USACE PL 84-99 support can be requested if the State is low on resources.

Figures 3-6 and 3-7 respectively show the LMA boundaries and flood management facilities within the LSDN. Section 3.2.2 Roles and Responsibilities details further roles of the governing agencies within the area.

Typical operation and maintenance work performed on a routine basis includes: erosion repairs, road repairs, debris removal, minor core trenching, ditch cleaning, pump repair and maintenance, vegetation control, rodent control, and rodent damage repair.

3.4.2.3 Flood Emergency Preparedness, Response, and Recovery

Critical emergency response facilities and their locations often determine the ability of land use agencies and special districts' to respond to emergencies. The location of these critical facilities can also impact the potential losses when a disaster occurs. An inventory of the region's critical emergency response facilities is shown on Figure 3-13.

As set forth in the California Government Code, the California Public Contract Code, the CWC, and the State Emergency Plan, DWR is the lead State agency for responding to flood emergencies; however every emergency response begins at the local level and appropriate coordination of response efforts is critical to saving lives, property, and the environment. Coordinated emergency response planning and execution, at the local, city, county, and State levels, is the region's best bet for timely and effective response; and it provides a guide to LMAs, Operational Areas, and DWR for addressing flood threats as quickly as possible using the SEMS and the Incident Command Structure.

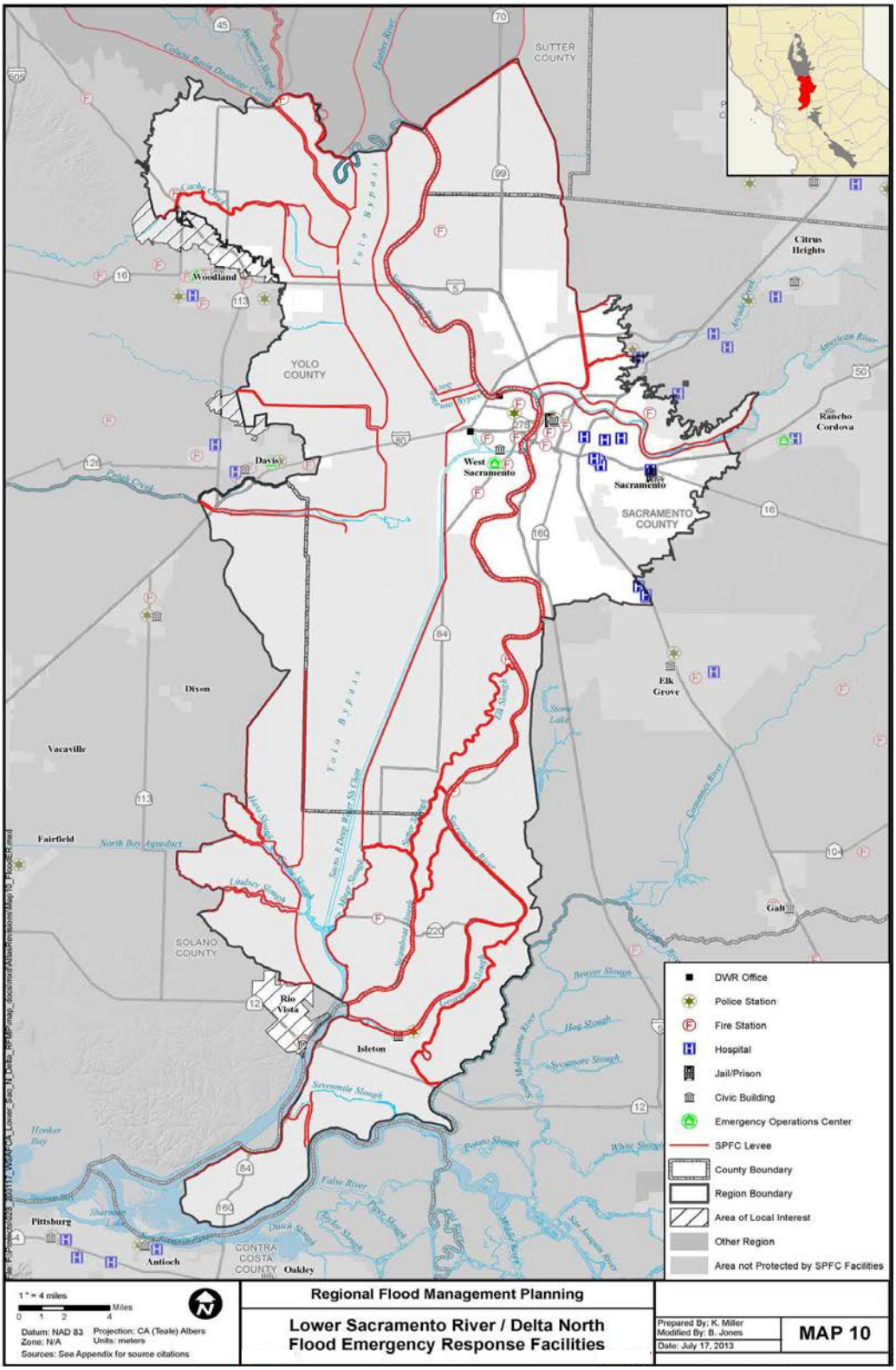
Under SEMS, the LMAs are responsible for patrolling their levee systems during high water events, initiating flood fights where necessary, and requesting assistance through their respective Operational Areas. Each county in the Region is organized as an Operational Area for emergency purposes and can, in turn, forward requests for assistance to the Cal OES Inland Regional Operations Center in Rancho Cordova, which can then request additional flood fight support from the DWR Flood Operations Center. It is vital that local and county agencies follow SEMS and ICS protocols for addressing threats at the local level and have complete up-to-date emergency action plans that:

- Streamline communications (contact information, call tree, radio frequencies, protocols)

- Provide preparation and activation protocols
- Identify Emergency Operation Center locations and contact information
- Provide a management structure for emergency work
- Provide protocols for prioritizing actions
- Direct resources effectively during an emergency
- Provide locations and procedures to obtain necessary resources (i.e. equipment, materials, manpower)
- Identify critical sites or problem areas that need special attention
- Identify critical infrastructure
- Provide an evacuation plan and rally points
- Include training and exercise schedules

LMA Emergency Action Plans support County level emergency response plans and need to be included in the flood hazard component of a Multi-Hazard Mitigation Plan.

Figure 3-13 LSDN Flood Emergency Response Facilities



-LSDN Atlas, 2013

3.4.3 Local Governance

There are several types of agencies within the Region and each has their own unique governance structure. Most Reclamation Districts are independent, special districts with three, five, or seven-member board of trustees elected by landowners or appointed by the County Board of Supervisors.

There are two JPAs in the region. SAFCA was created under applicable provisions of the California Government Code. SAFCA's member agencies consist of the City of Sacramento, Sacramento County, Sacramento County Water Agency, Sutter County, Sutter County Water Agency, RD 1000, and the American River Flood Control District. SAFCA and its members have the power and authorization to acquire, construct, operate and maintain works for the purpose of controlling and conserving waters for the protection of life and property that would or could be damaged by being inundated by still or flowing water. SAFCA is governed by a Board of Directors consisting of thirteen (13) persons. The Board is composed of 5 board members from the Sacramento County Board of Supervisors; 3 council members from the Sacramento City Council; 2 trustees from the American River Flood Control District; 2 trustees from Reclamation District 1000; and 1 board member from the Sutter County Board of Supervisors.

WSAFCA is a joint powers authority created by an agreement made between the City of West Sacramento, RD 900, and RD 537. The three member Board formulates and enacts policy for WSAFCA. The elected boards of RD 900, RD 537, and the West Sacramento City Council each appoint a director and alternate director to serve as a member of the WSAFCA Board.

There are several cities in the Region that are governed by a Mayor and a legislative body composed of council members. There are four counties within the Region that are headed by a board of supervisors, made up of five members. The Board is responsible for enacting ordinances and resolutions, adopting the budget, levying taxes, and approving formal contracts and agreements. The Board of Supervisors also serves as the governing body for several special districts which provide water, sewer, and fire suppression services in the unincorporated areas. Sacramento County is governed by a five-member Board of Supervisors elected to serve four-year terms. Yolo County consists of five members of the Board that are elected by district, are non-partisan and serve four-year terms. Solano County is governed by a five-member Board of Supervisors elected to serve four-year terms. Sutter County is governed by a five-member Board of Supervisors elected to serve four-year terms. In addition, there are several local water agencies and districts that have flood protection responsibilities.

4.0 Problem Definition

The Region is facing many of the same flood management problems as other regions in the Central Valley. However, this Region is unique given its location in the system, particularly with the Yolo Bypass running through the Region and its proximity to the Delta. This section provides an overview of the Region's flood management problems, including specific descriptions of issues for each of the region's major flood management agencies. Information for this section was developed from previous studies (as described in Section 3.4) and through meetings with the Region's flood managers. The RFMP does not rank any of the problems. With a more thorough understanding of these problems, FloodProtect was able to identify a comprehensive list of improvements later in the planning process.

4.1 General Problems

Flood management problems found throughout the Region can be grouped into eight main overarching categories. It is understood that many problems in the region fall within multiple categories and are not discrete. The categories compound upon each other and make feasible solutions extremely difficult to find. For example, there are numerous instances of deficient levees due to seepage and erosion as well as encroachments, animal burrows and vegetation. Insufficient funding prevents not only repair, but also proper O&M and institutional requirements for permitting, etc.

Here are the categories in no particular order:

- Flood management infrastructure
- Operations and maintenance
- Environmental and ecosystem
- Agricultural sustainability
- Funding
- Climate change
- Institutional
- Flood Emergency Preparedness, Response, and Recovery (FEPRR)

The following sections include general descriptions of these problem categories.

4.1.1 Flood Management Infrastructure

There are various problems facing the Region's flood management system of levees, channels, and hydraulic structures. These problems can be attributed to poor original design and construction with substandard materials, age, deterioration, encroachments, obstructions, and subsidence. Specific instances of these problems are discussed in Section 4.2.

4.1.2 Operations and Maintenance

Faced with limited funding and staffing, increasing regulatory constraints, and changing expectations for the multiple uses of the flood management system, it is increasingly difficult for local agencies in the Region to operate and maintain levees and channels. This has jeopardized eligibility for Federal levee rehabilitation funds under Public Law 84-99 (PL 84-99), administered by the USACE, and levee accreditation under the FEMA NFIP.

Operations and maintenance and repairs of the flood management system are difficult to execute and often deferred for many reasons. Among the most significant constraints are the cost and difficulty of navigating the regulatory process and the constricted time windows in the year when maintenance work can be carried out. Lack of clear and consistent requirements from State and Federal agencies make it more difficult for agencies to comply. There are also complex permitting terms and conditions which end up being costly and cumbersome. A recent change in the USACE (beginning in 2006) approach toward woody levee vegetation also poses new challenges for those who operate and maintain the existing system of levees. Since the levee system failures along the Gulf Coast caused by Hurricane Katrina in 2005, USACE has strengthened their position that no woody vegetation should be tolerated on or near Federal project levees and, through a series of administrative actions, has moved to promulgate and further enforce this approach. Vegetation can reduce erosion, provide ecological and aesthetic value and is extremely costly for local agencies to remove because USACE policy requires excavating roots down to 1” in diameter, necessitating levee reconstruction when trees are removed. Vegetation can also cause O&M problems like obscuring potential problems and preventing access for flood fighting. Inconsistent policies have made vegetation management more difficult.

Woody vegetation on levees has the potential to compromise the effectiveness of levees. This, however, is a complex issue, as observation and research suggests there are instances where vegetation may be beneficial or at least not a problem. There are existing efforts, such as the California Levee Vegetation Research Program (CLVRP), a partnership of Federal, State, and local agencies, which are researching whether removing vegetation may actually amplify the probability of levee failure due to other risk factors.

The CVFPP adopts a levee vegetation management approach that is intended to protect public safety while reducing the cost and environmental impacts that would be associated with strict adherence to the USACE policy. This approach allows the retention of vegetation on the lower waterside slope, pruning of vegetation elsewhere in the levee system for access and inspection, and regular inspection and removal of hazard trees anywhere in the levee system. The CVFPP promotes adaptive management of levee vegetation and the modification of policy based on continued research by the CLVRP and USACE.

Other problems arise from levees getting evaluated individually rather than as a system (or as a whole), and critical non-project levees being overlooked. Encroachments are also a potential problem because they limit the ability to inspect, flood fight, and maintain levees.

4.1.3 Environmental and Ecosystem

The ecosystem within the Central Valley has been modified by a wide variety of land use and habitat changes over more than 160 years, resulting in an overall reduction in habitat quality and function. These changes have included urbanization, agricultural conversion, historical mining activities and associated mercury contamination, water damming and diversions, channelization of streams, habitat isolation, the introduction of invasive species, water quality degradation, and climate change. In addition, the construction of flood management infrastructure and ongoing flood management operations within the Central Valley have changed the ecosystem's function and processes, particularly within seasonal wetland, riparian, and river and tidal habitats.

The geographic extent, quality, and connectivity of native habitats along Central Valley rivers, streams, and sloughs have all declined. Today, less than four percent of the historical riparian forests that lined Central Valley streams remain, with a significant portion of this forest growing on or close to SPFC levees. A number of California and Federal endangered or threatened species depend on these remnants of riparian habitat, including the winter- and spring-run Chinook salmon. Where levees have been constructed, the floodplain areas that historically experienced periodic inundation have been separated from the adjacent streams.

The historical placement of the SPFC levees (as well as non-project levees) adjacent to the channels they contain, has limited the growth of the woody vegetation that formed this riparian habitat. It has also limited the wetlands, gravel bars, grasslands and other land area that provided nutrient reintroduction into the Central Valley ecosystem. Inundated floodplain habitat provides an essential ecological foundation for two major population groups – waterfowl and anadromous salmonids – as well as many other species. For waterfowl, seasonally inundated floodplains provide ideal growing conditions for both nutrient rich, seed bearing plants needed for energy and protein-rich aquatic insects needed for the development of flight muscles and reproductive organs. The loss of seasonally inundated floodplain habitat is one of the ecosystem changes that have contributed to the shrinkage of these populations. Salmon and steelhead, as well as other native fishes, rely on the seasonally inundated floodplains for juvenile rearing. These warmer, shallow waters provide a rich broth of nutrients in the form of plankton and invertebrates, permitting high rates of growth, which directly translate into higher survival and return as adults. Similar to waterfowl, the loss of seasonally inundated floodplain habitat is one of the ecosystem changes that have contributed to salmonid population reductions. The overall reduction of floodplain area and degradation in habitat quality within the Central Valley has adversely affected once thriving populations of salmon, steelhead, sturgeon, Swainson's hawks, bank swallows, giant garter snakes, wintering waterfowl and other waterbirds, and many other fish and wildlife species.

The ecosystem can be adversely affected by flood management projects in a variety of ways. In addition to the reduction of periodically inundated floodplains, levees and bank revetments can cause the disruption of dynamic river processes when they confine the river channels and disrupt the fluvial geomorphic processes (e.g., channel meander, channel migration, sediment

transport) that are required for the long-term physical and biological sustainability of the river ecosystem. Within the Central Valley, many of the levees were constructed close to the river channels to induce sediment scour, which interferes with the river's natural meandering process and contributes to levee erosion.

Flood management projects can alter the hydrology of waterfowl habitat by modifying the area, depth and duration of inundation within floodplains and seasonal wetland, which can directly affect waterfowl diversity and abundance. The lack of functioning floodplains can also contribute to impaired water quality due to reduced infiltration and decreased natural treatment. However, due to the presence of mercury within the ecosystem, both naturally occurring and associated with historical mining activities, changes in flood operations that increase areas of inundation can increase mercury methylation, which adversely affects water quality.

An example within the Region of the flood system's effects on specific species is evident in the existing fish passage structure at the Fremont Weir at the northern end of the Yolo Bypass. This structure is inadequate to allow normal fish passage at most operational levels of the Sacramento River. Therefore, adult salmonids and sturgeon migrating upstream through the Yolo Bypass are unable to reach upstream spawning habitat in the Sacramento River and its tributaries when there is no flow over the Fremont Weir. Other structures within the Yolo Bypass, such as the Toe Drain, Lisbon Weir, and irrigation dams in the northern end of the Tule Canal, also can impede migration of adult anadromous fish. In the winter of 2012-13, a large number of endangered winter-run Chinook salmon followed the attraction flows of the Knight's Landing Ridge Cut from the Toe Drain into the Colusa Drain and eventually to their demise further reducing the reproductive population of an endangered species.

In order to implement flood system management activities, regulatory coverage under the Federal Endangered Species Act, the California Endangered Species Act, the National Environmental Policy Act, the California Environmental Quality Act, and a broad range of other Federal, State and local environmental regulations would likely be required. The typical mechanisms for complying with these regulations include Habitat Conservation Plans, Incidental Take Authorizations, and Safe Harbor Agreements. However, multiple other initiatives are underway within the Region that will require habitat restoration and enhancement (e.g., the BDCP, the Fish Restoration Program Agreement, the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan, County Habitat Conservation Plans). Having multiple habitat restoration efforts implemented within the same geographic Region could result in direct competition for habitat lands, making habitat restoration for flood management activities more time consuming and cost prohibitive.

In addition, the introduction of new habitat lands in proximity to agricultural areas could result in direct land use conflicts. The plowing, spraying, and harvesting associated with agricultural operations could adversely affect adjacent wildlife habitat, and conversely, the introduction of protected species from new habitat areas onto adjacent agricultural lands could limit farming operations.

4.1.4 Agricultural Sustainability

Central Valley agriculture is a critical sector of the State economy that provides and supports reliable, affordable food and fiber production, both domestically and on a global scale. Within the Region, the counties of Yolo, Solano, Sutter, and Sacramento are all committed to maintaining the existing agricultural and rural character of the Region and ensuring its long-term sustainability. Each county and many of the cities have adopted General Plans that largely reflect this vision of preserving the Region's agricultural resources. As an example, Yolo County has policies in its general plan to conserve and preserve agricultural land by enacting ordinances limiting the use of agricultural lands, creating minimum parcel sizes, and implementing the Williamson Act (which enables local governments to enter into restrictive contracts with private landowners of agricultural lands to preserve agriculture in exchange for reduced taxes). Agriculture within the Region has been transitioning from lower-value to higher-value crops, such as vineyards and more organic crop production, and the agri-tourism industry has been expanding with an increased interest in "farm-to-fork" food options.

However, the long-term sustainability of agriculture in the Region has been affected by historic land use changes, including the original establishment of floodplain bypasses, which increased the frequency of flooding on agricultural lands within the bypasses and decreased it for agricultural lands outside of the bypasses. The more recent conversion of agricultural lands to other uses, including for urban uses or wildlife habitat, has had a negative effect on long-term agricultural sustainability within the Region by reducing total agricultural acreage. Reducing agricultural acreage reduces the demand for the agricultural support facilities and suppliers that make up a large portion of the agricultural economy.

The viability of agriculture over the long-term is anticipated to be adversely affected by the conversion of agricultural and rural lands that may be necessary to decrease flood risk in the system and achieve the ecosystem restoration objectives of the myriad long-term conservation efforts in the Region (e.g., CVFPP Conservation Strategy, Bay Delta Conservation Plan, endangered species Biological Opinions, local Habitat Conservation Plans). Large areas of agriculture are proposed to be converted to habitat to meet the biological objectives of these planning efforts. In addition, agricultural lands may experience less productivity within the SPFC due to the construction of setback levees or the expansion of bypasses, which would increase the frequency of inundation on agricultural lands and likely reduce agricultural yields or require crop changes. Also, increases in floodplain inundation within bypasses intended to increase habitat for threatened and endangered fish species could interfere with ongoing agricultural practices. The Delta Stewardship Council is one entity that coordinates and prioritizes restoration and other efforts in the Delta. Conversely, flood risk management measures would discourage urban development in the 100-year floodplain, which could increase agricultural sustainability. Agriculture is compatible within floodplain areas that experience 100-year floods while urban development would be inappropriate within these same areas. By preserving agricultural land within the 100-year floodplain, peak flows downstream would remain largely unchanged. If these areas are urbanized and appropriate flood protection

measures are taken, rivers could be further straightened which would cause an increase in downstream peak flows.

The loss of agricultural lands would adversely affect the economy of the Region through the loss of high-value crops and the decrease in the critical mass of agricultural production necessary to support agriculture-related industries. The loss of agricultural lands would also diminish the agricultural character of the Region, the maintenance of which is an important priority for the Region, as reflected in both the Sacramento Area Council of Governments Blueprint adopted in December 2004 and the Next Economy Prosperity Plan adopted in March 2013 and may have the unintended consequence of inducing development in the agricultural areas.

An additional concern for rural agricultural communities is the much higher level of flood protection provided to urban areas compared to rural areas. Due to the inherently low population base within rural agricultural areas, sufficient financial resources are typically not allocated to reducing the flood risk in rural areas. The lower level of flood protection in rural agricultural areas results in higher life safety risks for residents and agricultural enterprises within these areas when compared to urban areas. With the increase in flood insurance costs, it may diminish the ability of these agricultural areas to remain viable and sustainable over the long-term.

4.1.5 Funding

The lack of adequate funding is a common problem facing many public agencies in recent years. LMAs tend to rely on land owner assessments for the majority of their funding. Many times these funds may only be sufficient to maintain normal operations. However, with the deterioration and aging of much of the flood management infrastructure, more funding will be needed to complete many of the proposed repairs to the flood management infrastructure. It will likely be difficult to secure funding to make all of the repairs and improvements that are being considered for the flood management system. Therefore, regional and State priorities must be considered to get the greatest benefit from the available funding.

Another problem with funding is the difficulty LMAs have in identifying, applying for, and managing grants from the State. Often LMAs are understaffed or underfunded and are not able to take advantage of potential grant funds designed to help with structural or non-structural actions. Grants are typically competitive, have strict requirements, rigorous applications, and cost-share requirements. Local agencies typically have similar difficulties with Federal funding.

4.1.6 Climate Change

Uncertainty of future hydrology is another problem facing the flood management system in the Region. Earlier snowmelt and shifts from snowfall to rainfall will place increased demands on the operation of the reservoirs. Climate change also has the potential to increase the severity of

storms in the Region and in wildfires in the watershed which could increase runoff and sedimentation.

Anticipated sea-level increases of 17 to 66 inches by 2100 due to climatic changes will affect water-level stages in the Delta and the lower reaches of the Sacramento River. A rise in sea level would increase exposure to waves and wind set-up, increasing the pressure on levees currently protecting low-lying land, much of which is already below sea level. These effects would contribute to the threat of catastrophic levee failures that could inundate communities, damage infrastructure, and interrupt water supplies throughout the State. Engineering Regulation 1100-2-8162 *Incorporating Sea Level Change in Civil Works Programs* provides USACE guidance for sea-level rise. Federal and State regulations require studies and projects consider climate change, and subsequent sea-level rise, in planning and design.

4.1.7 Institutional

Flood managers in the Region also face several institutional problems. Many of these problems are due to the lack of coordination among local, State, and Federal agencies with responsibilities over different aspects of the flood management system and flood risk reduction. Inconsistent policies and requirements imposed without sufficient data have put additional burdens on already challenged flood managers.

Points of contention over land use have included the needs of urban and/or agricultural development versus the needs of the environment and floodplains. Land use decisions are made at the local level by agencies with land use authority, usually cities and counties. These agencies have typically proposed new development because of the expanding population of the Region and to support the regional economy by providing jobs and increases in tax revenue. Flood management considerations have not always been included when new development is proposed.

With existing land uses, conflicts can arise with the desire to increase the capacity of the flood management system, such as the Yolo Bypass. Increasing capacity could involve actions taken within the existing footprint or expansion of the footprint through levee setbacks and widening of the weirs. However, such expansions would affect some existing urban and agricultural land uses and would raise a series of geographical constraints, local zoning regulations, local economic considerations, private property rights, and water rights considerations.

Other institutional problems include LMAs struggling with permitting involving multiple agencies and varying requirements. Particularly, LMAs have difficulty conducting routine operation and maintenance of the levee system because increasingly, the resource agencies are requiring compensatory mitigation. The timelines and cost of permitting, along with those of mitigation are not sustainable for LMAs. A streamlined approach is necessary to meet the public safety needs of the Region, while providing adequate conservation of ecological resources to compensate for impacts from flood projects.

4.1.8 Flood Emergency Preparedness, Response, and Recovery

The adequacy of the Region's FEPRR is also a source of the Region's flood management problems. As described previously, FEPRR in the Region is impacted by funding and institutional challenges. Coordination occurs within each county; however, because this Region overlaps four counties, a more coordinated response would be needed, including coordinated planning, preparing, exercising, responding, and recovering.

Problems with FEPRR exist across the Region but certain areas and agencies are better resourced and trained, and have better plans than others. It is difficult to get an accurate assessment of the state of the region's emergency preparedness due to lack of formal plans and documentation in many areas and the inability to verify certain information. Though, in general, the region's problems include:

- Lack of formalized coordination between adjacent LMAs and their cities and counties (OAs), to include mutual aid agreements
- Many LMAs don't have the funding to maintain adequate staff, plans, and resources
- Unsatisfactory flood warning/public notification systems
- Many residents are uninformed about flood risk
- Inadequate or nonexistent emergency response or action plans
- No record of updating, practicing or implementing a plan that does exist
- Incomplete understanding of flood fight roles
- Insufficient or no flood fight training
- No record of participating in any exercises
- SEMS and ICS organization and operational procedures are not followed – sometimes LMAs communicate directly with DWR and OAs are not in the loop
- Inconsistent stockpiling of resources
- Reliance by multiple agencies on the same resource vendors and resources during emergencies
- No designated evacuation plans to include critical infrastructure: staging areas, routes, etc.
- Where evacuation procedures exist, not all residents are aware
- Also, not all designated evacuation infrastructure has adequate flood protection and the present elevation of some of that infrastructure guarantees that it will be under water and unusable for evacuation purposes
- Restrictions on reimbursable costs from FEMA

Some particular problems are noted in Table 4-1.

Table 4-1 Regional FEPRR Status

	Emergency Action Plan?	Flood forecasting and early warning/public notification systems?	Unified command structure for field operations?	Protocols for Monitor, Flood, Danger stage, and Incident?	Identified and trained response personnel and Calling Tree in place?	Standard SEMS and NIMS training?	Any specific flood-fight training?	Levee patrol plan and schedule?	Mutual aid agreements in place with other agencies?	Agreements (City, County, State) cover liability & roles /responsibilities?	Stockpiling of flood-fight materials?	Evacuation/rescue/command/communications materials and equipment?	Contacts for materials vendors and contracts in place?	Designated critical facilities to protect/flood-proof?	Evacuation procedures to include rally points, routes, and transportation?	Environmental compliance and mitigation in flood fight plans?
Sacramento County	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
City of Sacramento	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
Courtland (RDs 551, 755)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Hood	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
City of Isleton (BALMD)	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	N	Y	N
Locke and East & West Walnut Grove (RDs 3, 369, 554)	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	N	Y	N
RD 1000 and ARFCD	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
East Delta (RDs: 349, 556)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
South Delta (RDs: 341, 563, 1601)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Solano County	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	N	Y
City of Rio Vista	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	N	N	N	Y
RDs 2068 & 2098	Y	Y	Y	Y	N	N	Y	N	Y	N	Y	Y	Y	N	N	N
RD 501	Y	Y	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N
RD 536	Y	Y	Y	Y	N	N	N	N	Y	N	N	N	N	N	N	N
RD 2060	Y	Y	Y	Y	N	N	N	N	Y	N	Y	N	N	N	N	N
RD 2104	N	Y	Y	N	N	N	N	N	Y	N	N	N	N	N	N	N
Yolo County	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
City of Davis	N	Y	Y	Y	N	N	N	N	N	N	N	Y	N	Y	Y	N
City of West Sacramento (WSAFCA, RD 900)	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N
City of Woodland	N	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N
Clarksburg (RDs: 150, 307, 765, 999)	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	N	N	Y
Knights Landing (CSA 6, KLRDD)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Yolo	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Elkhorn Basin (RDs: 537, 785, 827, 1600)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
RD 2035	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

4.2 Specific Problems

This section presents specific problems for areas and agencies in the region, and is organized by land use type: urban/urbanizing, small communities, and rural. The information presented was collected from individual stakeholder meetings and existing studies (described in Section 3.4) such as the LMA Inspection Reports, NULE, and FSRP. The locations of LMAs described are shown on Figure 3-6.

4.2.1 Urban and Urbanizing

Urban areas in the Region include cities with populations greater than 10,000. Rio Vista is considered urbanizing because it is expected to grow to a population beyond 10,000 within the next 10 years.

4.2.1.1 Woodland (Including YCFCWCD and RD 2035)

The major problems facing the Woodland area include deficient levees along the Yolo Bypass, Cache Creek, the CCSB, and Willow Slough Bypass, LMAs being underfunded and understaffed, a lack of understanding of the state of the levees along the west side of the Sacramento River between the Fremont Weir and Elkhorn, inadequate emergency response planning for the CCSB, inadequate flood protection for the Irrigation Cross Bypass Canal and Interstate 5, and the need to mitigate the effects from other projects.

For example, out of bank flows and levee failures West of I-5 can be diverted northwest and southeast along the I-5 embankment from Cache Creek. These Southeast flows are directed into the City of Woodland and continue East by over topping I-5 and using the Beamer Underpass as a siphon under 1-5. An additional example is that construction of the CCSB did not provide for returning flows from the south bank overflows from Cache Creek back to the Yolo Bypass. This results in large expanses of RD 2035 being put under more than eight feet of water along with I-5, for several months. This situation also subjects the City of Davis' wastewater treatment plant and the Yolo County landfill to being flooded.

More specific issues needing to be addressed:

- The City of Woodland is subject to flooding from the lower Cache Creek. The lower Cache Creek levees were constructed in 1958 as part of the Federally-authorized Sacramento River Flood Control Project and are part of the State Plan of Flood Control. In anticipation of the construction of the upstream Wilson Valley Reservoir project, the Lower Cache Creek levees were designed to contain a flow of 30,000 cubic feet per second with three feet of freeboard. A flow of this magnitude is estimated to have an Annual Exceedance Probability of 0.10 (1 in 10 years). The Wilson Valley Reservoir project has not been constructed because of seismic and sediment concerns; therefore the City of Woodland does not enjoy the level of flood risk reduction required by the CVFPP for urban areas. The Cache Creek levees were overtopped in 1958, 1983, and 1995. In1983 there was a levee

failure near County Road 102 and overland flow from Cache Creek flooded what is now Woodland's industrial area.

- The leveed portion of Cache Creek discharges into the Cache Creek Settling Basin, which is also a component of the Sacramento River Flood Control Project and of the State Plan of Flood Control. Cache Creek has historically carried a large sediment load. The settling basin was constructed to prevent sediment carried by Cache Creek from adversely affecting the hydraulic capacity of the Yolo Bypass through excessive sediment deposition. The Settling Basin currently covers 3,600 acres and is bounded by levees on all sides with an outlet weir to the Yolo Bypass.
- Flooding within the City is exacerbated by the raised embankment of Interstate Highway 5 and the Cache Creek Settling Basin which direct out-of-bank flows southward and into the City.
- No levees in Yolo County are certified as meeting FEMA standards. Seepage, slope stability, and erosion problems are preventing certification of the levees along the Yolo Bypass, Cache Creek, the CCSB, and Willow Slough Bypass. There are levees that are not in the USACE Rehabilitation and Inspection Program and are not eligible for PL 84-99 funding for repairs after a flood event. LMAs do not have the funding to upgrade levees. Work required to bring levees up to standard for certification is too expensive for LMAs. Levees can be de-accredited by FEMA and still be in the USACE Rehabilitation and Inspection Program and be eligible for PL-84-99 funding for repairs after a flood event.
- Some LMAs have inadequate funding and staff for proper O&M or to put together proposals for DWR grant funding.
- Details of problems with the levees along the west side of the Sacramento River, between the Fremont Weir and Elkhorn, are unknown because no detailed geotechnical data or analysis exists.
- Upgrading urban levees to the Urban Level of Protection standard and implementing recommendations from other initiatives such as the BDCP and the Conservation Strategy could cause additional flooding effects in the region and these effects must be addressed and mitigated.
- There has been no emergency response planning for a failure of the CCSB.
- It is unclear whose is responsible for and what the SPFC status is of the pre-1992 CCSB south levee.
- Interstate-5 (I-5), a major evacuation route, would flood if levees failed. There is no designated alternate evacuation route if I-5 floods and is impassable.
- Willow Slough Bypass north levee may warrant urban classification instead of non-urban since it protects the Yolo County landfill and the City of Davis Wastewater Treatment Plant.

- Improved flood protection is needed for the RD 2035 Cross Bypass irrigation canal and for I-5.

Other Data

Table 4-2 shows the overall maintenance rating for RD 2035 for the last six years. A description of these data is presented in Section 3.4. Clarification needs to be provided for the status and responsibility for the pre-1992 south levee of the CCSB.

Table 4-2 Overall Maintenance Rating for LMAs in the Woodland Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 2035, Conaway Tract	U	A	A	A	U	M	M
Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System *A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data*							

Table 4-3 presents the results of NULE evaluations for non-urban levees in the Woodland area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-3 Woodland Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
150	Reclamation District 2035 Unit 2 - Yolo Bypass	LD	C	LD	C	C
297	Reclamation District 2035 Unit 3 - Willow Bypass	LD	B	LD	C	C
Notes: 2011 Geotechnical Assessment Report North NULE Study Area *A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data*						

4.2.1.2 Davis (including DWR Maintenance Yard – Putah Creek, DWR Maintenance Yard – Willow Slough Bypass)

Though the majority of the City of Davis is not within this designated region, nor is it protected by the Yolo Bypass, Sacramento Bypass, or SPFC facilities, and while there are no records of flooding in downtown Davis, the City does have concerns about potential adverse effects to its facilities and infrastructure resulting from a high water event which causes flooding in the Yolo Bypass.

Specifically, the City is concerned about effects to its existing wastewater treatment facility as well as its planned municipal water intake and conveyance system. Besides being subject to flooding by a failure of the Willow Slough Bypass left levee, the wastewater treatment facility and the Yolo County landfill are subject to flooding from breaches in the CCSB west and south levees, the abandoned south levee of the pre-1992 CCSB, and the Yolo Bypass west levee.

Additionally, the City is concerned about high flows downstream which could cause water to back-up in Putah Creek and overtop the bank. In 1997 Mace Boulevard overtopped due to overbank flooding from Putah Creek. In addition to existing vegetation blocking the channel, it is very possible that backwater in Putah Creek from the Yolo Bypass combined with tributary inflow and releases from Monticello Dam could overwhelm project levees.

Other Data

Table 4-4 presents the results of NULE evaluations for non-urban levees in the Davis area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-4 Davis Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
112	Putah Creek Unit 2 - south bank	LD	A	LD	A	LD
169	Willow Slough Bypass Unit 1 - north bank	A	A	A	A	A

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

4.2.1.3 West Sacramento (including WSAFCA, RD 900, DWR Maintenance Area 4)

The major flood concerns in the City of West Sacramento are centered on the levees and their susceptibility to failure from high flows in the Sacramento River, Yolo Bypass, and Sacramento River Deep Water Ship Channel. The 50 miles of perimeter levees surrounding the City do not currently meet the urban requirements of 200-year level of protection. Specific problems needing to be addressed are:

- Seepage and geometry deficiencies on 6,300 feet of the south levee of the Sacramento Bypass
- Seepage and vegetation on the Sacramento River west levee near the I Street Bridge
- Seepage and geometry deficiencies on 3,100 feet of the south levee of the Sacramento River north of Bryte Park
- Seepage, stability, and erosion on 5.6 miles of the Sacramento River South levee
- Anticipated increased flows on the Sacramento Weir and Bypass due to climate change and other upstream levee improvements
- Overtopping in the area of the Port of West Sacramento
- Overtopping, seepage, and stability problems in the area south of the Port of West Sacramento
- Stability problems, seepage, and erosion along the Sacramento River North levee
- Stability problems and seepage along the Yolo Bypass levee

- Stability problems, seepage, and overtopping along the South Cross levee near the southern limits of the City of West Sacramento
- Stability problems, seepage, and geometry concerns along the Sacramento Deep Water Ship Channel East Levee
- Stability, seepage, erosion, and geometry concerns overtopping along the Sacramento Deep Water Ship Channel West Levee

Other Data

Table 4-5 shows the overall maintenance rating for LMAs in the West Sacramento area for the last six years. A description of these data is presented in Section 3.4.

Table 4-5 Overall Maintenance Rating for LMAs in the West Sacramento Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 900, West Sacramento	U	U	M	M	M	U	A
Sacramento Maintenance Yard, Maintenance Area 4	A	A	A	A	A	A	LD

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

4.2.1.4 Sacramento City and County (including SAFCA, ARFCD, DWR Maintenance Area 9)

The Sacramento area is one of the most at-risk areas in America from catastrophic flooding. Specifically, the area needs improvements to flood management structure and levees to meet urban levee protection requirements, a simplified process for permitting O&M activities, quicker emergency response, better coordination, sufficient funding, and oversight of multiple maintenance agencies. SAFCA, in cooperation with DWR, USACE and the CVFPB, has initiated urgently needed improvements to the Federal project levee system protecting the Sacramento Area. These improvements address identified deficiencies in the levee system based on recent recognition of seepage problems which led to a significant downgrade of the system's performance capability. These agencies, along with the US Bureau of Reclamation are currently constructing additional spillway capacity to Folsom Dam that will allow the reservoir's flood management space to be used more effectively. Raising Folsom Dam to increase flood management space is authorized and included in the design. Remaining deficiencies include:

- Significant underseepage issues in the levees along the east side of the Sacramento River in the Natomas, Pocket and Little Pocket areas and along Arcade Creek, Dry Creek and the Natomas East Main Drainage Canal (NEMDC) in Natomas and North Sacramento
- Erosion in the levees along the American and Sacramento Rivers
- Lack of needed conveyance capacity in the Natomas Basin perimeter drainage channels which divert runoff from the foothills into the Sacramento and American Rivers

- Limited upstream reservoir storage capacity combined with limited conveyance capacity of the lower American River threatens flooding of Sacramento from large storm events.

Other Data

Table 4-6 shows the overall maintenance rating for LMAs in the Sacramento area for the last six years. A description of these data is presented in Section 3.4.

Table 4-6 Overall Maintenance Rating for LMAs in the Sacramento Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
American River Flood Control District	M	A	A	A	A	A	A
City of Sacramento	U	A	A	A	A	A	A
Sacramento Maintenance Yard, Maintenance Area 9	M	M	M	M	M	A	U

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

4.2.1.5 Rio Vista

Rio Vista, located in Solano County, is susceptible to flooding from both the Yolo Bypass and the Sacramento River. Flooding in the downtown area, to include City Hall, is partially caused by the Yolo Bypass backing up and overtopping Highway 84 and then flowing through the Highway 12 underpass and into downtown, but flooding can also come directly from the Sacramento River. Flooding can be exacerbated by tides, runoff, wakes of large ships, wind, releases upstream and being at the bottom of the Yolo Bypass. Rio Vista does not have a SPFC levee along the Sacramento River, but does receive protection from the Yolo Bypass levee (the Mellin Levee), which is part of the SPFC (unverified).

Flooding directly from the Sacramento River affects the downtown and City Hall, residences on Edgewater Drive, and downstream at the wastewater treatment plant.

There is an existing floodwall from the boat launch behind City Hall to the Helen Madere Bridge. The 1986 flood overtopped this wall, and it was then raised 2 feet before the 1997 flood, which did not overtop the wall.

Storm run-off flows into Edgewater Drive from the natural grade and the Montezuma Hills. The City pumps water from private property owners on Edgewater drive through flood season and until the beginning of May every year, since any impounded water cannot naturally escape because of the floodwall. Individual property owners have flood walls which look contiguous but they were all constructed individually and are not maintained by the city. Additionally, there is a runoff ditch right before Montezuma Drive that needs a larger drain pipe.

The old wastewater treatment facility, adjacent to the river, is potentially at risk in larger floods. The city is currently going through the process to re-permit the facility (for 5 years

through the State Water Resource Control Board). The City is concerned whether they can continue to re-permit the facility.

Rio Vista has a floodwall improvement/expansion project that is shelf-ready. The floodwall expansion project would protect Front Street to City Hall, however Front Street has an underpass (Highway 12) leading to Highway 84 so the water would still get through (the floodwall expansion plans include 3 feet of freeboard which may not be adequate for ULDC/SB5 200-year flood requirements with sea level rise taken into consideration).

There is a decommissioned Army base along the Sacramento River that is being studied for reuse that may be in the floodplain. It was formerly used by the USACE for dredging operations. An EIR/EIS is underway for a project to turn the base into a Delta Research Center for agencies such as DFW, USFWS, and others. The site is adjacent to the river. Hills made from dredged material surround the base adding to drainage issues.

Highway 84, which runs along the river and downstream end of the Yolo Bypass, needs to be evaluated for ways to prevent flood flows from being redirected into the City. Highway 84 is owned and maintained by the California Department of Transportation (Caltrans) who would need to be a part of the evaluation of alternatives.

Runoff from the natural grade of the Montezuma Hills Road causes flooding along Airport Drive and adjacent lands.

Rio Vista has felt disregarded and left out of projects in the past. Also, city staff can get overwhelmed with all the different State and Federal projects, underlining the need for the RFMP to distinguish itself from the other projects. Rio Vista currently gets meeting and information requests from 10 different Delta/planning efforts, including the RFMP.

4.2.2 Small Communities

In small communities raising structures may be a cost effective method to lower flood risk. However, many of the residential and commercial structures in the Region's small communities are not built to current code. Therefore small communities are not able to secure the proper permits to make necessary improvements, including elevating the structures.

Also, small communities struggle to afford the necessary improvements and maintenance to meet FEMA 100-year requirements. Because of this, flood insurance premiums will soon be cost prohibitive for many of the residents, who may be forced to relocate, which may further reduce the tax base.

4.2.2.1 Clarksburg (including RD 999, RD 150, RD 307, RD 765)

The Clarksburg area has not flooded since the original levee system was completed. Downtown Clarksburg is at a higher elevation than the rest of the district. However, only about 1/3 of the Clarksburg District population lives in town, 2/3 live outside in surrounding areas.

RD 999 (problems in priority order)

- If the levee on the north side of Prospect Island fails it will pass water onto weaker, smaller levees, starting a chain reaction that could cause flooding of the entire District.
- On the Miner's Slough project levee, the waterside berms are gone.
- On Ryer Island, at the bridge crossing, the USACE raised the RD 999 levee to increase the freeboard, but they were not able to complete coordination with Caltrans so there is a 3 foot drop in the RD 999 levee which is 150 feet wide.
- There is erosion along approximately one mile of Unit 3 of Sutter Slough. Additionally, the top of the levee is covered in elderberry bushes making the mitigation cost for addressing the erosion far too expensive.
- The levee at Elk Slough failed the USACE inspection due to inadequate cross section geometry.
- There are erosion and underseepage problems in the levee at center of Clarksburg (end of Netherlands Ave/Road 154). The USACE had a project designed to address this. However, it has not been constructed.
- There is subsidence approximately 10-15 feet from the toe of the levee at Miner's Slough Corner.
- There are multiple encroachment problems that include approximately 130 separate pipes through the levees.

RD 150 (problems in priority order)

- At the Courtland Road (Elk Slough to Road 143) there are seepage issues which were fixed 15 years ago and the toe was rebuilt; however, there are multiple boils and the underseepage issues continue.
- Along the water side of the levee from Elk Slough to Clarksburg there is a vertical drop, likely due to erosion, down to the water. During high water events this is an area where rock has to be added. The worst seepage area is a 2-mile stretch from Road 143 toward Road 142.
- Seepage along the north end of the Sacramento River. There is erosion along the waterside as well.
- The levee along Sutter Slough is built on top of pure sand and there are underseepage issues.

Other Data

Table 4-7 shows the overall maintenance rating for LMAs in the Clarksburg area for the last six years. A description of these data is presented in Section 3.4.

Table 4-7 Overall Maintenance Rating for the Clarksburg Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 150, Merrit Island	U	M	M	M	A	A	M
RD No. 307, Lisbon	U	U	U	U	M	U	U
RD No. 765, Glide	U	U	U	U	U	U	U
RD No. 999, Netherlands	U	U	U	U	U	U	U
Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data							

Table 4-8 presents the results of NULE evaluations for non-urban levees in the Clarksburg area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-8 Clarksburg Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
117	Reclamation District 0150 Unit 1	LD	A	LD	A	LD (A or B)
118	Reclamation District 0307	B	A	LD	C	C
132	Reclamation District 0765	LD	A	LD	B	LD (B or C)
142	Reclamation District 0999 Unit 1	A	B	A	A	B
244	Reclamation District 0999 Unit 5	LD	A	LD	B	B
303	Reclamation District 0999 Unit 4	B	A	A	B	B
304	Reclamation District 0999 Unit 2	B	LD	A	B	B
305	Reclamation District 0999 Unit 3	B	LD	LD	B	B
306	Reclamation District 0150 Unit 2	C	A	LD	B	C
386	Reclamation District 0150 Unit 3	B	A	LD	B	B
Notes: 2011 Geotechnical Assessment Report North NULE Study Area A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data						

Table 4-9 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-9 Clarksburg Area FSRP Critical and Serious Repair Sites

Segment #[1]	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
305	Sutter Slough	RD 999	Seepage	Critical	0.2-0.25
303	Sacramento River	RD 999	Seepage	Serious	0.03-0.21
142	SRDWSC	RD 999	Stability	Serious	0.5-1.0
142	SRDWSC	RD 999	Stability	Serious	1.8-1.9
118	Sacramento River	RD 307	Stability	Serious	6.16-6.49
304	Miner Slough	RD 999	Erosion	Serious	0.64
305	Sutter Slough	RD 999	Erosion	Serious	0.0-0.62
244	Elk Slough	RD 999	Erosion	Serious	0.12-9.5
244	Elk Slough	RD 999	Freeboard	Serious	5.5
107	Sacramento River	MA9	Seepage	Serious	17.9-18.10
306	Sacramento River	RD 150	Erosion	Serious	2.04-2.16
306	Sacramento River	RD 150	Erosion	Serious	3.38
306	Sacramento River	RD 150	Erosion	Serious	3.48
306	Sacramento River	RD 150	Erosion	Serious	4.58-4.65
306	Sacramento River	RD 150	Seepage	Critical	5.9-5.95
386	Elk Slough	RD 150	Erosion	Serious	0.19-7.94
386	Elk Slough	RD 150	Seepage	Serious	1.05
386	Elk Slough	RD 150	Seepage	Critical	1.58
386	Elk Slough	RD 150	Erosion	Serious	2.52-2.54
386	Elk Slough	RD 150	Erosion	Serious	2.93
386	Elk Slough	RD 150	Erosion	Serious	3.13
386	Elk Slough	RD 150	Erosion	Serious	3.36-3.48
386	Elk Slough	RD 150	Erosion	Serious	3.64
386	Elk Slough	RD 150	Erosion	Serious	3.9-3.93
386	Elk Slough	RD 150	Erosion	Serious	4.42-4.48
386	Elk Slough	RD 150	Erosion	Serious	4.58
386	Elk Slough	RD 150	Erosion	Serious	4.95
386	Elk Slough	RD 150	Erosion	Critical	6.51
386	Elk Slough	RD 150	Erosion	Serious	7.95-8.05
386	Elk Slough	RD 150	Erosion	Critical	8.38
386	Elk Slough	RD 150	Erosion	Serious	8.44-8.49
386	Elk Slough	RD 150	Erosion	Serious	8.69
386	Elk Slough	RD 150	Freeboard	Critical	9.54-9.57

1. Levee segments are defined and shown in Section 5. Segments help describe general location of the levee

4.2.2.2 Isleton (including BALMD)

The City of Isleton's overarching issues are that part of the city is in the 100-year floodplain, the city lacks the funding for necessary flood improvements, there are seepage issues from areas outside the Sacramento River, and Georgiana Slough seepage threatens the wastewater treatment ponds and percolation basins. FEMA insurance rates will also be increasing substantially for downtown residents and development in the area has stalled due to lack of financing.

Other Data

Table 4-10 shows the overall maintenance rating for LMAs in the Isleton area for the last six years. A description of these data is presented in Section 3.4.

Table 4-10 Overall Maintenance Rating for LMAs the Isleton Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
Brannan-Andrus Levee Maintenance District	U	U	A	A	M	M	U

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

Table 4-11 presents the results of NULE evaluations for non-urban levees in the Isleton area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-11 Isleton Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
40	Brannan-Andrus Levee Maintenance District Unit 1	C	B	B	A	C
378	Brannan-Andrus Levee Maintenance District Unit 2	A	LD	LD	B	B
1048	Brannan-Andrus Levee Maintenance District Unit 5	B	B	B	A	B
1049	Brannan-Andrus Levee Maintenance District Unit 4	B	B	LD	B	B
1050	Brannan-Andrus Levee Maintenance District Unit 3	C	C	C	B	C

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

Table 4-12 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-12 Isleton Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
129	Georgiana Slough	RD 556	Stability	Critical	1.8
129	Georgiana Slough	RD 556	Stability	Serious	3.42-3.75
129	Georgiana Slough	RD 556	Stability	Serious	4.829
129	Georgiana Slough	RD 556	Stability	Serious	4.872
390	Sacramento River	RD 556	Erosion	Serious	0.31-0.60
390	Sacramento River	RD 556	Erosion	Serious	3.21-3.25
390	Sacramento River	RD 556	Seepage	Critical	3.58-3.95
40	Georgiana Slough	BALMD	Stability	Serious	1.5
40	Georgiana Slough	BALMD	Stability	Serious	1.82-1.89
378	Sacramento River	BALMD	Erosion	Serious	2.7-2.74
378	Sacramento River	BALMD	Erosion	Serious	3.14
378	Sacramento River	BALMD	Erosion	Serious	3.32-3.49
378	Sacramento River	BALMD	Erosion	Serious	3.62-3.7
378	Sacramento River	BALMD	Erosion	Serious	5.68-5.71
378	Sacramento River	BALMD	Erosion	Serious	5.793
378	Sacramento River	BALMD	Erosion	Serious	5.822
378	Sacramento River	BALMD	Erosion	Serious	6.067
378	Sacramento River	BALMD	Erosion	Serious	7.01-7.04
1050	North Mokelumne River	BALMD	Seepage	Serious	1050+00-1060+00
1050	North Mokelumne River	BALMD	Stability	Critical	1080+00-1095+00
1050	North Mokelumne River	BALMD	Stability	Serious	1090+00-1100+00
1049	San Joaquin River	BALMD	Stability	Critical	1970+00-1980+00

4.2.2.3 East & West Walnut Grove (including RD 554 and RD3)

In general, structures in East and West Walnut Grove do not meet permitting standards to elevate for multiple reasons to include: propane tanks are located too close to structures; stairwells are on other properties, etc. There are a number of registered historical buildings and sites which would be problematic to elevate or modify. In many cases structures would have to be elevated a minimum of 8-10 feet.

Additionally, the need to keep farmers and laborers located close to the farmland they work restricts the number of feasible solutions.

Other Data

Table 4-13 shows the overall maintenance rating for LMAs in the East Walnut Grove area for the last six years. A description of these data is presented in Section 3.4.

Table 4-13 Overall Maintenance Rating for LMAs in the East Walnut Grove Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 554, Walnut Grove	U	U	U	U	M	M	U

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

Table 4-14 presents the results of NULE evaluations for non-urban levees in the East Walnut Grove area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-14 East Walnut Grove Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
127	Reclamation District 0554 - north portion	A	A	A	A	A
128	Reclamation District 0554 - south portion	A	A	A	A	A

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

Table 4-15 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-15 East Walnut Grove Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
130	Georgiana Slough	RD 563	Erosion	Serious	1.11-1.13
130	Georgiana Slough	RD 563	Seepage	Critical	2.25
130	Sacramento River	RD 563	Seepage	Serious	2.20-2.59
130	Georgiana Slough	RD 563	Erosion	Serious	2.63-2.77
130	Georgiana Slough	RD 563	Erosion	Serious	4.0-4.11
130	Georgiana Slough	RD 563	Erosion	Serious	5.27-5.51
130	Georgiana Slough	RD 563	Erosion	Serious	5.61-641
130	Georgiana Slough	RD 563	Erosion	Critical	6.76
130	Georgiana Slough	RD 563	Erosion	Serious	6.67-7.29
130	Georgiana Slough	RD 563	Erosion	Serious	7.7-8.22
130	Georgiana Slough	RD 563	Erosion	Serious	8.29-8.76
130	Georgiana Slough	RD 563	Erosion	Serious	9.8-9.89

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
130	Georgiana Slough	RD 563	Erosion	Serious	10.33-10.42
130	Georgiana Slough	RD 563	Erosion	Serious	10.63-10.93
130	Georgiana Slough	RD 563	Erosion	Serious	11.7-12.0
1043	North Mokelumne River	RD 563	Seepage	Serious	233+75
1043	North Mokelumne River	RD 563	Seepage	Serious	227+25

Table 4-16 shows the overall maintenance rating for LMAs in the West Walnut Grove area for the last six years. A description of these data is presented in Section 3.4.

Table 4-16 Overall Maintenance Rating for LMAs in the West Walnut Grove Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 3, Grand Island	U	U	M	M	M	M	M
Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data							

Table 4-17 presents the results of NULE evaluations for non-urban levees in the West Walnut Grove area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-17 West Walnut Grove Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
113 Reach 2	Reclamation District 0003 Unit 1	C	LD	LD	B	C
113 Reach 1	Reclamation District 0003 Unit 1	B	LD	B	B	B
Notes: 2011 Geotechnical Assessment Report North NULE Study Area A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data						

Table 4-18 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-18 West Walnut Grove Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
113	Steamboat Slough	RD 3	Seepage	Critical	4.74-4.92
113	Steamboat Slough	RD 3	Seepage	Critical	6.32-6.52
11	Steamboat Slough	RD 3	Erosion	Critical	10.8-11.02
384	Sacramento River	RD 3	Seepage	Critical	8.24-8.30

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
384	Sacramento River	RD 3	Erosion	Serious	11.55-11.64

4.2.2.4 Courtland (including RD 551)

The small community of Courtland is experiencing many of the same problems as other small communities in the Region.

Other Data

Table 4-19 shows the overall maintenance rating for LMAs in the Courtland area for the last six years. A description of these data is presented in Section 3.4.

Table 4-19 Overall Maintenance Rating for LMAs in the Courtland Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 551, Pearson	U	U	A	A	A	M	A

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

Table 4-20 presents the results of NULE evaluations for non-urban levees in the Courtland area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-20 Courtland Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
1040	Reclamation District 0551	B	LD	A	A	B
1041	Reclamation District 0551	B	LD	A	A	LD

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

Table 4-21 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-21 Courtland Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
131	Sacramento River	RD 755	Seepage	Critical	0.1-0.2
131	Sacramento River	RD 755	Seepage	Serious	0.2-0.9

4.2.2.5 Hood (including DWR Maintenance Area 9)

The small community of Hood is experiencing many of the same problems as other small communities in the Region.

Other Data

Table 4-22 shows the overall maintenance rating for LMAs in the Hood area for the last six years. A description of these data is presented in Section 3.4.

Table 4-22 Overall Maintenance Rating LMAs in the Hood Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
Sacramento Maintenance Yard, Maintenance Area No. 09	M	M	M	M	M	A	A
Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data							

Table 4-23 presents the results of NULE evaluations for non-urban levees in the Hood area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-23 Hood Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
106	Sacramento Maintenance Yard, Maintenance Area No. 09	C	B	C	B	C
Notes: 2011 Geotechnical Assessment Report North NULE Study Area A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data						

Table 4-24 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-24 Hood Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
106	Sacramento River	MA9	Seepage	Serious	10.7
106	Sacramento River	MA9	Seepage	Critical	11.95-12.05
106	Sacramento River	MA9	Seepage	Serious	12.5
106	Sacramento River	MA9	Seepage	Critical	12.62-12.8
106	Sacramento River	MA9	Seepage	Serious	14.3-14.6
106	Sacramento River	MA9	Seepage	Critical	15.5-15.65
106	Sacramento River	MA9	Seepage	Critical	15.89-16.07
106	Sacramento River	MA9	Seepage	Serious	16.7-16.97

4.2.2.6 Locke (including RD 369)

The small community of Locke is experiencing many of the same problems as other small communities in the Region.

Other Data

Table 4-25 shows the overall maintenance rating for LMAs in the Locke area for the last six years. A description of these data is presented in Section 3.4.

Table 4-25 Overall Maintenance Rating for LMAs in the Locke Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 369, Libby McNeil	U	U	A	A	M	U	A

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

Table 4-26 presents the results of NULE evaluations for non-urban levees in the Woodland area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-26 Locke Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
121	Reclamation District 0369	A	A	A	A	A

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

4.2.2.7 Knights Landing (including Knights Landing Ridge Drainage District)

Knights Landing needs a funding solution to finish repairs in Area 3 of the Mid-Valley Area Levee Reconstruction Project. The project has been in the USACE design and permitting process for more than 15 years, since floods in 1986 and 1997. The estimated total project cost is $7 million (85% Federal/15% Local split), but the benefit-cost ratio is being recalculated. Yolo County Service Area (CSA) #6 project also has a reach that has been identified for repair and is part of the Mid-Valley project but separate from the KLRDD portion. This project would bring levees up to approximately 60 year level of protection from the current 20 year. The project schedule is to construct the Knights Landing side in 2015. The CSA #6 site does not have funding and is not currently scheduled for construction. The KLRDD Board succeeded in a Proposition 218 election in 2012 for the KLRDD site and now has local funding with which they have been able to take over part of the project from USACE and will be funding in partnership with DWR as part of the State's EIP grant program.

O&M of the existing perimeter levee is complicated by the fact that it is split between three different LMAs. Yolo County (CSA #6) maintains the levee along the Sacramento River. DWR maintains the levee along the Yolo Bypass. KLRDD maintains the levee along the Ridge Cut. Erosion along the Ridge Cut, on the outside levee toe, and seepage issues along several thousand feet of levee have caused the systems to be "kicked out" of PL 84-99. Additionally, there are significant vegetation issues on the levee segment along the Sacramento River.

Timing of the development and potential adoption of rural levee standards could also cause issues for the KLRDD.

FEMA insurance rates may increase substantially, to as much as $25,000 per dwelling. Knights Landing lacks the tax base to pay for all the work needed to satisfy FEMA standards. The KLRDD needs support to engage with and educate residents regarding potential FEMA impacts and strategies to address flood risk.

Other Data

Table 4-27 shows the overall maintenance rating for LMAs in the Knights Landing area for the last six years. A description of these data is presented in Section 3.4.

Table 4-27 Overall Maintenance Rating for LMAs in the Knights Landing Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
Knights Landing Ridge Drainage District	U	M	U	A	A	A	M
Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System *A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data*							

Table 4-28 presents the results of NULE evaluations for non-urban levees in the Knights Landing area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-28 Knights Landing Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
216	Knights Landing Ridge Cut - Unit 1	A	C	LD	B	C
217	Knights Landing Ridge Cut - Unit 2	A	C	A	C	C
Notes: 2011 Geotechnical Assessment Report North NULE Study Area *A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data*						

Table 4-29 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-29 Knights Landing Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
41	Cache Creek	Cache-Yolo	Erosion	Critical	2.54-2.58
41	Cache Creek	Cache-Yolo	Erosion	Critical	2.80-2.84
41	Cache Creek	Cache-Yolo	Erosion	Critical	3.86-3.95
41	Cache Creek	Cache-Yolo	Erosion	Critical	4.13-4.27
217	Knights Landing Ridge Cut	KLDD	Erosion	Serious	3.63-3.76
162	Sacramento River	Yolo County	Seepage	Serious	3.34-3.45

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
		CSA #6			
162	Sacramento River	Yolo County CSA #6	Seepage	Serious	5.7-5.8
162	Sacramento River	Yolo County CSA #6	Erosion	Serious	5.9-0.01 (Segment 172)

4.2.2.8 Yolo (including DWR Maintenance Yard – Cache Creek)

The small community of Yolo is experiencing many of the same problems as other small communities in the Region. The levee south of Yolo (the Cache Creek north levee) is subject to failure, and is uncertified. Unpermitted encroachments exist along the levee footprint. Overtopping of Cache Creek can flow over I-5 and impact Yolo from the West.

Other Data

Table 4-30 presents the results of NULE evaluations for non-urban levees in the Yolo area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-30 Yolo Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
41	Cache Creek - Yolo County Unit 1b	C	A	C	C	C

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

4.2.3 Rural

Rural areas make up the vast majority of the Region and include major flood management features such as the Yolo Bypass.

4.2.3.1 Yolo Bypass (including RD 2093, RD 2120, RD 2084, DWR Maintenance Yard – East Levee Yolo Bypass, DWR Maintenance Yard – West Levee Yolo Bypass, Yolo Bypass Foundation)

Yolo Bypass LMAs are facing many of the same infrastructure, funding, O&M, institutional, emergency response, environmental, agricultural sustainability, and climate change problems as the rest of the Region. Specific issues include:

- Putah Creek floods are unpredictable and come very quickly, without warning. There is no high flow gauge on Putah Creek or the two tributaries below the Solano Diversion.
- Water carried by the South Davis Drain is pumped into the Yolo Bypass about 1 mile south on the West Levee at the entrance to the Yolo Bypass Wildlife Area. At high water it can overwhelm the drainage ditches affecting access for public use and O&M.

- There is wave fetch damage on the east levee of the toe drain on the southern most area of the Yolo Bypass Wildlife Area.
- There is a need for more refugia for Giant Garter Snakes and other animals that use the West Levee to escape floodwaters.
- During very high flows, floodwater encroaches on lands to the west and south of Putah Creek where there is no west levee. These flows block access on county roads in the short term and often leave damaged county roads as they recede. County Roads 34A, 35, 106A and northern sections of 106 are especially vulnerable. In addition, the State did not purchase flowage easements on these lands and the flooding is attributed to construction of the SRFCP.
- Willow Slough and Willow Slough Bypass and its tributaries have limited channel capacity. These channels have been narrowed and straightened, thus reducing their capacity to accept and hold stormwater. Straightening has increased the erosive capacity of and energy of the flow. There is also sedimentation in the above waterways.
- Restricted capacity in the Yolo Bypass due to the Sierra Northern Rail line and the Sacramento Deep Water Ship Channel.

Other Data

Table 4-31 presents the results of NULE evaluations for non-urban levees in the Yolo Bypass. A description of the NULE evaluations is presented in Section 3.4.

Table 4-31 Yolo Bypass NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
172	Yolo Bypass West Levee Unit 1	LD	B	A	B	B
173	Yolo Bypass West Levee Unit 2	A	B	A	B	B
174	Yolo Bypass West Levee Unit 3	A	LD	A	B	B
171	Yolo Bypass East Levee	B	C	A	B	C

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

4.2.3.2 Elkhorn Basin (including RD 537, RD 1600, RD 827, RD 785, DWR Maintenance Yard – Sacramento Bypass)

The Elkhorn Basin LMAs are facing many of the same infrastructure, funding, O&M, institutional, emergency response, environmental, agricultural sustainability, and climate change problems as the rest of the Region. Levees were constructed in the early 1900s and they do not meet current design standards. Additionally, all levees along the Sacramento River within this basin have elderberry bushes which restrict inspection and maintenance. The following sections describe some specific problems for RD 785, RD 537, and RD 1600.

RD 785

Approximately 2 miles of the Yolo Bypass levee were never completed when constructed. Also, the levee slope on the bypass side was never rip-rapped as originally designed. And the levee needs rock placed onto the crown to allow for winter patrol access and emergency access during flood warning times.

RD 537

- The crown of the levee on the north side of the Sacramento weir is collapsing due to both underseepage and stability problems.
- The levee along Old River Road around Monument Bend has no berm on the river side.
- At Monument Bend, RD 537 constructed an oxbow levee (an interior levee) in 1965 to protect against failure of the Sacramento River levee. During a high water event RD537 maintains this oxbow levee which puts the responsibility on DWR and Yolo County to maintain the river levee and the Old River Road. This will create problems for emergency evacuation.

RD 1600

- Along the Sacramento River west levee, 8 miles north of Road 117 and Old River Road, there are three large, deep scour holes approximately 6ft off the waterside toe.
- Along the landward side of the Sacramento River levee, 1000 ft north of the Fremont Weir and running for 1.6 miles, the levee side slope is approximately 1:1. This area is part of the Mid Valley project and RD 1600 has been paying DWR $5,000 per year ($150,000 over 30 years) to repair this levee and bring the side slope to 3:1, but there have been no repairs yet.
- On the Yolo Bypass levee starting 2 miles south of the Fremont Weir and running for 2.3 miles, the levee crown road needs an additional 5-6 inches of base and gravel added to ensure the ability to safely drive the road during patrols in wet weather and high water events as this road surface gets extremely muddy and deeply rutted. Also, on the landward side of this levee, there have been slope stability issues during each of the previous high water events. And, this levee's side slope is extremely steep and needs soil to be added to give a 3:1 slope. A half-mile stretch of this levee is eight tenths of a foot under the 1957 profile.
- Also, on the Yolo Bypass levee starting 3-4 miles south of the Fremont Weir, there is erosion on the bypass side from wave wash. The erosion extends down the entire side slope into the Tule Canal. The canal is approximately 80 ft wide and there is no road at the levee toe. With no road it is difficult to access these erosion sites to repair them and maintain them.

Other Data

Table 4-32 shows the overall maintenance rating for LMAs in the Elkhorn Basin area for the last six years. A description of these data is presented in Section 3.4.

Table 4-32 Overall Maintenance Rating for LMAs in the Elkhorn Basin Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 537, Lovdal District	U	A	M	U	A	M	U
RD No. 1600, Mull District	U	M	A	U	U	U	U
RD No. 785, Driver District	U	A	M	U	U	U	U
RD No. 827, Elkhorn	U	M	A	U	U	A	U

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

Table 4-33 presents the results of NULE evaluations for non-urban levees in the Elkhorn Basin area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-33 Elkhorn Basin Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
124	Reclamation District 0537 Unit 1 - north of Sac Bypass	B	A	LD	C	C
136	Reclamation District 0785 Unit 1	B	A	A	B	B
139	Reclamation District 0827 Unit 1	B	A	LD	B	B
147	Reclamation District 1600 Unit 1	B	B	LD	C	C
156 Reach 1	Sacramento Bypass Unit 1 - North BANK	B	B	LD	A	B
156 Reach 2	Sacramento Bypass Unit 1 - North BANK	A	B	A	B	B
241	Reclamation District 0827 Unit 2	LD	C	A	B	C
295	Reclamation District 1600 Unit 2	B	C	A	B	C
393	Reclamation District 0785 Unit 2	A	C	A	C	C

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

Table 4-34 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-34 Elkhorn Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
241	Yolo Bypass	RD 827	Stability	Serious	0.3-0.5

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
393	Yolo Bypass	RD 785	Erosion	Serious	2.2

4.2.3.3 Solano County (including Solano County Water Agency, RD 501, RD 2068, RD 2098, RD 2104, RD 2060, RD 536)

Most eastern Solano County lands are not in a historical floodplain, but many do flood. The existence of the SPFC complicates drainage issues and contributes to potential flooding by the introduction of waters not historically present in the eastern portion of Solano County. Since the construction of the SPFC, even 5-10 year flood events cause problems, and the northern portion of RD 2068 and areas to the west of it have flooded. The boundaries of the Sacramento-San Joaquin Drainage District closely define the areas that flooded during high flow events before construction of the SPFC. In 1986, during high flow events in the Yolo Bypass, (such as encroachment into the design freeboard in 1986 and 1997), flood waters outflanked the northern end of the Yolo Bypass levee and entered the flood protected area of RD 2068. This event required the construction of a temporary levee to stop the flow to the landside of the levee. Flood waters significantly encroached into levee freeboard in these high water events, estimated in 1986 to be approximately 2.1 feet at RD 2068 Unit 1, Yolo Bypass Right Bank, LM 5.5. Electric motors at RD 2068's Pumping Plant No. 1 (Hass Slough), were constructed to be 2.0 feet above SPFC design water surface elevation where in the flood waters in 1986.

Lands without flood easements in the reach with no levee, between the Putah Creek south levee and the beginning of the RD 2068 Yolo Bypass levee, have flooded during high flow events; encroaching upon areas without flood easements by up to ½ mile west of the easements. These flooded lands include areas outside of the LFPZ or RFMP boundary. The local drainage system is not able to handle all the water from local runoff when the Yolo Bypass is at capacity. This occurs because of either inadequate pumping capacity in levee protected areas or, in non-leveed areas, due to the backwater effect of Yolo Bypass flows in local drainage facilities.

Solano County agencies, RD 2068, Maine Prairie Water District, the City of Dixon, and the Dixon Resource Conservation District have formed a Joint Powers Authority to address some of these drainage issues. The back-levee system, part of the SPFC, was constructed on the west side of RDs 2068 and 2098 (in the 1940s or 1950s) to protect Solano County lands from flooding caused by the SPFC. The Dixon Main Drain, adjacent to the toe of the levee, is another example of a structure that is impacted by flooding caused by the SPFC.

These local agency efforts have reduced their flood risk, but their local flood protection system still has deficiencies. The west levee of the Yolo Bypass along RDs 2068 and 2098 has insufficient freeboard (5-6 feet of freeboard is required as part of the SPFC design) to adequately protect against wave fetch during high-water events in the Yolo Bypass. The back-levee system was not designed or built to continuously hold back water, but that is exactly what it must do since it was constructed using an existing irrigation canal bank as the levee, so the

toe of the levee has water constantly on it and therefore has re occurring erosion and sloughing issues. Also, there is a critical erosion site in the Yolo Bypass west levee along RD 2068. Specifically, at this site the levee has erosion at the toe on the Yolo Bypass side between levee miles 3.6 and 5.5, and erosion at the toe on the land side between levee miles 3.2 and 5.5. These levee segments have no protective berms. Additionally, Table 4-37 shows other current critical and serious sites identified through the State's FSRP.

Solano County LMAs were not set up or resourced to correct design deficiencies or provide rehabilitation beyond routine O&M for this flood protection system. DWR maintains structures, channels, and levees in specific sections of the SPFC as specified in California Water Code Section 8361, but Section 8361 does not include O&M of the levees in RDs 2068 and 2098. RDs 2068 and 2098 cannot afford the necessary repair and rehabilitation currently expected that is beyond routine O&M, and therefore cannot meet the criteria to get their levees certified. Additionally, RD 2068 and the landowners of RD 2098 pay costs to pump water from areas that would not normally flood (without the SPFC), and they pay costs to maintain those drainage pumps.

The LMAs also have unpermitted levee encroachments for which the Reclamation District's do not have permitting authority. Encroachment permits fall under the jurisdiction of the Central Valley Flood Protection Board, a State agency. RD 2068's only drainage pump is an approximately 60-year-old pumping plant discharging through the levee to Shag Slough, tributary to the Sacramento River, and it needs to be updated. The PG&E (Segment15) 500kV Table Mountain Power Line, which comes through the Yolo Bypass parallel to the levee, would be threatened if the levee broke as would the PG&E 115 kV power line along the back-levee, and the natural gas lines that run through the district.

Other Data

Table 4-35 shows the overall maintenance rating for LMAs in the Solano County for the last six years. A description of these data is presented in Section 3.4.

Table 4-35 Overall Maintenance Rating for LMAs in Solano County

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 2060, Hastings	U	M	A	A	A	A	M
RD No. 2068, Yolano	A	A	A	A	M	A	A
RD No. 2098, Cache & Haas Slough	M	A	A	A	U	A	M
RD No. 2104, Peters Pocket Tract	U	U	U	U	U	U	U
RD No. 501, Ryer Island	U	U	U	U	U	U	U
RD No. 536, Egbert	U	U	U	U	U	U	U
Solano County Public Works (Mellin Levee)	U	U	MU	U	A	A	A

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

Table 4-36 presents the results of NULE evaluations for non-urban levees in Solano County. A description of the NULE evaluations is presented in Section 3.4.

Table 4-36 Solano County NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
123 Reach 2	Reclamation District 0536 Unit 1	LD	C	LD	A	C
123 Reach 1	Reclamation District 0536 Unit 1	A	A	A	A	A
151 Reach 2	Reclamation District 2060 Unit 1	A	A	A	A	LD
151 Reach 1	Reclamation District 2060 Unit 1	B	B	C	B	C
152	Reclamation District 2068 Unit 1	LD	B	A	B	B
153 Reach 1	Reclamation District 2098 Unit 1	B	B	A	B	B
153 Reach 2	Reclamation District 2098 Unit 1	LD (A or B)	LD (A or B)	A	A	LD (A or B)
155	Reclamation District 2104 - Hass Slough	A	LD	A	A	LD (A or B)
249	Reclamation District 2098 Unit 4	A	B	A	A	B
251	Reclamation District 2104 - west levee	A	LD	A	A	LD
311	Reclamation District 2068 Unit 2	A	A	A	A	A
312	Reclamation District 2098 Unit 3	A	C	A	B	C
313	Reclamation District 2098 Unit 2	LD	C	A	B	C
314	Reclamation District 2060 Unit 3a	B	B	A	B	B
315	Reclamation District 2060 Unit 2	LD	LD	A	A	LD
316 Reach 2	Reclamation District 0536 Unit 2	B	B	LD	A	B
316 Reach 2	Reclamation District 0536 Unit 2	B	LD	A	A	B

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

Table 4-37 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-37 Solano County Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
122	Steamboat Slough	RD 501	Seepage	Serious	1.64-1.66
308	Cache Slough	RD 501	Erosion	Serious	1.34-1.42
122	Steamboat Slough	RD 501	Erosion	Serious	1.86-2.1
122	Steamboat Slough	RD 501	Erosion	Serious	5.73-5.75
313	Cache Slough	RD 2098	Stability	Critical	5.9

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
249	Unknown Slough	RD 2098	Stability	Serious	9.53
152	Shag Slough	RD 2068	Seepage	Serious	2.54-2.68
313	Cache Slough	RD 2098	Freeboard	Serious	7.41
151	Lindsey Slough	RD 2060	Erosion	Serious	1.52
151	Lindsey Slough	RD 2060	Erosion	Serious	1.84-1.91
151	Lindsey Slough	RD 2060	Erosion	Serious	2.43-2.45
151	Lindsey Slough	RD 2060	Erosion	Serious	4.29
314	Cache Slough	RD 2060	Erosion	Serious	1.3
314	Cache Slough	RD 2060	Erosion	Serious	1.42
314	Cache Slough	RD 2060	Erosion	Serious	1.53
314	Cache Slough	RD 2060	Erosion	Serious	1.68
314	Cache Slough	RD 2060	Erosion	Serious	2.01-2.07
314	Cache Slough	RD 2060	Erosion	Serious	2.18-2.23
314	Cache Slough	RD 2060	Erosion	Serious	3.59
314	Cache Slough	RD 2060	Erosion	Serious	3.78-4.00
314	Cache Slough	RD 2060	Erosion	Serious	4.24
123	Lindsey Slough	RD 536	Seepage	Serious	0.52-0.88
123	Lindsey Slough	RD 536	Erosion	Serious	3.3-3.35
123	Lindsey Slough	RD 536	Erosion	Serious	4.83-4.86
123	Lindsey Slough	RD 536	Stability	Serious	4.9-5.03

4.2.3.4 East Area (including RD 3, RD 349, RD 551, RD 755, RD 556)

The East Area LMAs are facing many of the same infrastructure, funding, O&M, institutional, emergency response, environmental, agricultural sustainability, and climate change problems as the rest of the Region.

Other Data

Table 4-38 shows the overall maintenance rating for LMAs in the East Area for the last six years. A description of these data is presented in Section 3.4.

Table 4-38 Overall Maintenance Rating LMAs in the East Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 3, Grand Island	U	U	M	M	M	M	M
RD No. 349, Sutter Island	U	U	U	U	U	U	U
RD No. 551, Pearson	U	U	A	A	A	M	A

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 556, Upper Andrus	U	U	U	U	U	U	U
RD No. 755, Randall	U	U	A	U	U	U	U

Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System
A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data

Table 4-39 presents the results of NULE evaluations for non-urban levees in the East Area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-39 East Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
113 Reach 2	Reclamation District 0003 Unit 1	C	LD	LD	B	C
113 Reach 1	Reclamation District 0003 Unit 1	B	LD	B	B	B
120	Reclamation District 0349 Unit 1	LD	A	LD	A	LD
122	Reclamation District 0501 Unit 1	C	B	LD	B	C
126	Reclamation District 0551	B	A	A	B	B
129	Reclamation District 0556 Unit 1	B	LD	B	B	B
131	Reclamation District 0755	C	A	LD	B	C
307	Reclamation District 0349 Unit 2	C	LD	LD	B	C
308	Reclamation District 0501 Unit 2	B	C	B	B	C
309	Reclamation District 0501 Unit 3	B	B	LD	B	B
310	Reclamation District 0501 Unit 4	B	B	A	A	B
384	Reclamation District 0003 Unit 2	B	A	A	A	B
388	Reclamation District 0349 Unit 3	C	LD	A	B	C
390	Reclamation District 0556 Unit 2	B	A	B	B	B
1040	Reclamation District 0551	B	LD	A	A	B
1041	Reclamation District 0551	B	LD	A	A	LD (B or C)

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

Table 4-40 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-40 East Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
307	Steamboat Slough	RD 349	Erosion	Critical	1.3-1.4

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
388	Sutter Slough	RD 349	Seepage	Serious	0.04
388	Sutter Slough	RD 349	Seepage	Serious	3.01-3.05
307	Steamboat Slough	RD 349	Erosion	Serious	2.5

4.2.3.5 South Area (including RD 341, RD 369, RD 554, RD 563, RD 1601, BALMD)

The South Area LMAs are facing many of the same infrastructure, funding, O&M, institutional, emergency response, environmental, agricultural sustainability, and climate change problems as the rest of the Region.

Other Data

Table 4-41 shows the overall maintenance rating for LMAs in the South Area for the last six years. A description of these data is presented in Section 3.4.

Table 4-41 Overall Maintenance Rating for LMAs in the South Area

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
Brannan-Andrus Levee Maintenance District	U	U	A	A	M	M	U
RD No. 341, Sherman Island	U	U	A	A	M	U	U
RD No. 369, Libby McNeil	U	U	A	A	M	U	A
RD No. 554, Walnut Grove	U	U	U	U	M	M	U
RD No. 563, Tyler Island	U	U	U	U	U	U	U
RD No. 1601, Twitchell	A	A	A	A	A	A	A
Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data							

Table 4-42 presents the results of NULE evaluations for non-urban levees in the South Area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-42 South Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
1051	Reclamation District 0554/0563	LD	LD	LD	A	LD (A, B, or C)
40	Brannan-Andrus Levee Maintenance District Unit 1	C	B	B	A	C
119	Reclamation District 0341 Unit 1	B	B	B	B	B
121	Reclamation District 0369	A	A	A	A	A
127	Reclamation District 0554 - north portion	A	A	A	A	A

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
128	Reclamation District 0554 - south portion	A	A	A	A	A
130	Reclamation District 0563	C	B	B	C	C
148	Reclamation District 1601	C	B	B	B	C
378	Brannan-Andrus Levee Maintenance District Unit 2	A	LD	LD	B	B
387	Reclamation District 0341 Unit 2	C	B	B	C	C
1043	Reclamation District 0563	C	C	LD	LD	C
1044	Reclamation District 0341 – West Portion	LD	B	LD	A	LD (B or C)
1045 Reach 1	Reclamation District 0341 – East Portion	B	B	B	A	B
1045 Reach 2	Reclamation District 0341 – East Portion	B	LD	LD	A	B
1046	Reclamation District 1601	LD	B	C	C	C
1047	Reclamation District 1601	LD	B	C	C	C
1048	Brannan-Andrus Levee Maintenance District Unit 5	B	B	B	A	B
1049	Brannan-Andrus Levee Maintenance District Unit 4	B	B	LD	B	B
1050	Brannan-Andrus Levee Maintenance District Unit 3	C	C	C	B	C
Notes: 2011 Geotechnical Assessment Report North NULE Study Area *A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data*						

Table 4-43 presents the results of the FSRP and shows the critical and serious repair sites.

Table 4-43 South Area FSRP Critical and Serious Repair Sites

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
1046	San Joaquin River	RD 1601	Seepage	Critical	1830+00
148	Sevenmile Slough	RD 1601	Seepage	Critical	1.5-1.95
1046	San Joaquin River	RD 1601	Seepage	Critical	1730+00
1046	San Joaquin River	RD 1601	Seepage	Serious	1680+50
1047	Threemile Slough/Sevenmile Slough	RD 1601	Seepage	Serious	4.41-4.49
1047	Threemile Slough/Sevenmile Slough	RD 1601	Erosion	Serious	4.43
1047	Threemile Slough/Sevenmile Slough	RD 1601	Erosion	Serious	4.1
148	Threemile Slough/Sevenmile Slough	RD 1601	Erosion	Serious	1.09-1.10

Segment #	Water Way	LMA	Failure Mode	Site Status	Approximate Levee Mile Location
387	Sacramento River	RD 341	Erosion	Serious	4.12-4.16
387	Sacramento River	RD 341	Erosion	Serious	4.43-4.58
387	Sacramento River	RD 341	Erosion	Serious	4.72-4.76
387	Sacramento River	RD 341	Erosion	Serious	5.97-6.09

4.2.3.6 RD 1000 (including Sutter County)

RD 1000 is facing many of the same problems as the rest of Region, including problems with erosion and seepage along its levees.

Other Data

Table 4-44 shows the overall maintenance rating for LMAs in RD 1000 for the last six years. A description of these data is presented in Section 3.4.

Table 4-44 Overall Maintenance Rating for RD 1000

Name	Overall Maintenance Rating						
	2007	2008	2009	2010	2011	2012	2013
RD No. 1000, Natomas	A	A	A	A	A	A	A
Notes: 2013 Inspection and Local Maintaining Agency Report of the Central Valley State-Federal Flood Control System A-Acceptable, M-Minimally Acceptable, U-Unacceptable, LD-Lacking Data							

4.2.3.7 Yolo County and CSA #6 (Named Area 22)

Many of Yolo County CSA #6's major problems stem from flood protection across Yolo County that seems to have been planned and implemented in a piecemeal fashion - It is under the purview of many, small, un-resourced and disconnected Districts and Maintaining Agencies. The agencies are not coordinated and they don't share plans or funding.

There are a number of seepage, stability, and erosion problems in different locations along the Knights Landing levee. Segments of the Knights Landing levee along the west side of the Sacramento River (total levee approx. 6 miles long) have seepage (through and under) and stability problems recognized during previous high water events. Yolo County officials do not think the levee has ever failed. In USACE's recent levee inspection, this levee does not meet the minimally acceptable standard for the RIP and will be ineligible to receive funding through PL 84-99. There are erosion issues along the southeastern-most portion of the 6-mile Sacramento River levee at the point where State property starts, and very near the Ridge Cut. CSA#6 has no funding to fix the erosion. USACE has designed a solution for these levee problems through its Mid-Valley Project but there is no funding for construction. The levee only provides approximately 20-yr level of protection, but the Corps' proposed Mid-Valley Project would only bring the levee to 60-yr level of protection.

The Huff's Corner Levee (along the south side of Cache Creek) is the only levee under the responsibility of Yolo County. It is 0.29 miles long, but the county is not resourced for O&M. Yolo County has no funding for O&M of the Huff's Corner Levee. The State owns and maintains the levee on either side of this 0.29 mile segment, but provides no resources to the County for O&M of Huff's Corner. There has been some discussion between Yolo County and DWR about the State possibly taking over O&M.

Rate increase associated with the NFIP will most likely affect residents of Knights Landing within the next year. These increases can be an economic hardship on the rural areas and small communities in Yolo County, many of which are economically disadvantaged.

Other Data

Table 4-45 presents the results of NULE evaluations for non-urban levees in the Yolo County CSA#6 area. A description of the NULE evaluations is presented in Section 3.4.

Table 4-45 Yolo County CSA #6 Area NULE Levee Assessments

Segment #	Segment Name	Under-seepage	Slope Stability	Through Seepage	Erosion	Overall
162	Service Area 6 - Yolo County	B	LD	B	B	B

Notes: 2011 Geotechnical Assessment Report North NULE Study Area
A-Hazard Level A, B- Hazard Level B, C-Hazard Level C, LD-Lacking Data

4.3 Integrated Regional Water Management Opportunities

DWR is also encouraging and incentivizing local water management agencies to plan using the principles of integrated regional water management (IRWM). IRWM is a collaborative effort to manage all aspects of water resources in a region. IRWM crosses jurisdictional, watershed, and political boundaries; involves multiple agencies, stakeholders, individuals, and groups; and attempts to address the issues and differing perspectives of all the entities involved through mutually beneficial solutions.

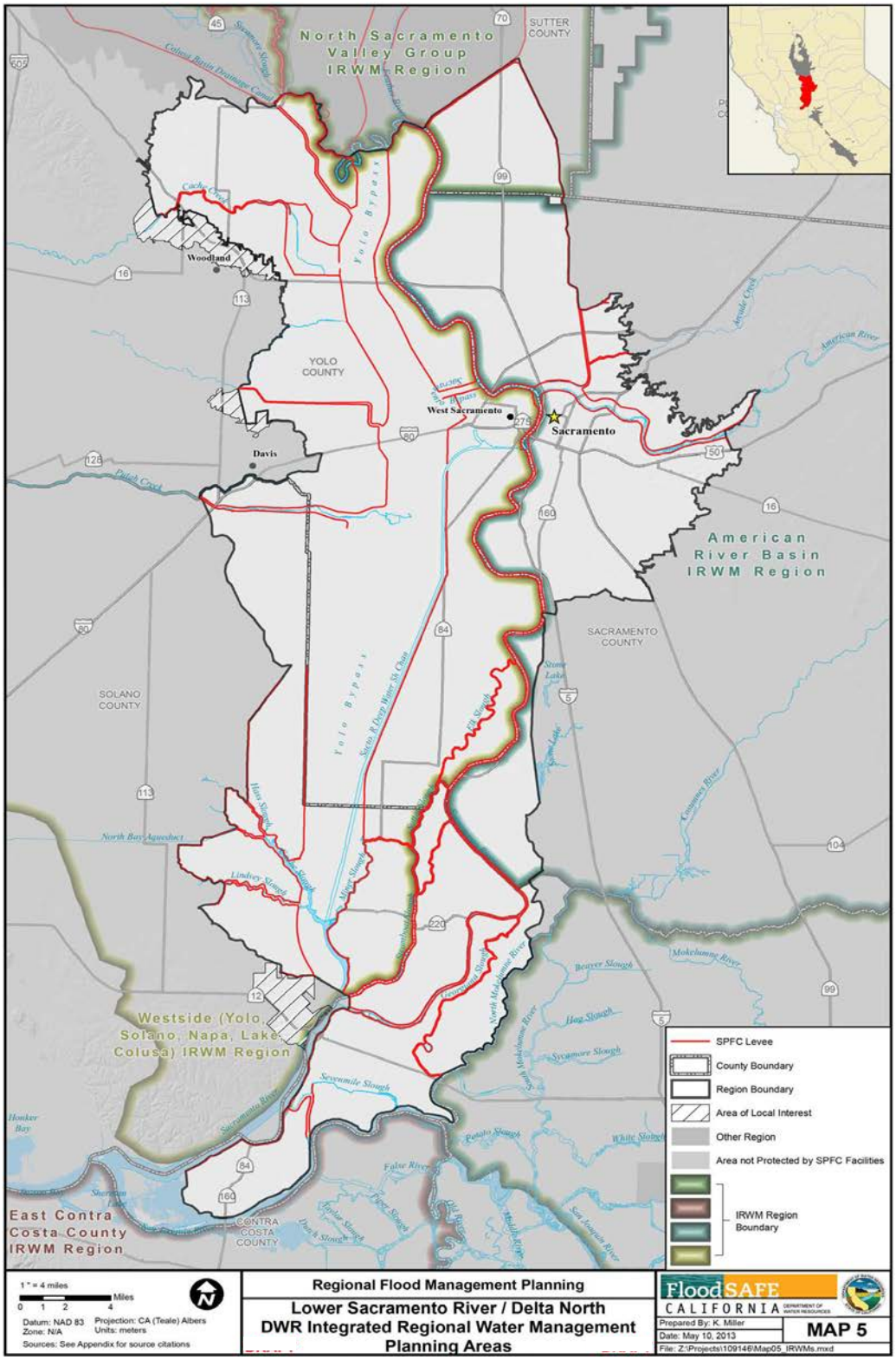
The Lower Sacramento/Delta North Region covers portions of Sacramento, Yolo, Sutter, and Solano Counties and overlaps three IRWM planning regions, shown on Figure 4-6:

- American River Basin IRWM Region – The overlap with the RFMP Region occurs in Sacramento County.
- Westside Sacramento IRWM Region – The overlap with the RFMP Region occurs in Yolo and Solano County.
- Northern Sacramento Valley IRWM Region – The overlap with the Northern Sacramento Valley IRWMP occurs in Sutter County.

Each of these IRWM regions is implementing their own integrated regional water management program to address water management issues (or problems) related to water supply, water

quality, environmental, ecosystem restoration, stormwater management, and flood management. The regions set measurable objectives and develop prioritized projects and programs to meet objectives and address their issues. Because of the overlap of regions, stakeholders, and projects, it is appropriate and necessary to coordinate with the IRWM regions. At times it may be more appropriate for a flood management project to be implemented through the IRWM, particularly if it is a local (or non-SPFC) issue.

Figure 4-1 Map of Integrated Regional Water Management Plan Regions



-LSDN Atlas, 2013

5.0 Regional Improvements

Following the documentation of the Region's flood management problems, FloodProtect set out to develop and prioritize solutions to those problems. This section of the RFMP presents those solutions in the form of structural and non-structural improvements to the regional flood management system. Section 6 presents a financing strategy for each of the recommended improvements. FloodProtect and its members understand that it may not be possible to solve all of the Region's flood management problems as part of the FloodProtect process, but every attempt was made to develop as comprehensive a list of improvements as possible.

The RFMP is centered on reducing flood risk to urban, rural, and small community areas. The planning process addressed the problems by developing multi-benefit solutions, where possible, through an integrated flood management approach which views the flood risk management system as part of a larger integrated water management system. The focus was on identifying and recommending needed flood system improvements and, where possible, paired, combined, and integrated into the larger water management system so that multiple benefits could be realized.

Multi-benefit projects are flood management projects which include improvements to fisheries and wildlife habitat, restoration of ecological processes, improvement of water quality, lower flood risk to and preservation of agriculture, and recreational opportunities. These are consistent with the stated goals and objectives of the CVFPP and will have a much higher likelihood of State and Federal funding.

However, not all projects can or should be multi-benefit. The economics of planning and implementing a project that is very small in scope and scale may dictate that the project be single-benefit.

As stated in Section 2.1.1, the level of detail of this RFMP is considered to be pre-feasibility, as no alternative analysis was conducted; but, limited research was done to determine if details of improvements already existed. Overall, the list of recommended improvements was developed from existing documents which include, but are not limited to: Reclamation District 5-year plans; IRWMPs; information from DWR, such as the FSRP and NULE; and communications with LMAs and other flood managers. When available, improvement details such as quantities, costs, permitting, funding, and schedule were included in the descriptions at their existing level of detail.

This section is organized into several subsections. The first three subsections, 5.1, 5.2, and 5.3, present structural improvements in Solano, Yolo, and Sacramento counties, respectively. For each county, the improvements are further organized into three categories: urban, small communities, and rural.

- Urban Improvements - In Solano County, improvements are presented for the City of Rio Vista; in Yolo County for West Sacramento, Davis, and Woodland; and in Sacramento County for SAFCA's area of responsibility.

- Small Community Improvements – For each of the region's small communities, a feasibility study was recommended. The feasibility studies would compare four standard options for improvements:

  - Structural Elevation Raising – This option includes raising the elevation of individual homes and property to decrease a property owner's exposure to ever-rising flood insurance costs.
  - Ring levee – This option includes the construction of levees that completely encircle or "ring" an area subject to inundation from all directions.[1] DWR evaluated and estimated costs of ring levees for several small communities as part of the development of the 2012 CVFPP. Information from that analysis was used in this RFMP.
  - Fixing in-place of perimeter levees – This option includes the repairs of perimeter levees that would improve protection of the small community and its surrounding areas within the perimeter. Programs such as NULE, ULE, and FSRP identified the costs of fixing the deficiencies of existing levees of the SPFC. Information from those other efforts was used in this RFMP.
  - Zone D designation - This option would involve working with FEMA to designate the small communities as Zone D rather than Zone AE. The Zone D designation is used where there are possible but undetermined flood hazards, but no definitive analysis of flood hazards has been conducted.

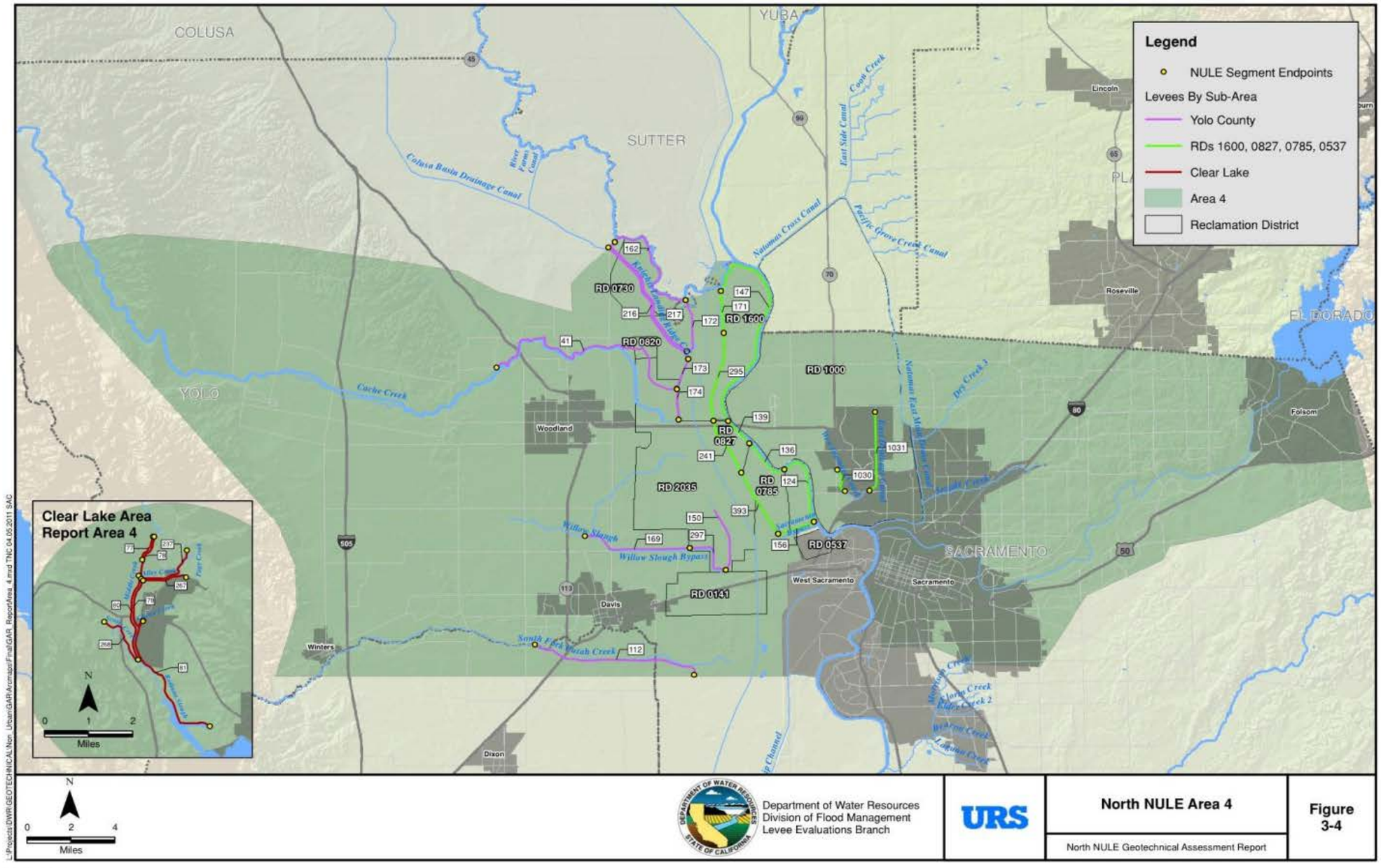
- Rural Improvements – Rural improvements are primarily those identified by LMAs protecting rural areas, including improvements needed to address problems identified as part of FSRP and NULE.

By organizing the improvements by county, type, and RD or other LMA, readers of the RFMP will be able to easily identify the recommended improvements in their area. The discussions about the improvements include: general descriptions, location maps, potential for multi-benefits, and costs.

When available, the improvement descriptions included maps. Many of the proposed improvements are rural levee improvements, as identified in DWR's NULE or FSRP projects. Many of the detailed maps in Section 5 refer to NULE levee segments. Figures 5-1a and 5-1b show the overall region, including the NULE levee segment numbers. These location maps can be used to understand the regional setting of the communities and the levee segments around them.

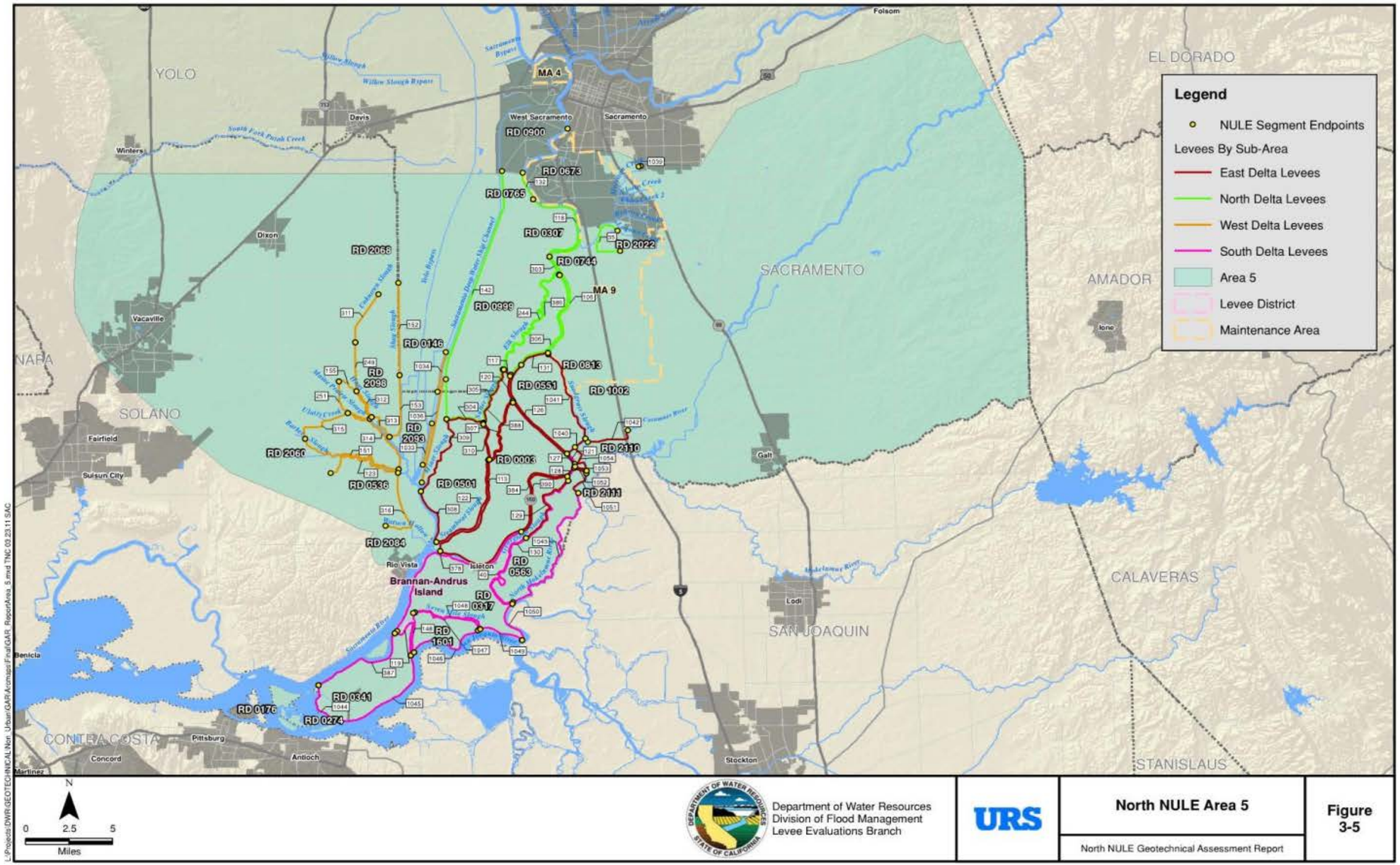
[1] U.S. Army Corps of Engineers Design and Construction of Levees, EM 1110-2-1913

Figure 5-1a. NULE Levee Segments



DWR 2011

Figure 5-1b. NULE Levee Segments



DWR, 2011

The descriptions also include information that speaks to several specific prioritization criteria. These criteria include the design readiness, permitting readiness, and funding readiness. These criteria will be equally considered to prioritize the improvements, as required by DWR. Table 5-1 shows each of the readiness criteria, possible responses, and explanations for each. These standard responses for the readiness criteria allowed for easier comparisons of the improvements. The results of the prioritization are found in Appendix B.

Table 5-1. Prioritization Criteria

Criteria	Possible Response	Explanation
Design Readiness	Pre-Feasibility	The improvement is early in its development. Design may only be 10% or less.
	Feasibility	The improvement is in the feasibility stage and may have only 30% or less level of design.
	Plans and Specifications under development	The improvement is partially designed or is a standard design that the LMA has performed many times, requiring less effort than a completely new design.
	Bid ready	The improvement's design is ready for the construction bid package.
Permitting Readiness	Not complete (complex requirements)	The permitting for the improvement is not complete. However, the required permitting is expected to be complex and require a significant level of effort from the LMA.
	Not complete (complex requirements) 408 permitting in progress	The permitting for the improvement is not complete and the 408 permitting is in progress. The required permitting is expected to be complex and require a significant level of effort from the LMA.
	Not complete (standard or simple requirements)	The permitting for the improvement is not complete. However, the required permitting is expected to be fairly simple or similar to other projects permitted by the LMA.
	Complete	The permitting is complete.
Funding Readiness	Local Funding Sources not Identified	Local funding sources for the LMA have not yet been identified.
	Local Funding Sources Under Development	Local funding sources have been identified, but not yet requested.
	Local Funding Source Secured	Local funding sources for the improvement have been requested and secured.
	Local Funding Source Secured and State Funding Requested	Local funding sources have been secured and State Funding has been requested by a measure such as a Grant Application.
	Local and State Funding Secured	Local and State funding has been secured for the project.
	Local and State Funding Secured and Federal Authorization	Local and State funding has been secured for the project and the project has been Federally authorized.

In addition to the improvements for each of the LMAs, Section 5.4 through Section 5.6 also describes regional efforts related to residual risk management (e.g. Flood Emergency Preparedness, Response, and Recovery, and Operations and Maintenance), habitat conservation, agricultural sustainability, and system improvements (Yolo Bypass/Cache Slough Integrated Water Management Plan).

The system improvements have also undergone a prioritization process, similar to that described for the regional improvements. The criteria used for this process were based on design readiness, funding readiness, and permitting readiness. Criteria were rated by collecting and reviewing information from existing studies, reports, and meeting documents. Some of these improvements are somewhat dependent upon one another. This inter-dependence was taken into consideration during the prioritization process.

Section 5 uses a series of maps from different sources to provide a general location/vicinity map of projects, waterways, and RDs in the area. These maps are not inclusive of all projects and may include references to projects not included in this RFMP.

5.1 Solano County Improvements

5.1.1 Solano County Urban Areas

The following section presents flood management improvements for the City of Rio Vista, the only Solano County urban area within the Region.

5.1.1.1 City of Rio Vista

As described in Section 4 (Problem Definition) the City of Rio Vista is subject to flooding from the Sacramento River and other local runoff. The City is continuing to develop solutions for these problems. Figure 5-3 shows the limits of the City, its proximity to the Sacramento River, topography, and the location of key features such as Edgewater Driver and the Mellin Levee. This section describes the City's flood management improvements, which are listed in Table 5-2.

Waterfront Floodwall and Public Access Project

The highest priority improvement for the City is the development of the Waterfront Floodwall and Public Access Project. The City's 2007 Waterfront Specific Plan proposed the construction of a 2,500 linear-foot vertical concrete floodwall generally along the current shoreline of the Sacramento River from south of Main Street to the State Fishing Pier near the Helen Madere Bridge (Highway 12). The floodwall expansion would protect Front Street to City Hall and would include 3 feet of freeboard. The design would likely need to be updated to meet the State Urban Levee Design Criteria, which would include consideration of sea level rise. The improvement would also include construction of a promenade in the same area to provide public access. The permitting process is estimated at 12 to 18 months.

Highway 84 Closure Structure

The floodwall, however, could still be outflanked by high water from the Yolo Bypass. Highway 84, which is owned and maintained by Caltrans, runs along the Sacramento River and the downstream end of the Yolo Bypass floods in high water. A levee or seawall is needed along Highway 84, from the Rio Vista Bridge to the Mellin Levee, to protect the City's Industrial area along the river and to prevent flood water from entering the downtown area through the bridge underpass. There will need to be a gate across Highway 84 at the Mellin

Levee to prevent flood water from rushing in through the gap and flooding the industrial area. Any flood protection solution along Highway 84 will need to be coordinated with Caltrans. A solution could be addressed as part of the realignment of the Rio Vista Bridge. Additional alternatives would be to raise Highway 84 or construct a floodwall along the Sacramento River.

Edgewater Drive Improvements

Along Edgewater Drive, there are properties still at risk of flooding from both overbank flows from the Sacramento River and from interior drainage capacity being exceeded. Currently, the City uses portable pumps to pump interior drainage flood water over the private property owners' floodwall as the water cannot escape because of high water. Individual property owners have floodwalls, which look contiguous but they were all constructed individually by property owners and are not maintained by the City. The City is interested in reducing flooding along Edgewater Drive through a new floodwall permanent pump station. However, a solution may be complicated since it is in the property owners' backyards and there is little room in which to work.

Airport Drive Improvements

While the Sacramento River is the primary source of flooding, other areas in the City are subject to flooding due to inadequate drainage during heavy storms. One of these areas is Church Road at Airport Road. This roadway intersection is often flooded during periods of moderate to heavy rainfall, with water overtopping the roadway up to several inches. To address this problem, the City would like to increase the size of undersized culverts and realign with the drainage ditches that currently allow stormwater flows to bottleneck and flood the intersection.

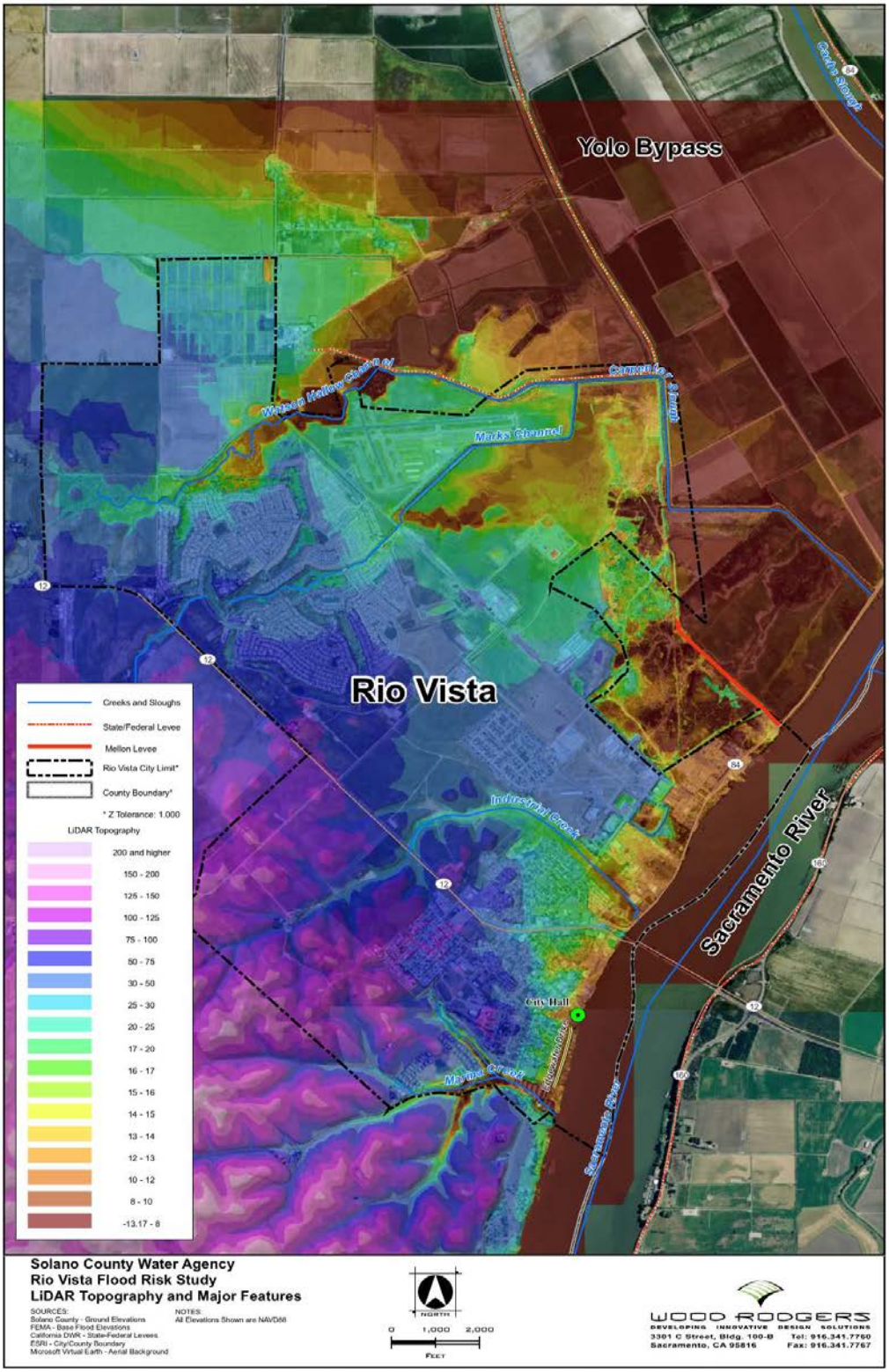
Mellin Levee Vegetation Control

Another consideration for the City is the condition of the Mellin Levee, which is maintained by Solano County Public Works and located in the northwest corner of the City. DWR recommended in its 2013 Inspection and Local Maintaining Agency Report that Solano County "should focus more on controlling vegetation to maintain visibility and access" on the levee. The City's view, however, is that this levee should be part of the SPFC and therefore maintained by the State. The City is concerned that the Mellin Levee is a dry levee and has not been sufficiently maintained. Originally, the levee was designed to direct bypass flows to the Sacramento River and not to protect Rio Vista from high Bypass flows. As stated in the October 22, 2009 Solano County Water Agency Flood Control Advisory Committee Minutes, the Mellin Levee "does not provide substantial flood protection."

Table 5-2. Rio Vista Improvements

Solution	Estimated Cost (2014, Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl. O&M)	Multi Benefits
Waterfront Floodwall and Public Access Project	$7,792,542	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Potential link to the RASP
Highway 84 Closure Structure	$500,000	Feasibility	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Potential link to the RASP
Edgewater Drive Improvements	TBD	Feasibility	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Potential link to the RASP
Airport Drive Drainage Improvements	TBD	Feasibility	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Potential link to the RASP
Mellin Levee Vegetation Control (possibly State adoption of this levee into the SPFC)	TBD	Pre-Feasibiilty	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Potential link to the RASP

Figure 5-2. Rio Vista Map



SCWA, 2009

5.1.2 Solano County Small Communities

There are no Solano County small communities within the Region.

5.1.3 Solano County Rural Areas

The following sections present regional improvements for LMAs in the rural areas of Solano County. The sections are generally organized from north to south: RD 2068, RD 2098, RD 2104, RD 2060, RD 536 and RD 501.

5.1.3.1 RD 2068 – Yolano (Yolo and Solano County border area)

As stated in Section 4.2, RD 2068 has a number of issues resulting from flooding caused by the construction of facilities of the SPFC. There are existing plans to address some of those issues which include a waterside enhancement project and a seepage repair project. Information on these improvements was collected from the June 2012 Five Year Plan for Yolano. These specific plans are described in the following two sections and are also summarized in Table 5-3. Figure 5-4 shows the levees around RD 2068. But RD 2068 also has other issues described in Section 4.2 which are not identified in the FSRP and for which no specific planned solutions exist. Proposed solutions for those issues are also described below.

Yolo Bypass Waterside Enhancement Project

The Yolo Bypass Waterside Enhancement project would provide additional slope material on the bypass side of the levee, from district defined levee station 185+00 to 285+00, at a possible 10:1 or flatter slope, generating habitat friendly slopes and providing much needed protection from high water flood forces which cause erosion during operation of the bypass. The project will also include a large enhancement and mitigation component. The project will address any freeboard deficiencies along the levee.

The cost of the construction of the bank protection project includes rough estimates for the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 1,000,000 tons of imported fill will be used.

Assuming the financing is secured, the project will take approximately 4 years to complete.

Yolo Bypass Seepage Repair Project

There is an additional serious seepage site in RD 2068 from the FSRP that is not addressed by improvements from its 5 year plan. RD 2068 plans to construct a seepage protection project along the Yolo Bypass. The seepage protection project would be 700 feet long from approximately levee mile 2.54 to 2.68. The seepage control project would consist of multiple gradations of rock and fill to control the seepage.

Yolo Bypass West Levee Improvement Project

As described in Section 4.2, this freeboard deficiency results in overtopping during high water events in the bypass combined with high winds and resulting wave fetch. Freeboard of approximately 5 to 6 feet is needed along this levee to assure no overtopping.

Yolo Bypass West Levee Erosion Repair Project

The Yolo Bypass West Levee in RD-2068 has a history of significant waterside slope erosion primarily associated with wind generated waves. The reach from approximately LM 3.0 to 5.5 has experienced scour during the last several high water events resulting in multiple occurrences of PL 84-99 assistance for rehabilitation. The existing condition is further aggravated by the general lack of a waterside berm within this reach along with the close proximity of Shag Slough to the waterside levee toe. A comprehensive erosion protection system, similar to that in place along much of the Yolo Bypass East Levee, is required to address this recurring deficiency.

Yolo Bypass West Levee Interior Erosion Repair Project

The Yolo Bypass West Levee in RD-2068 has a history of erosion along the landside levee toe and slope due to the impoundment of interior drainage against the levee. The reach from approximately LM 3.2 to 5.5 has experienced scour during multiple large flood events and is aggravated by the general lack of a landside berm within this reach due to the close proximity of a depression created by the borrow operation for construction of the levee. An erosion protection feature is required to ensure landside levee toe stability and avoid recurring landside slope and toe repairs.

Back Levee Erosion Repair Project

A portion of the levees comprising the western boundary of RD-2068 have a history of waterside levee slope and toe erosion primarily associated with the close proximity of a water supply canal. The reach from approximately LM 0.0 to 2.0 experiences minor but constant erosion from continuous water deliveries through the canal for a significant portion of every year. An erosion protection feature is required to ensure waterside levee toe stability and avoid recurring waterside slope and toe repairs. The water supply canal, through this reach, was constructed and operational prior to construction of the levee.

Adoption into California Water Code Section 8361

A solution is needed to fund the long-term O&M requirements (which are over and above routine maintenance) of the levees surrounding RD 2068. Perhaps the best solution is for the State to adopt RD 2068's levee system into the CWC Section 8361.

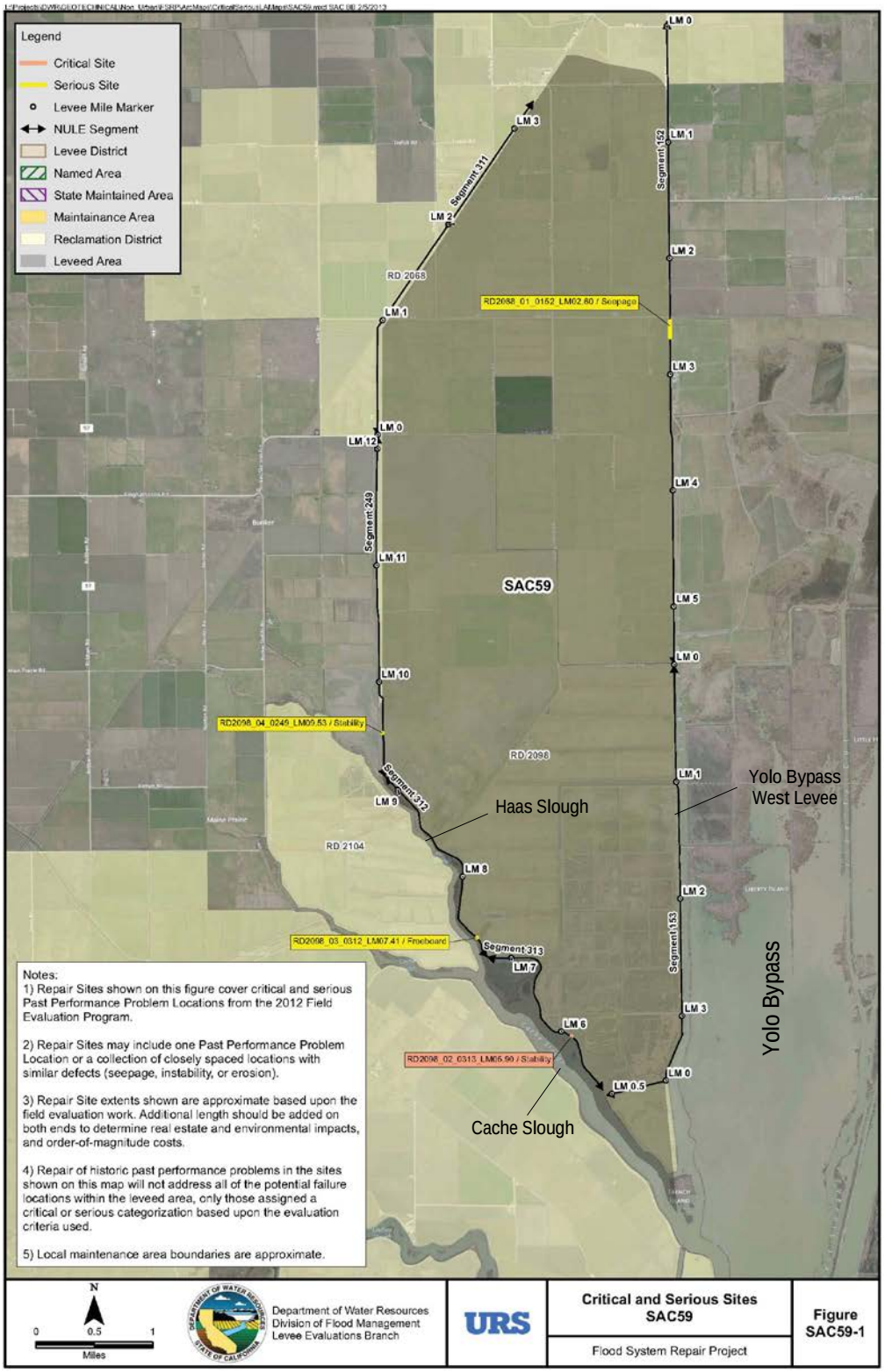
Encroachment Removal and Enforcement Project

Closer monitoring and enforcement by the CVFPB is needed to remove unpermitted encroachments and bring those that have exceeded the bounds of their permit into compliance.

Table 5-3. RD 2068 Improvements

Solution	Estimated Cost (Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl. O&M)	Multi Benefits
Yolo Bypass Waterside Enhancement Project	$6,820,533	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Ecosystem Restoration Contained in RD2068 5-Year Plan
Yolo Bypass Seepage Repair Project	$452,098 (PCET)	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding source secured	Potential link to the RASP
Yolo Bypass West Levee Improvement Project	TBD	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Potential link to the RASP
Yolo Bypass West Levee Erosion Repair Project	TBD	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Potential link to the RASP
Yolo Bypass West Levee Interior Erosion Repair Project	TBD	Pre-Feasibility	Not complete (standard or simple requirements)	Local Funding sources not identified.	Potential link to the RASP.
Back Levee Erosion Repair Project	TBD	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Potential link to the RASP
Adoption into CWC 8361	TBD	Pre-Feasibility	Not complete (complex requirements)	Local funding sources not identified	Potential link to the RASP
Encroachment Removal and Enforcement Project	TBD	Pre-Feasibility	Not complete (complex requirements)	Local funding sources not identified	Potential link to the RASP

Figure 5-3. RD 2068 and RD 2098 Levees



DWR FSRP, 2013

5.1.3.2 RD 2098 – Cache & Haas Slough

As stated in Section 4.2, RD 2098 has similar issues to the other communities in the region. Their primary issues however, are related maintenance activities. No major improvements were recommended for RD 2098 from the June 2012 Five Year Plan for the Cache Haas Slough Area. However, there are proposed improvements to RD 2098's critical and serious sites identified in the FSRP. The following are descriptions of proposed improvements for RD 2098, which are summarized in Table 5-4. Figure 5-5 shows the levee around RD 2098.

Yolo Bypass West Levee in RD-2098 Erosion Repair

The Yolo Bypass West Levee in RD-2098 has a history of significant waterside slope erosion primarily associated with wind generated waves. The reach from approximately LM 0.0 to 3.5 has experienced scour during the last several high water events resulting in multiple occurrences of PL 84-99 assistance for rehabilitation. The existing condition is further aggravated by the general lack of a waterside berm within this reach along with the close proximity of Shag Slough to the waterside levee toe. A comprehensive erosion protection system, similar to that in place along much of the Yolo Bypass East Levee, is required to address this recurring deficiency.

Back Levee Erosion Repair Project in RD 2098

A portion of the levees comprising the western boundary of RD-2098 have a history of waterside levee slope and toe erosion primarily associated with the close proximity of a water supply canal. The reach from approximately LM 9.7 to 12.2 experiences minor but constant erosion from continuous water deliveries through the canal for a significant portion of every year. An erosion protection feature is required to ensure waterside levee toe stability and avoid recurring waterside slope and toe repairs. The water supply canal through this reach was constructed and operational prior to construction of the levee.

Cache Slough Stability Project

There are additional critical and serious stability sites in RD 2098 from the FSRP that are not addressed by improvements from its 5 year plan. RD 2098 plans to construct a stability protection project along Cache Slough. The stability protection project would be near levee mile 5.9 (critical stability site) and levee mile 9.53 (serious stability site) totaling approximately 160 feet of construction.

A landside levee slope and toe stability issue has also been observed along the reach of levee extending from LM 6.8 to LM 7.2 near the confluence of Cache and Haas Sloughs. This deficiency was not identified as part of the FSRP; however, the LMA has previously attempted to address performance problems including landside levee slope sloughing and subsidence in the past.

Cache Slough Freeboard Project

Subsidence has caused an additional serious freeboard deficiency in RD 2098 from the FSRP that are not addressed by improvements from its 5 year plan. RD 2098 plans to address the freeboard deficiency by fixing the levee crown along Cache Slough. The project would be approximately 100 feet long near levee mile 7.41.

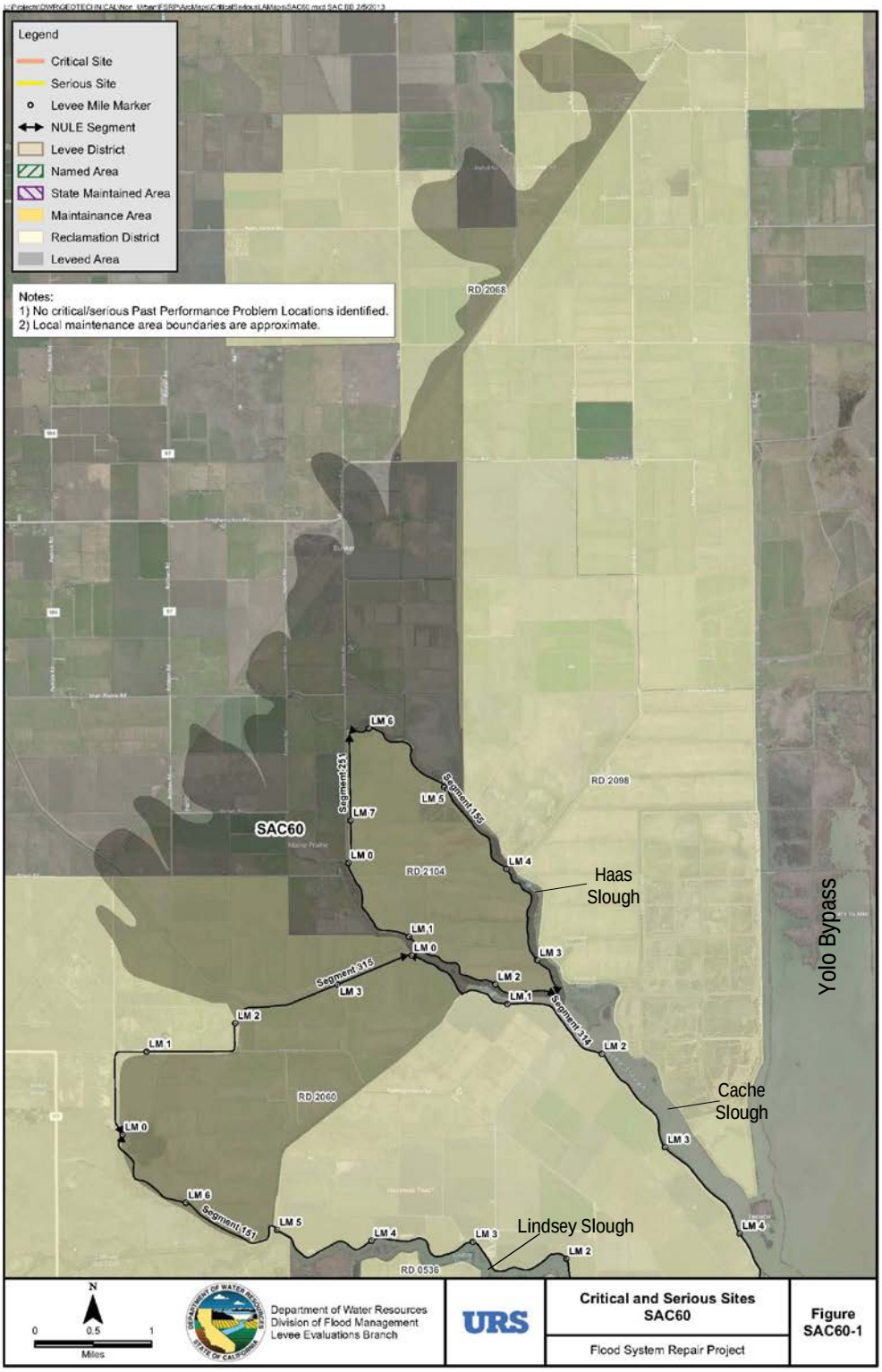
Table 5-4. RD 2098 Improvements

Solution	Estimated Cost (Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl. O&M)	Multi Benefits
Cache Slough Stability Project	$34,808 (PCET)	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Potential link to the RASP
Yolo Bypass West Levee Erosion Repair – RD 2098	TBD	Pre-Feasibility	Not complete (standard or simple requirements)	Local Funding sources not identified.	Potential link to the RASP.
Back Levee Erosion Repair Project – RD 2098	TBD	Pre-Feasibility	Not complete (standard or simple requirements)	Local Funding sources not identified.	Potential link to the RASP.
Cache Slough Freeboard Project	$28,844 (PCET)	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Potential link to the RASP

5.1.3.3 RD 2104 – Peters Pocket Tract

RD 2104 has similar issues to the other communities in the region. Their primary issues however, are related maintenance activities. Because of this, there are no major improvements recommended for RD 2104 in this RFMP. RD 2104 will instead focus on vegetation and rodent control, seepage control, bank protection/erosion control, access road maintenance, and encroachment repairs and modifications. Figure 5-5 shows the levees around RD 2104

Figure 5-4. RD 2104 Levees



DWR FSRP, 2013

5.1.3.4 RD 2060 – Hastings

As stated in Section 4.2, RD 2060 has similar issues to the other communities in the region. The plan to address those issues also includes two large bank protection projects, beyond the annual maintenance requirements of the District, that need to be addressed in the coming years. Information on these improvements was collected from the June 2012 Five Year Plan for Hastings Track. These proposed improvements represent a comprehensive solution to RD 2060's flooding problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for RD 2060, which are summarized in Table 5-5. Figure 5-6 shows the levees around RD 2060.

These projects will improve the integrity of the levee system, support the long-term goals of maintaining eligibility in the Rehabilitation Inspection Program under PL 84-99, and support the operation of the SRFCP along the western levee of the Yolo Bypass. These projects along Wright Cut, Lindsey Slough, and Cache Slough will repair erosion damages that have occurred over several previous flood events.

Wright Cut Bank Protection Project

The Wright Cut project would rehabilitate all 3,500 feet of the waterside bank to withstand Yolo Bypass flood flows, and incorporate an enhanced lower waterside slope habitat area with possible riparian forest, scrub shrub and emergent/freshwater marsh features to mitigate and enhance the habitat values.

The estimate was developed only from a planning perspective and is only based on rough quantities and anticipated costs. The cost of the construction of the bank protection project includes rough estimates for the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 40,000 tons of riprap quarry stone and 15,000 tons of imported fill will be used.

Assuming that financing is secured, the project will take approximately three years to complete.

Lindsey and Cache Slough Bank Protection Project

Lindsey and Cache Slough Bank Protection Project would repair multiple sites along 12,000 lineal feet of Cache Slough and Lindsey Slough. This project would be a scaled down version of the Wright Cut Bank Protection Project, described above. The focus of this project would be to rehabilitate all areas along the lower 2.25 miles of each section closest to Yolo Bypass flows.

The estimate was developed from a planning perspective only and is based on rough quantities and anticipated costs only. The cost of the construction of the bank protection project includes rough estimates for the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 30,000 tons of riprap quarry stone and 10,000 tons of imported fill will be used.

Assuming the financing is secured, the project will take approximately three years to complete.

Cache Slough Bank Protection Project

There is an additional serious erosion site along Cache Slough from the FSRP that is not addressed by improvements from its 5 year plan. RD 2060 plans to construct a bank protection project along Cache Slough. The project will rehabilitate the waterside bank from levee mile 1.3 to 2.23 and incorporate an enhanced lower waterside slope habitat area with possible Riparian Forest, Scrub-Shrub, and emergent/freshwater marsh features to mitigate for loss of habitat and enhance the habitat value along the slough. The total rehabilitated length is 2,420 feet.

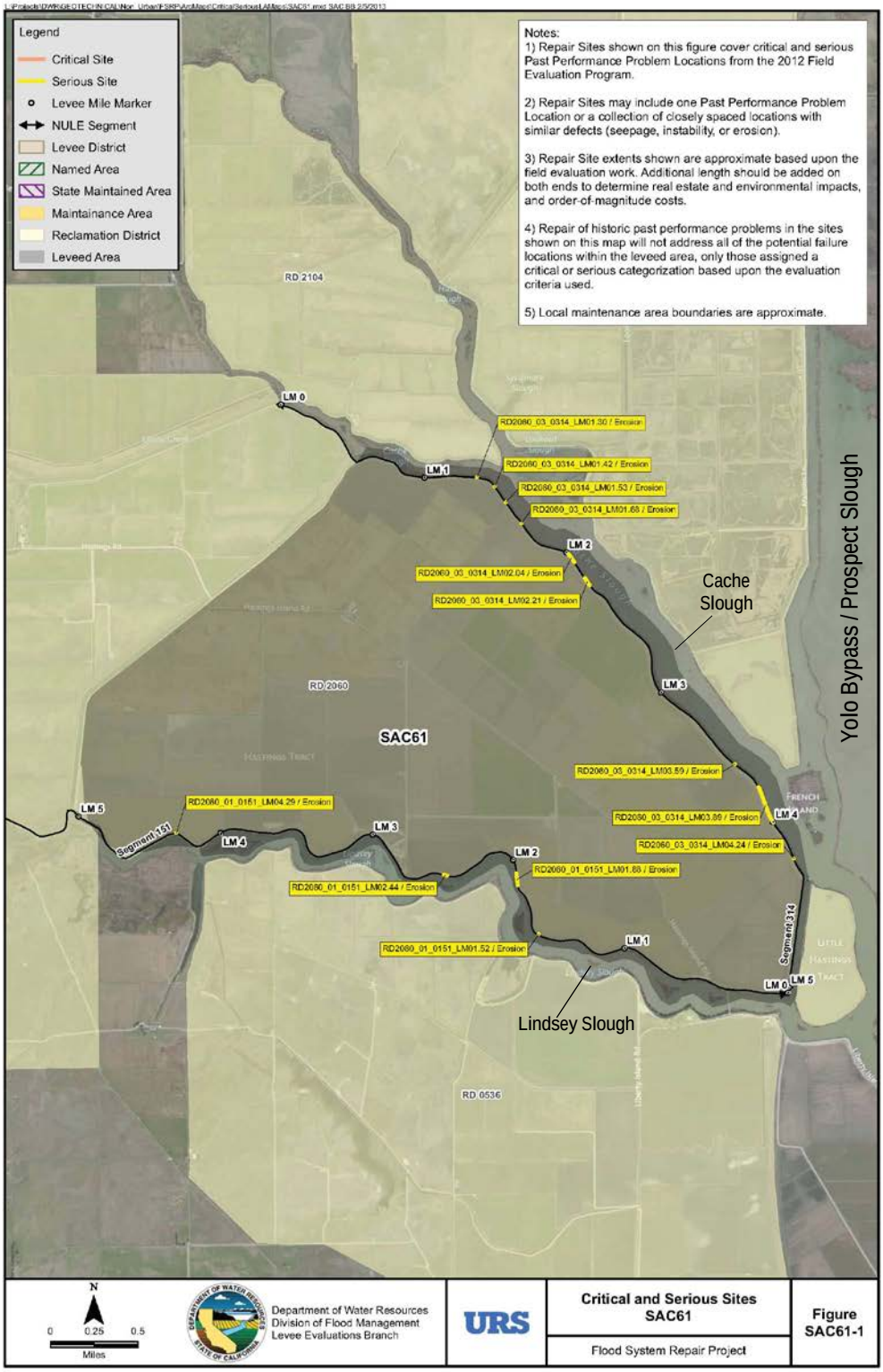
Lindsey Slough Bank Protection Project

There are additional serious erosion sites along Lindsey Slough from the FSRP that are not addressed by improvements from its 5 year plan. RD 2060 plans to construct a bank protection project along Lindsey Slough. The project will rehabilitate the waterside bank from levee mile 2.43 to 2.45 and at levee mile 4.29. The project will also incorporate an enhanced lower waterside slope habitat area with possible Riparian Forest, Scrub-Shrub, and emergent/freshwater marsh features to mitigate for loss of habitat and enhance the habitat value along the slough. The total rehabilitated length is 750 feet.

Table 5-5. RD 2060 Improvements

Solution	Estimated Cost (Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl. O&M)	Multi Benefits
Wright Cut Bank Protection Project	$3,100,242	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Ecosystem Restoration Containing in RD2060 5-Year Plan
Lindsey and Cache Slough Bank Protection Project	$2,066,828	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Ecosystem Restoration Containing in RD2060 5-Year Plan
Cache Slough Bank Protection Project	$2,744,207 (PCET)	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Ecosystem Restoration
Lindsey Slough Bank Protection Project	$850,477 (PCET)	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding sources not identified	Ecosystem Restoration

Figure 5-5. RD 2060 Levees



DWR FSRP, 2013

5.1.3.5 RD 536 – Egbert

RD 536 – Egbert has similar issues to the other communities in the region. Their primary issues however, are related to maintenance activities. The following improvements include repairs to their system at sites identified in the FSRP. Table 5-6 summarizes these improvements and Figure 5-7 shows the levees around RD 536.

Lindsey Slough Seepage Repair Project

There is a critical seepage site in RD 536, identified in the FSRP. This site would be repaired with the construction of a seepage protection project along the Lindsey Slough. The seepage protection project would be 300 feet long from approximately levee mile 3.3 to 3.35. The seepage control project would consist of multiple gradations of rock and fill to control the seepage.

Lindsey Slough Bank Protection Project

There is an erosion site along the Lindsey Slough identified in the FSRP. This erosion site can be improved through the construction of a bank protection project along the Lindsey Slough. The project will rehabilitate the waterside bank from levee mile 4.83 to 5.03, a total rehabilitated length of 460 feet.

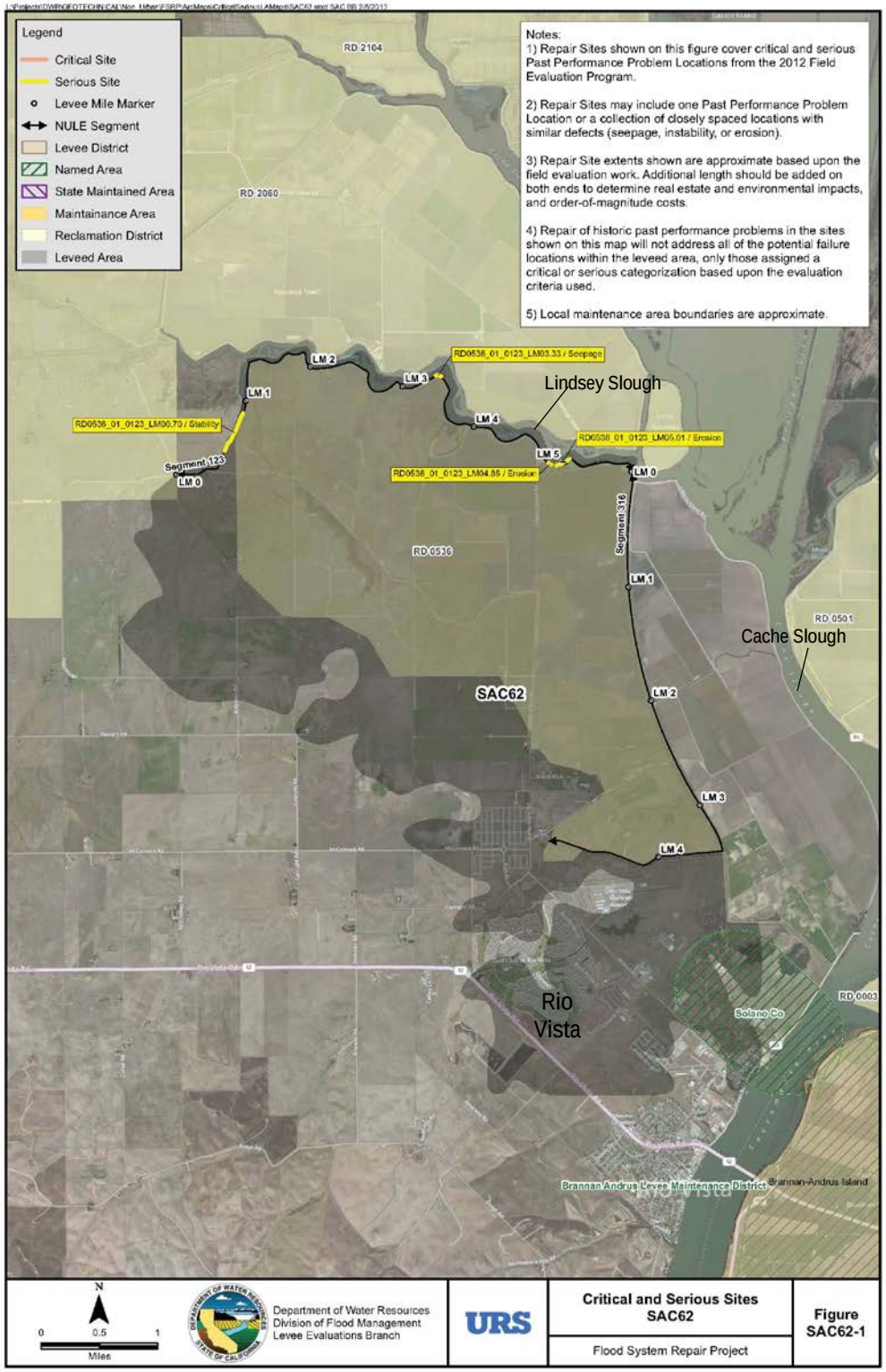
Lindsey Slough Stability Project

There is a stability site in RD 536 identified in the FSRP. This site would be repaired through the construction of a stability protection project along Lindsey Slough. The stability protection project would be 1900 feet from levee mile 0.52 to 0.88.

Table 5-6. RD 536 Improvements

Solution	Estimated Cost (Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl. O&M)	Multi Benefits
Lindsey Slough Seepage Repair Project	$193,756 (PCET)	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Potential link to the RASP
Lindsey Slough Bank Protection Project	$521,626 (PCET)	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Potential link to the RASP
Lindsey Slough Stability Project	$1,102,240 (PCET)	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Potential link to the RASP

Figure 5-6. RD 536 Levees



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5.1.3.6 RD 501 – Ryer Island

As stated in section 4.2, RD 501 has seepage and erosion concerns that need to be addressed. Two improvements are proposed to address the concerns which include a rock slope protection project and a vegetation control project. Information on these improvements was collected from the March 2012 Five Year Plan for Ryer Island. These proposed improvements represent a comprehensive solution to RD 501's flooding problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for RD 501, which are summarized in Table5-7. Figure 5-8 shows the levees around RD 501.

Rock Slope Protection Project

RD 501 plans, first, to ensure the protection of the existing levee by adding supplementary quarry stone riprap above the existing riprap to any portions of the waterside slope of the levee requiring additional rock slope protection. This will prevent erosion and avoid ongoing repairs. Prior to submitting a project proposal, a thorough riprap inventory of the District must be completed to determine where supplementary riprap may be necessary and determine more definitive quantities and costs required to complete the project. Quantities and costs are based on the most recent survey and inspection.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the Rock Slope Protection Project. Assuming the financing is secured, the project will take approximately three years to complete.

Vegetation Control Project

In addition to the Rock Slope Protection Project, RD 501 will perform general vegetation removal from the levee slope and 15 feet from the levee toe including the removal of invasive Arundo Donax, removal and mitigation of elderberry bushes that currently impede visibility, thinning and trimming of existing trees, and removal of tree stumps if deemed necessary, as well as any other various vegetation related issues. The goal of this project is to meet, at minimum, the Central Valley Flood Protection Plan Levee Vegetation Management Strategy criteria.

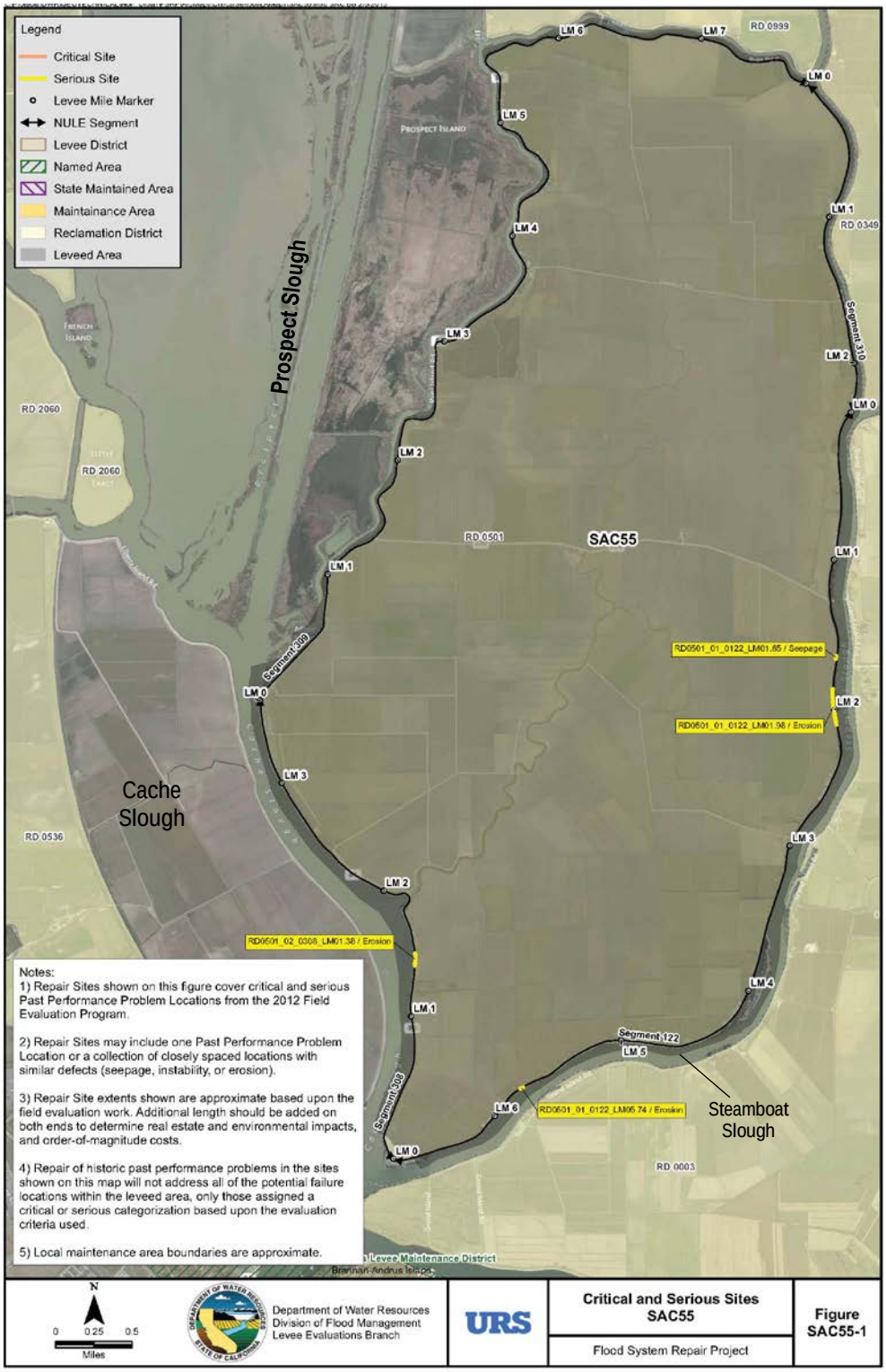
Quantities and costs are based on the most recent survey and inspection. A thorough inspection of the District must be completed, prior to submitting a project proposal, to determine more definitive quantities and costs required to complete the project.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the Vegetation Control Project. Assuming financing is secured, the project will take approximately two years to complete.

Table 5-7. RD 501 Improvements

Solution	Estimated Cost (Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl. O&M)	Multi Benefits
Rock Slope Protection Project	$7,337,240	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding source secured	Potential link to the RASP
Vegetation Control Project	$3,926,973	Plans and Specifications under development	Not complete (Standard or Simple requirements)	Local funding source secured	Potential link to the RASP

Figure 5-7. RD 501 Levees



DWR FSRP, 2013

5.2 Yolo County Improvements

5.2.1 Yolo County Urban Areas

The following sections present flood management improvements for Yolo County urban areas Woodland, Davis, and West Sacramento.

5.2.1.1 City of Woodland

City of Woodland Feasibility Study

The City of Woodland is pursuing a feasibility study to identify and evaluate alternatives for reducing the risk of flooding. Some of the identified alternatives under consideration include the construction of in-place levee improvements or setback levees along Cache Creek, bypass channels and/or integration with a regional solution that would expand the capacity of the Yolo Bypass. Preliminary estimates for these alternatives range from $200 million to $400 million. A USACE feasibility study was initiated in 2010 with the intent of identifying Federal interest in a flood risk reduction project. However, because of limited Federal funding, the City of Woodland is pursuing a strategy to conduct a joint City/State feasibility study that could be the basis of providing in-kind contributions toward the USACE study, if future Federal funds are available. If Federal funding is not available, the City of Woodland would be positioned to pursue a joint City/State flood risk reduction project without Federal participation. The City of Woodland expects to complete a feasibility study in 2015.

Table 5-8. City of Woodland Improvements

Solution	Estimated Cost (Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl. O&M)	Multi Benefits
City of Woodland Feasibility Study Alternatives Analysis	TBD	Feasibility	Not complete (Standard or Simple requirements)	Funding sources not identified	Ecosystem Restoration

5.2.1.2 City of Davis

The primary concern for the City of Davis, related to the SPFC facilities, is to ensure that any improvements recommended by the RFMP do not negatively impact the City. There are a few areas in the City limits that are within the FEMA flood zone, with the area near the wastewater treatment plant (WWTP) and its planned water supply project, as the areas of biggest concern (see Figure 5-9 and Table5-9). Additionally, there is concern about the potential of flooding from Putah Creek.

Wastewater Treatment Plant Flood Protection Measures

The City is in the process of upgrading the WWTP. It may be necessary for the City of Davis to implement flood protection measures at the WWTP to comply with the requirements of its NPDES permit (West Yost, 2013).

To provide the necessary flood protection at the WWTP, a floodwall or levee around the key facilities at the plant would need to be constructed and the Willow Slough Bypass north levee would need to be raised along the area to be protected. There are uncertainties regarding the required limits of the floodwall or levee. One of the uncertainties is related to which facilities must be protected. The current NPDES permit for the WWTP states that the treatment ponds and biosolids storage facilities must be protected from a 100-year storm, but it does not mention any other facilities. Currently, the biosolids storage area and treatment ponds have berms or levees surrounding them that are six to 10 feet above the ground elevations outside of the WWTP. These berms provide adequate protection against flooding that could occur from local runoff during a 100-year storm but could be overtopped if a nearby levee failed along the Yolo Bypass, Willow Slough Bypass, or Cache Creek during a 100-year storm. Because the volume of flood water associated with a levee failure would be very large, any pollutants washed from the WWTP would likely be diluted to concentrations that could be considered less than significant. Therefore, it may be possible to make a case for protecting just the main WWTP area. This will need to be negotiated with the RWQCB and remains an area of uncertainty.

For the area north of the Willow Slough Bypass, the highest potential flood elevation at the WWTP would occur upon failure of a levee along Cache Creek or the Cache Creek Settling Basin levee, which would release water to the south toward the WWTP. The 100-year design flood elevation for this scenario was determined to be 32.8 feet (NAVD88). It is recommended that the flood protection structure for the WWTP provide at least two feet of freeboard, which would require a top elevation of 34.8 feet (NAVD88).

Within the Willow Slough Bypass, it is recommended that the design water surface elevations be the worst case 100-year profile. The water surface elevation along the area to be protected varies from 30.2 to 30.7 feet (NAVD88). It is recommended that the Willow Slough Bypass north levee be raised to provide at least three feet of freeboard, which would require a top of levee elevation ranging from 33.2 to 33.7 feet (NAVD88).

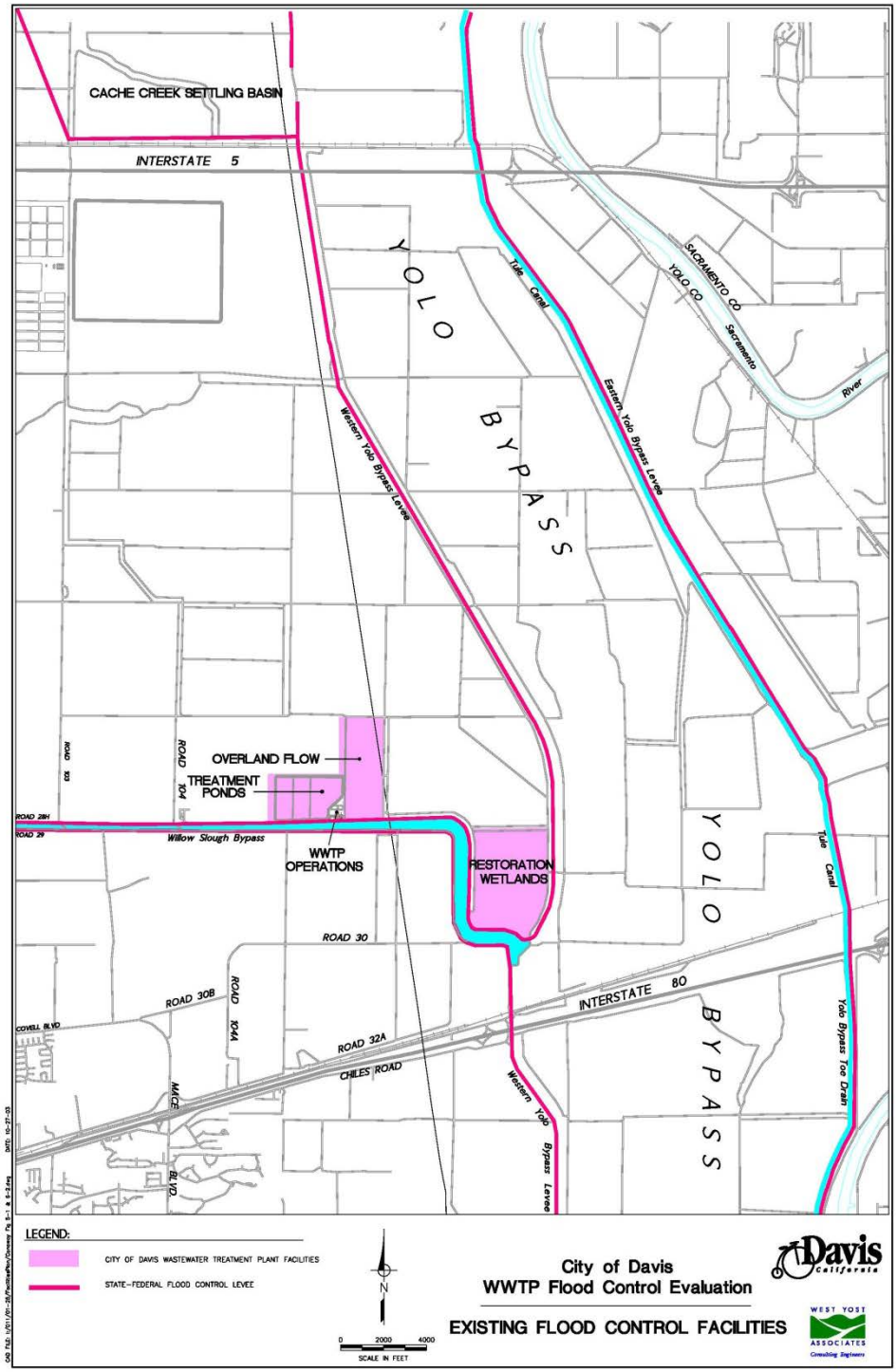
Putah Creek

Experience in 1997 shows that Putah Creek will flood, but the extent of possible flooding is not known. An existing capacity study of Putah Creek is recommended to determine if it meets design flow objectives in its current condition.

Table 5-9. City of Davis Improvements

Solution	Estimated Cost (Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl. O&M)	Multi Benefits
Wastewater Treatment Plant Flood Protection Measures	$9,966,387	Feasibility	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Water Quality Contained in Davis WWTP TM 15 – Prelim. Design Report
Putah Creek Capacity Study	TBD	Pre-Feasibility Study	Not complete (Standard or Simple requirements)	Local Funding sources not identified	Water Supply Ecosystem Restoration

Figure 5-8. City of Davis WWTP



City of Davis, 2013

5.2.1.3 City of West Sacramento

West Sacramento basin is bounded by the Sacramento Bypass on the north, the Sacramento River on the east, the Yolo Bypass and the Sacramento Deep Water Ship Channel on the west and the South Cross levee on the south. The levee system is a part of the SRFCP and includes over 50 miles of levees. Approximately half of the levees are federally recognized navigation levees constructed in conjunction with the Deep Water Ship Channel. See Figure 5-10 and Table 5-10 for projects that reside in the City of West Sacramento.

The Deep Water Ship Channel essentially divides the City, creating two basins – north and south. The north basin is a ring levee bounded by the Sacramento Bypass levee on the north, the Port North levee on the south, the Yolo Bypass levee on the west and the Sacramento River West North levee on the east. The south basin is an 'open' ring levee that is bounded on the north by the Port South levee and on the east by the Sacramento River West South levee. The South Cross levee and the Deep Water Ship Channel West levee provide some flood protection to the basin on the south and west, but the Deep Water Ship Channel provides a hydraulic open pathway for floodwaters to encroach into the south basin via backwatering during high stage events in the Yolo Bypass. The South Cross Levee is a "dry levee" that protects the City from flooding due to a levee failure south of the city limits.

The following "plan" presents the findings of an Alternatives Analysis performed in 2009 for upgrading the West Sacramento levee system to a level that provides protection from a 200-yr flood event. The plan includes mitigation of all levee system deficiencies, identified in the entire West Sacramento basin, both north and south. The total construction cost for implementing the plan is estimated at approximately $565 million. Following is a narrative description of the plan components by reach, with special features specific to each reach noted.

The levee improvements discussed in this section are being considered by USACE in a feasibility study which could lead to Federal funding for further construction. In advance of Federal authorization, the City of West Sacramento has constructed improvements independently (described below) and may receive credit of their share of a larger Federal project, once the feasibility study is completed and authorized. To continue to provide flood risk reduction to the community, West Sacramento is considering continued advancement of improvements until such time as a Federal project is authorized. The City is also pursuing a Section 221 agreement with the USACE in conjunction with the release of the draft GRR in 2014.

The Deep Water Ship Channel Closure Structure and Weir is discussed in Section 5.6.2 of this report.

North Basin

Sacramento River West North Levee: (partially completed with I Street and Rivers EIPs completed in 2008 and 2011, respectively) requires the remainder of the levee to be upgraded with a combination of cutoff walls (conventional and deep soil mixed) and raised levees, with

waterside slope flattening throughout and also calls for jet-grouting beneath the I Street Bridge and a closure structure for the Union Pacific Rail Road portion of the bridge.

Yolo Bypass Levee: improve with a stability berm throughout, and a cutoff wall over a 2-mile stretch. This plan assumes, based on levee performance during 1997 and 1998 high water events, that the USACE's Contract B improvements at the north end of the levee are effective and require minimal future upgrades. Ongoing maintenance for this levee section will be required.

Port North Levee: improve with a floodwall approximately oriented at an offset, internally, to the property line of the Port. That alignment would maintain a minimum 25-ft offset from local railways and would require two closure structures at the east end of the property.

South Basin

Port South Levee: improve with a combination of waterside slope flattening, a section of flood wall, and a section of cutoff wall.

Sacramento River West South Levee: upgrades include a combination of approximately 3.6 miles setback levees (creating two "offset areas"), adjacent levee, slope flattening, cutoff walls and landside seepage berms. The offset areas create floodplain and habitat restoration features.

South Cross Levee: improve with a combination of slope flattening, a short cutoff wall, and an adjacent levee raise with an interior drainage system.

Deep Water Ship Channel East Levee: improve at each existing pump station location with slope flattening, installation of a cutoff wall, and stabilization with revetment.

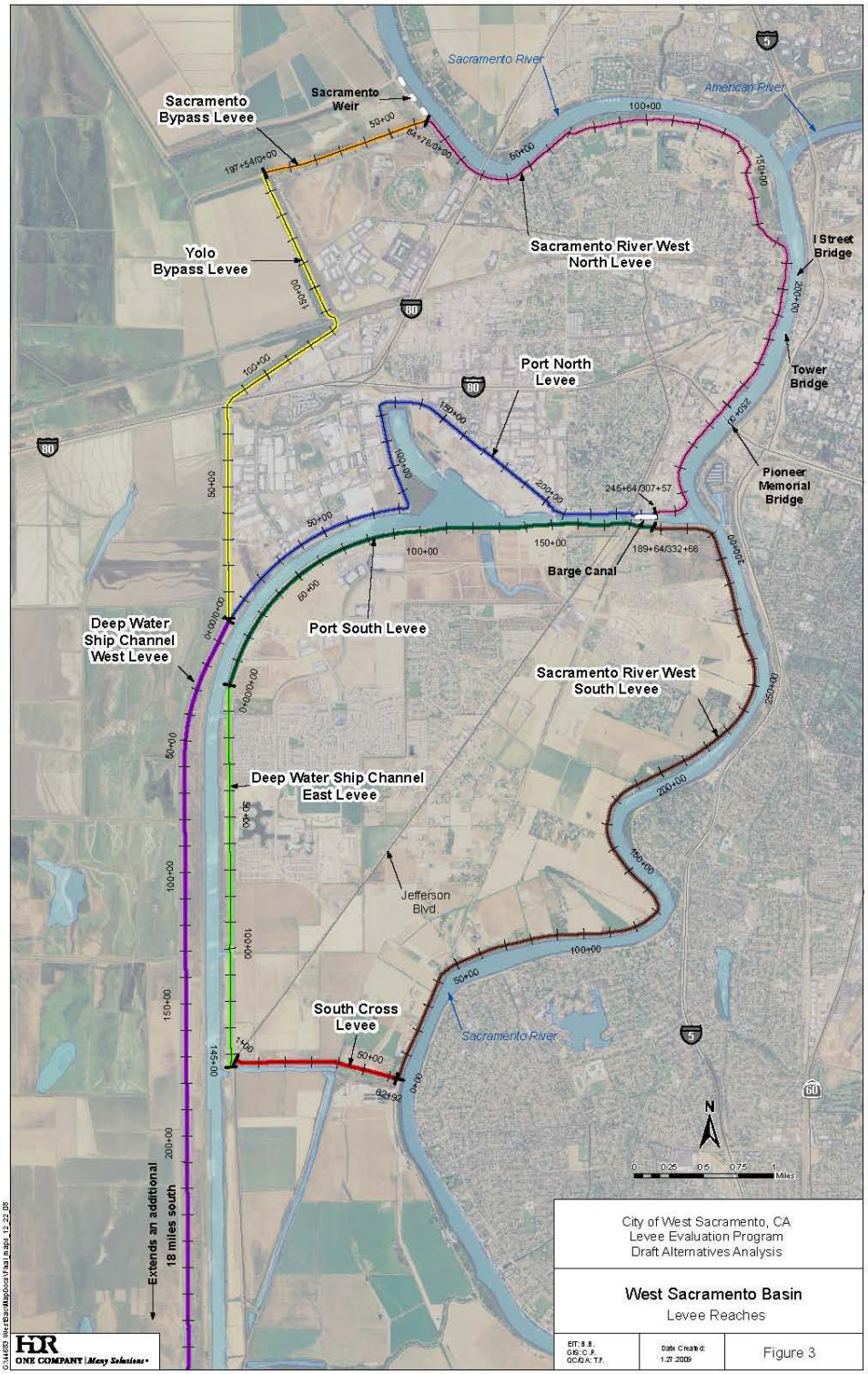
Deep Water Ship Channel West Levee: improve with slope flattening, a levee raise and over 11 miles of revetment. Mitigation of freeboard deficiency along this reach was based on establishing a crest elevation 5 ft above the 200-yr water surface elevation (5 feet of freeboard, rather than 3 feet), consistent with the original levee design.

Table 5-10. City of West Sacramento Improvements

Solution	Estimated Cost (Incl. O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sacramento River West North Levee Balance of Reaches	$77,702,000	Feasibility	Not complete (complex requirements)	Local funding source secured	Potential link to the RASP
Yolo Bypass Levee	$51,531,000	Feasibility	Not complete (complex requirements)	Local funding source secured	Potential link to the RASP
Port North Levee	$37,650,000	Feasibility	Not complete (complex requirements)	Local funding source secured	Potential link to the RASP
Port South Levee	$9,049,000	Feasibility	Not complete (complex requirements)	Local funding source secured	Potential link to the RASP
Sacramento River West South Levee (Southport EIP)	$190,000,000	Plans and Specifications under development	Not complete (complex requirements) 408 permitting in progress	Local and State funding secured	Ecosystem Restoration
South Cross Levee	$11,684,000	Feasibility	Not complete (complex requirements)	Local funding source secured	Potential link to the RASP
Deep Water Ship Channel East Levee	$6,141,000	Feasibility	Not complete (complex requirements)	Local funding source secured	Potential link to the RASP
Deep Water Ship Channel West Levee	$144,814,000	Feasibility	Not complete (complex requirements)	Local funding source secured	Potential link to the RASP

Notes: Costs Values provided by WSAFCA

Figure 5-9. WSAFCA Map



Southport, WSAFCA EIP AA, 2009

5.2.2 Yolo County Small Communities

Agricultural sustainability in levee protected flood basins is dependent, in many ways, on the vitality of the small communities that occupy the basins. Current trends in the administration of the NFIP, as reflected in the Biggert Waters Flood Insurance Reform Act of 2012, present a serious threat to many of these small communities in the form of unaffordable insurance rates and restrictions on community development activities. One way to manage these threats is to devise strategies for meeting the minimum 100-year flood protection standards of the NFIP either on a structure-by-structure basis through flood proofing or on a community-wide basis by constructing affordable flood protection projects. From a cursory look, it appears that the latter option could be feasible for two small communities (though this still needs to be verified): Knights Landing, which is located on the Sacramento River west of the Fremont Weir, and the town of Yolo which is located along the north bank of Cache Creek northwest of Woodland.

5.2.2.1 Knights Landing

The small community of Knights Landing (Figure 5-11) is in the Knights Landing Drainage District and Yolo County's Community Service Area 6. The community is located at the confluence of the Knights Landing Ridge Cut (Ridge Cut), the Colusa Drain, and the Sacramento River channel. The community is surrounded on three sides by levees and/or high ground. The levees appear to be high enough to meet NFIP standards (though this still needs to be verified) but may have embankment and foundation stability problems. Because the RFMP analysis is pre-feasibility, a definite solution for Knights Landing has not been determined. Therefore, the recommended solution for the area would be a feasibility study, (Table 5-11), to determine the most appropriate solution. The feasibility study could consider these alternatives:

Table 5-11. Knights Landing Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Knights Landing Feasibility Study	TBD	Pre-Feasibility	Not complete (complex requirements)	Local Funding sources not identified	Potential link to the RASP
Knights Landing Ridge Cut Repair	$7,242,000	Bid ready	Complete	Local Funding Sources not Identified	Potential link to the RASP
Sacramento River Levee (sites 9, 10, and 11)	TBD	Bid ready	Not complete (simple requirements)	Local Funding sources not identified	Potential link to the RASP
SWIF	TBD	N/A	N/A	Local Funding sources not identified	

Structure Raises

In Knights Landing there are an estimated 328 structures: 32 commercial, 5 industrial, 9 public, and 282 residential. It would cost $32,800,000 to raise the structures by one story at $100,000[2] per structure.

Ring Levee

A ring levee system was investigated in the 2012 CVFPP. The alternative includes a ring levee and construction of in-place repairs to portions of Segments 217 and 162. A new levee would be constructed on the south between existing Segments 217 and 162. The new levee would have a 12-foot crown with an average height of 18 feet spanning about 1.04 miles. The conceptual alignment of the ring levee is shown on Figure 5-11.

Fix-in-place of Perimeter Levees

The perimeter levees; Levee Segments 217, 172, and 162; around Knights Landing would be remediated by either repairing critical or serious sites on those levees identified in the FSRP or remediating the entire levee segments as calculated in NULE.

A fix-in-place of deficiencies, of the entire length of the perimeter levees, was calculated through NULE. Costs for those repairs are shown in Table 5-12.

Table 5-12. Costs of Remediation of Perimeter Levee around Knights Landing from NULE

Segment	Length (Feet)	Length (miles)	Total fix-in-place cost (2014 Dollars)
217	34,870	6.60	$79,078,120
172	13,800	2.61	$36,782,000
162	30,530	5.78	$68,878,800
Total	79,200	15.00	$184,738,920

Zone D

As stated previously, the Zone D designation would involve working with FEMA to designate the town as Zone D rather than Zone AE. The Zone D designation is used where there are possible but undetermined flood hazards, but no definitive analysis of flood hazards has been conducted.

Sacramento River Levee (sites 9, 10, and 11)

Work on the Sacramento River levee would be conducted at sites 9, 10, and 11, between river miles 70 and 113 southeast of Knights Landing. These sites are located on the gravel maintenance road on top of the levee between the river and Yolo County Road 116B.

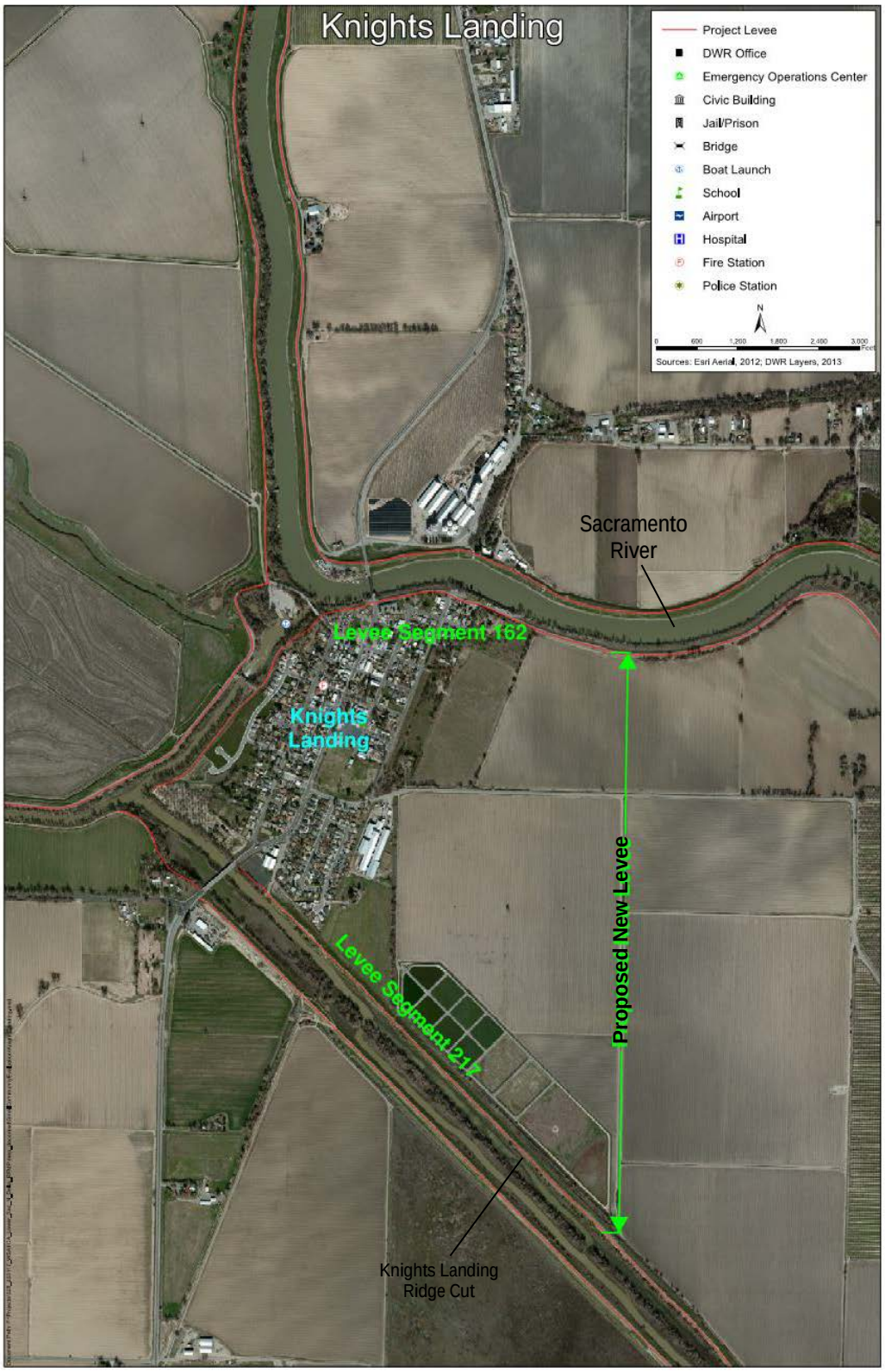
[2] $100,000 to raise a structure is from the 2012 CVFPP – Attachment 8J.

- Site 9 starts approximately 1 mile east of Knights Landing at river mile (RM) 87.2 and extends 793 feet downstream to RM 87.1.
- Site 10 starts approximately 1,584 feet downstream of site 9 at RM 86.8 and extends 878 feet downstream to RM 86.7.
- Site 11 starts approximately 1.5 miles downstream of site 10 at RM 85.2 and extends 1.05 miles (5,555 feet) downstream to RM 84.1 along County Road 116B, just down river from sites 9 and 10.

Remediation work at sites 9, 10, and 11 would consist of installing a soil/bentonite cutoff wall, of various lengths and depths, to reduce seepage. The work would involve (1) degrading the existing top of the levee down 4 to 5 feet to create a level working surface to install the cutoff wall and (2) excavating a trench 3 feet wide and at least 21 feet deep down through the crown of the levee, as follows:

- Site 9 cutoff wall depth would vary from 26.27 feet to 31.08 feet deep.
- Site 10 cutoff wall depth would vary from 23.04 feet to 26.38 feet deep.
- Site 11 cutoff wall depth would vary from 21.00 feet to 116.75 feet deep, as follows:
  - 900 feet (Stations 0+00 to 9+00) would be 21.00 feet to 27.04 feet deep.
  - 700 feet (Stations 9+00 to 16+00) would be 24.95 feet to 26.15 feet deep.
  - 800 feet (Stations 16+00 to 24+00) would be 23.52 to 25.3 feet deep.
  - 3155 feet (Stations 24+00 to 55+57) would be 113.48 feet to 116.75 feet deep.

Figure 5-10. Knights Landing



5.2.2.2 Yolo

The small community of Yolo (Figure5-12) is along the north bank of Cache Creek. The north levee of Cache Creek protects the town from flooding. Because the RFMP analysis is pre-feasibility, a definite solution for Yolo has not been determined. Therefore, the recommended course of action is a feasibility study, shown in Table 5-5-14, to determine the most appropriate solution. The feasibility study could consider these alternatives:

Structure Raises

In Yolo, there are an estimated 186 structures: 2 industrial, 12 public and 172 residential. It would cost $18,600,000 to raise the structures by one story at $100,000[3] per structure.

Fix-in-place of Perimeter Levees

The perimeter levee; Levee Segments 41; around Yolo would be remediated by either repairing critical or serious sites on the levee, identified in the FSRP, or remediating the entire levee segment as calculated in NULE.A fix-in-place of deficiencies of the entire length of the perimeter levees was calculated through NULE. Costs for those repairs are shown in Table 5-13.

Table 5-13. Costs of Remediation of Perimeter Levee around Hood from NULE

Segment	Length (Feet)	Length (miles)	Total fix-in-place cost (2014 Dollars)
41	61,700	11.69	$45,388,654
Total	61,700	11.69	$45,388,654

Zone D

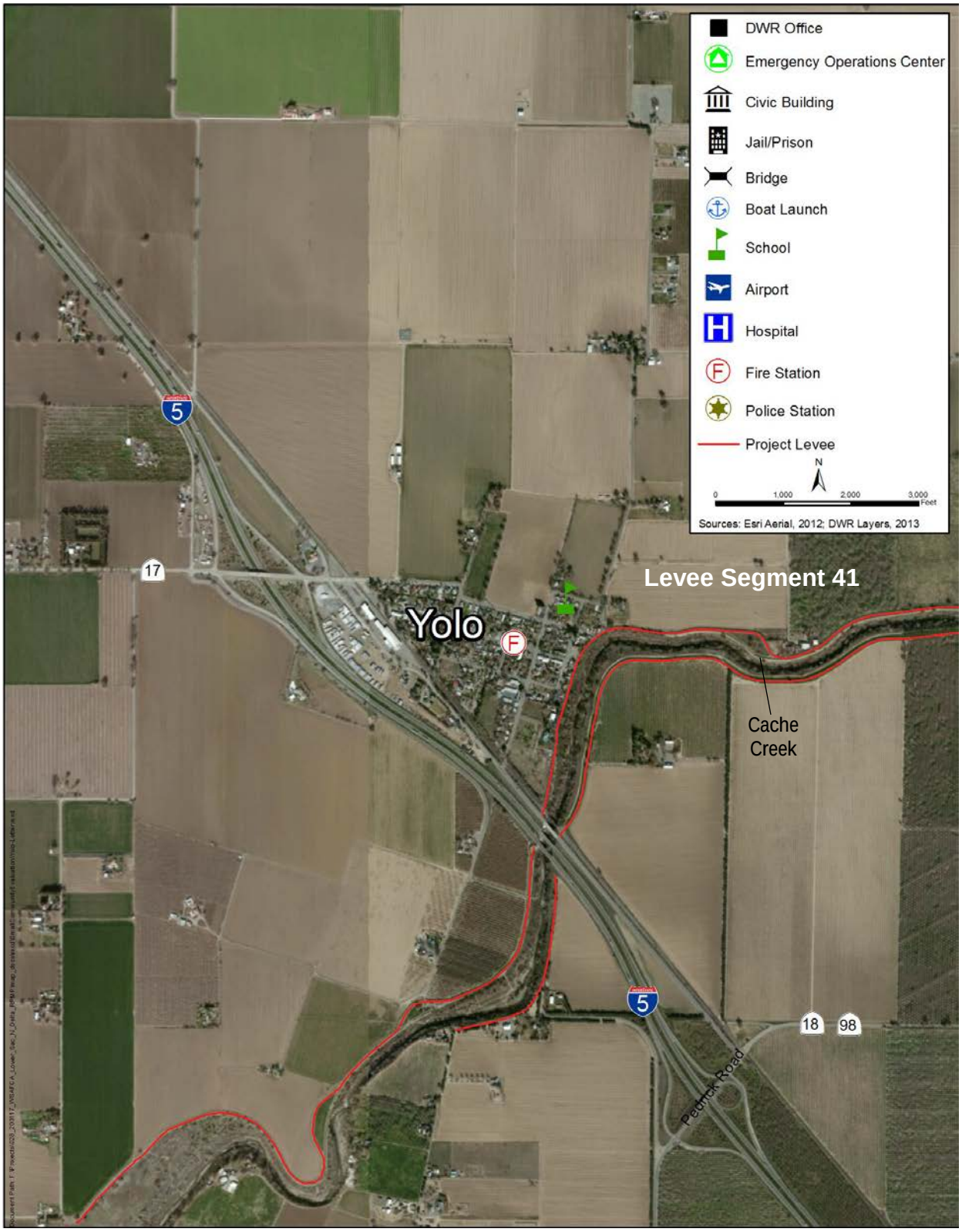
As stated previously, the Zone D designation would involve working with FEMA to designate the Clarksburg as Zone D rather than Zone AE. The Zone D designation is used where there are possible but undetermined flood hazards but no definitive analysis of flood hazards has been conducted.

Table 5-14. Yolo Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Yolo Feasibility Study	TBD	Pre-Feasibility	Not complete (complex requirements)	Funding sources not identified	Potential link to the RASP

[3] $100,000 to raise a structure is from the 2012 CVFPP – Attachment 8J.

Figure 5-11. Yolo Levees



5.2.2.3 Clarksburg

The small community of Clarksburg is unique, as about one third of the population lives in the "town" (RD 999) and the other two thirds live in the surrounding rural areas. Therefore, the unofficial Clarksburg District is considered a larger area encompassing RDs 765, 307, 999, and 150. Because the RFMP analysis is pre-feasibility, a definite solution for Clarksburg has not been determined. Therefore, the recommended solution for Clarksburg would be a feasibility study, shown in Table 5-16, to determine the most appropriate solution. The feasibility study could consider these alternatives:

Structure Raises

In Clarksburg, in RD 999, there are an estimated 271 structures: 24 commercial, 10 industrial, five public, and 232 residential. It would cost $10,400,000 to raise the structures by one story at $100,000[4] per structure.

Ring Levee

A ring levee system was investigated in the 2012 CVFPP. The alternative includes a ring-levee around the main population center of Clarksburg (RD 999) and construction of in-place repairs to portions of Levee Segments 303 and 244, as well as construction of new levees on the north and west. The new levees would have a 12-foot crown with an average height of 8 feet, spanning about 1.6 miles in total. The estimated cost of the ring levee option would be $34,705,578 (escalated to 2014 dollars). The conceptual alignment of the Clarksburg ring levee is shown in Figure5-13. This project could provide 100 yr. level of protection to the approximately 500 people living in "town", though the remaining Clarksburg population of about 1,000 would still be in the floodplain.

Fix-in-place of Perimeter Levees

The perimeter levees; Levee Segments 132, 118, 303, 244, 305, 304, and 142; around Clarksburg would be remediated by either repairing critical or serious sites on those levees identified in the FSRP or remediating the entire levee segments as calculated in NULE.

Repairs to critical or serious sites on the perimeter levees are described in Section 5.2.2.3 for RDs 765, 307, 999, and 150.

A fix-in-place of deficiencies of the entire length of the perimeter levees was calculated through NULE. Costs for those repairs are shown in Table 5-15.

[4] $100,000 to raise a structure is from the 2012 CVFPP – Attachment 8J.

Table 5-15. Costs of Remediation of Perimeter Levee around Hood from NULE

Segment	Length (Feet)	Length (miles)	Total fix-in-place cost (2014 Dollars)
132	18,370	3.48	$13,932,640.00
118	34,590	6.55	$168,748,820.00
303	6,510	1.23	$19,281,400.00
244	49,960	9.46	$101,077,360.00
305	19,770	3.74	$52,798,600.00
304	12,060	2.28	$35,151,720.00
142	244,410	46.29	$137,962,180.00
Total	385,670	73.04	$528,952,720.00

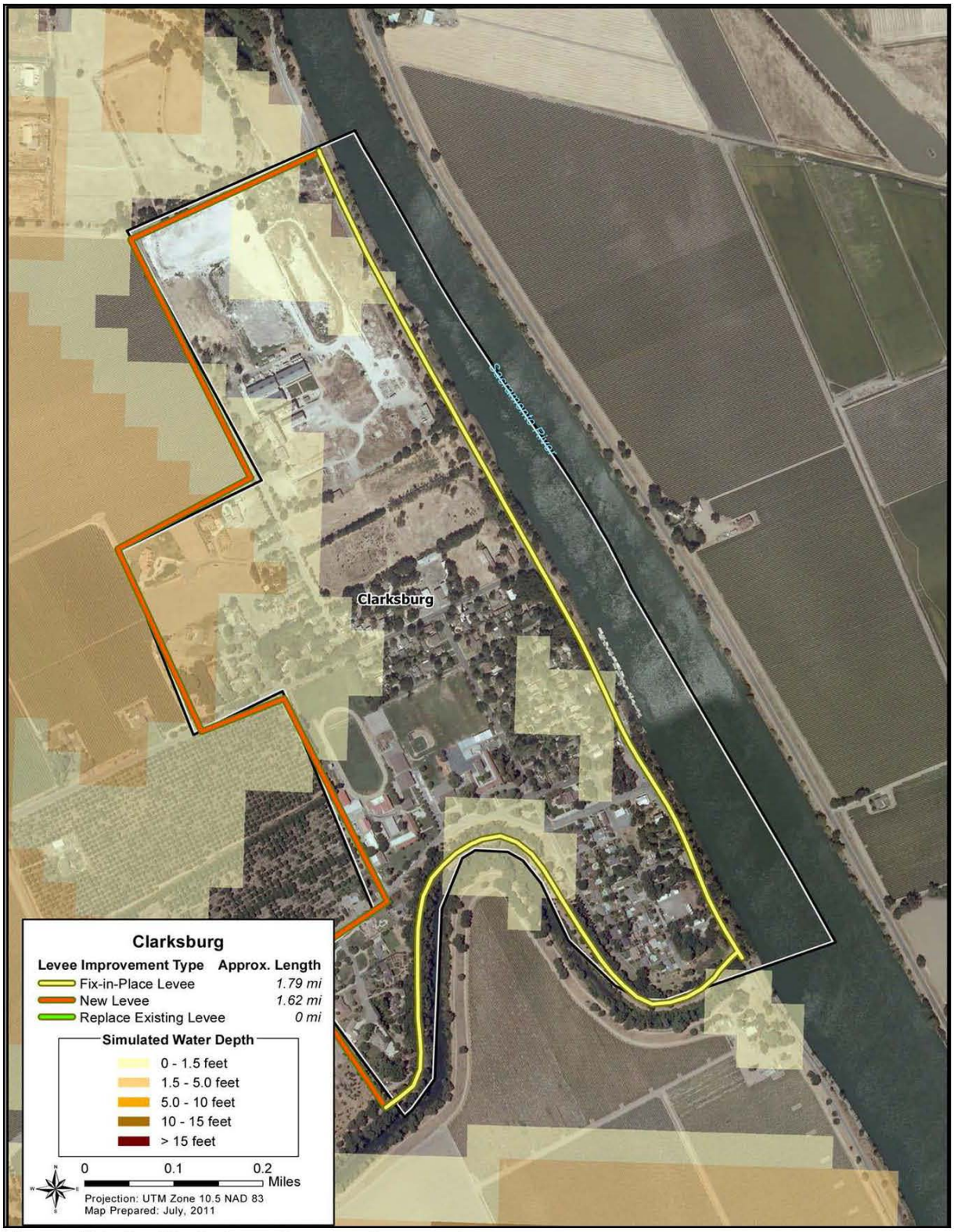
Zone Designation

As stated previously, the Zone D designation would involve working with FEMA to designate the Clarksburg as Zone D rather than Zone AE. The Zone D designation is used where there are possible but undetermined flood hazards, but no definitive analysis of flood hazards has been conducted.

Table 5-16. Clarksburg Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Clarksburg Improvements Feasibility Study	TBD	Pre-Feasibility	Not complete (complex requirements)	Funding sources not identified	Potential link to the RASP

Figure 5-12. Ring Levee for Clarksburg



DWR CVFPP, 2013

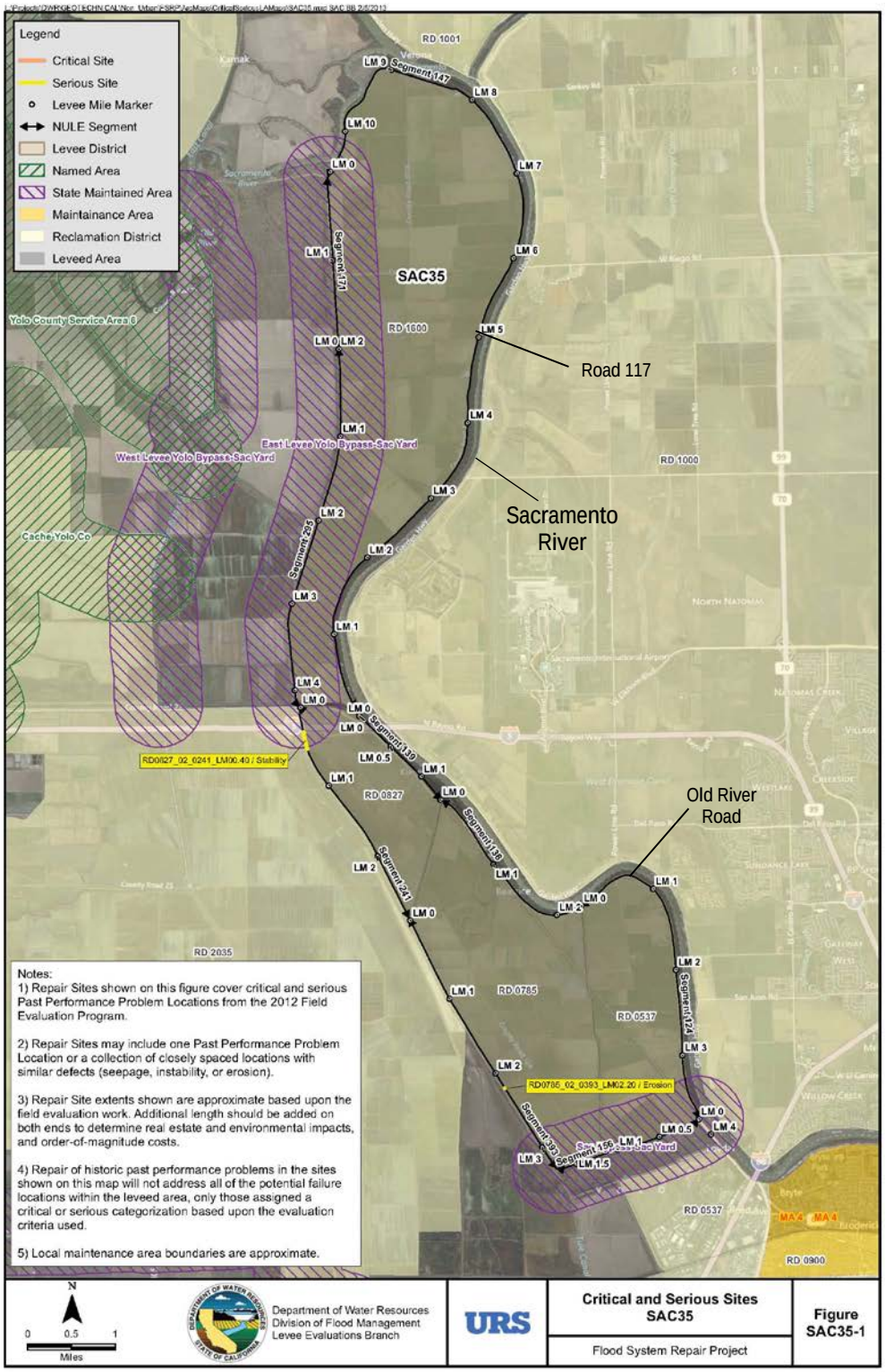
5.2.3 Yolo County Rural Areas

The following sections present regional improvements for LMAs in the rural areas of Yolo County. The sections are generally organized from north to south: Elkhorn (RD 1600, RD 827, RD 785, and RD 537), RD 2035, and DWR Maintenance Areas.

5.2.3.1 Elkhorn

As described in Section 4 (Problem Definition), the Elkhorn Basin includes 4 RDs, from North to South: RD 1600, RD 827, RD 785, and RD 537. This section describes the basin's flood management improvements. Figure 5-14 shows the levees around the Elkhorn area.

Figure 5-13. Elkhorn Levees



DWR FSRP, 2013

RD 1600 – Mull District

Improvements for RD 1600 are presented in the following sections and summarized in Table 5-17.

Sacramento River Scour Hole Repair

Approximately 8 miles north of Road 117 and Old River, there are three large, deep scour holes 8 feet off the waterside levee toe. These holes would need to be repaired to increase the levee stability.

Yolo Bypass Levee Crown Repair

On the Yolo Bypass levee starting 2 miles south of the Fremont Weir and running for 2.3 miles (12,144 feet), the levee crown road needs an additional 5-6 inches of base and gravel added to ensure the ability to safely drive the road during patrols in wet weather and high water events. Also, on the landward side, the levee needs improved stability and additional soil to have a 3 to 1 slope.

Yolo Bypass Bank Protection

The Yolo Bypass levee (Levee Segment 295), approximately 3 miles south of the Freemont Weir, needs repair of erosion. The levee requires gravel to improve access and repair to a 3 to 1 slope. The total rehabilitated length is approximately 6,800 feet.

Vegetation Mitigation Management

DWR has three mitigation sites along the Sacramento River, on the waterside of the levees. These sites require vegetation maintenance and gravel for the access road.

Table 5-17. RD 1600 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sacramento River Scour Hole Repair	TBD	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Yolo Bypass Levee Crown Repair	$3,502,834 (PCET)	Plans and Specifications under development	Not complete (complex requirements)	Local Funding sources not identified	Potential link to the RASP
Yolo Bypass Bank Protection	$7,679,243 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Vegetation Mitigation Management	TBD	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

RD 827 – Elkhorn District

The RD827 levee system is part of the SRFCP and is a subset of the Sac-Yolo North levee system which consists of nine levee segments, two of which RD 827 is responsible for maintaining. These segments are:

- Elkhorn Unit 1, Sacramento River (ELK1) – Right bank for the Sacramento River from a half mile southeast of Keisel to the intersection of old River Road and Interstate 5.

- Elkhorn Unit 2, Yolo Bypass (ELK2) – Left bank of the Yolo Bypass from County Road 22 southeasterly along the Yolo Bypass for 2.79 miles.

RD 827 is a rural district and is facing significant challenges as it tries to meet new standards and expectations for levee operations and maintenance. The December 2013 Period Inspection Report, prepared by the USACE for the Sac-Yolo North levee system, identified a number of deficiencies with the RD 827 system which the USACE believes have the potential to impact system performance during the next flood event. However RD 827 lacks the resources to address these issues in a comprehensive manner. The levees maintained by RD 827 provide systemwide, regional benefits and are integral to region's flood safety. Therefore, the following projects are proposed for inclusion in the FloodProtect Regional Flood Management Plan.

New East-West Cross Levee

The on-and off ramps to Interstate 5, at the northern end of the District, provide a critical route for basin ingress and egress. This access also provides a potential emergency evacuation route for West Sacramento. A levee failure upstream for RD 827 has the potential to inundate the Interstate 5 on-and off ramps. Constructing a new east-west cross levee north of Old River Road to redirect inundation flows back into the Yolo Bypass, would improve public safety for the region.

Yolo Bypass Freeboard Restoration

The existing bypass levee does not, currently, have the recommended six foot of freeboard above the 1957 Design Water Surface Profile prescribed in the USACE O&M manual. With this project the levee crown elevation should be restored to the authorized elevation.

Consolidation for Maintaining Agencies

The Sac-Yolo North levee system is currently maintained and operated by four separate agencies. Consolidation of LMAs could result in greater efficiencies and consistency in how the system is maintained and operated.

Yolo Bypass Stability Berm

A site along the Yolo Bypass requires a stability berm, as identified by the FSRP. The location is between levee mile 0.3 and 0.5, with a length of 110 feet. This site is considered to have serious stability problems.

Vegetation Control Program

The December 2013 USACE Period Inspection identified the current level of vegetation as being "unacceptable" for ELK 1 and ELK 2. RD 827 would like to develop a project to remove vegetation from the levee slope and 15 feet from the levee toe. This would also include the removal of invasive species, which currently impede visibility, thinning and trimming of existing trees; and removal of tree stumps if deemed necessary. The goal of this work would be to meet, at a minimum, the Central Valley Flood Protection Plan Levee Vegetation Management Strategy criteria.

Systemwide Beneficiaries O&M Subvention Program

The levees maintained by RD 827 provide systemwide, regional benefits, and are integral to the overall region's flood safety. RD 827 would like to evaluate the potential development of an O&M subventions-type program to augment the District's funding of O&M for systemwide facilities.

Sac-Yolo North Systemwide Improvements Framework Plan

RD 827 levees are currently inactive in the RIP and are ineligible for PL84-99 post flood assistance. RD 827 would like to work with its neighboring LMAs to prepare a Sac-Yolo North Systemwide Improvement Framework (SWIF) Plan so the system could regain PL84-99 eligibility. However, the LMAs currently lack the resources to develop a SWIF and would require grant funding assistance to do so.

Yolo Bypass Levee Relocation

Relocation of the Yolo Bypass levee is currently being evaluated as part of Sacramento Weir and Bypass Project, described in Section 5.6.1 of the FloodProtect plan. RD 827 is supportive of the relocation evaluation and looks forward to further discussions regarding this potential project.

Additional improvements for RD 827 are presented in the following sections and summarized in Table 5-18. Improvements for RD 827 and 785 are summarized in the same table because of the close coordination between the two RDs.

Yolo Bypass Stability Berm

A site along the Yolo Bypass requires a stability berm, as identified by the FSRP. The location is between levee mile 0.3 and 0.5, with a length of 110 feet. This site is considered to have serious stability problems.

Yolo Bypass Levee Flattening

The Yolo Bypass Levee Flattening is a project being planned in coordination with RD 785. Details to be provided by RD 827.

RD 785 –Driver District

Improvements for RD 785 are presented in the following sections and summarized in Table 5-18.

Yolo Bypass Levee Improvements

Approximately 2 miles of the Yolo Bypass levee needs repairs including riprap and rock placed on the crown to allow for winter patrol access and emergency access.

Yolo Bypass Bank Protection Project

There is a serious erosion site along the Yolo Bypass and identified in the FSRP. This erosion site can be improved through the construction of a bank protection project along the bypass. The project will rehabilitate the waterside bank at levee mile 2.2, a total rehabilitated length of 200 feet.

Table 5-18. RD 827 and RD 785 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
RD 827 - Yolo Bypass Stability Berm	$63,814 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential Link to the RASP
RD 785- Yolo Bypass Levee Improvements	$3,045,943 (PCET)	Plans and Specifications under development	Not complete (complex requirements)	Local Funding sources not identified	Potential link to the RASP
RD 785- Yolo Bypass Bank Protection Project	$226,794 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Yolo Bypass Levee Flattening Project	TBD	Bid ready	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

RD 537 – Lovdal District

The improvement for RD 537 is presented in the following section and summarized in Table 5-19.

Monument Bend Maintenance

The RD 537 must work with DWR and Yolo County to determine responsibility of maintaining the levee at Monument Bend along the Sacramento River on Old River Road. RD 537 has created and is maintaining an oxbow levee. The RD does not maintain the levee along Old River Road and Monument Bend and currently there is a need for the toe to be rebuilt on the river side.

Table 5-19. RD 537 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Monument Bend Maintenance	TBD	Feasibility	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

5.2.3.2 RD 2035 – Conaway Tract

RD 2035 has similar issues to the other communities in the region. Its primary issues however, are related to maintenance activities like vegetation and rodent control, seepage control, bank protection/erosion control, access road maintenance, and encroachment repairs and modifications. The following improvement is to correct a serious site identified in the FSRP. The improvement is summarized in Table 5-20. No map is available for this area; however, RD 2035 is shown in Figure 5-14 in Section 5.2.3 above.

Willow Slough Bypass Stability Project

There is a site with a serious stability issue in RD 2035 from the FSRP with a total length of 100 feet. This problem will be corrected with the construction of stability protection project along the Willow Slough Bypass.

Table 5-20. RD 2035 Improvements

Solution	Cost	Design Readiness	Permitting Readiness	Funding Readiness	Multi Benefits
Willow Slough Bypass Stability Project	$58,013 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

5.2.3.3 DWR Sacramento Maintenance Yard

There are several areas in Yolo County that are maintained by the DWR Sacramento Maintenance Yard. These include: Cache Creek (ST0001), East Levee Yolo Bypass (ST0004), Putah Creek (ST0007), Sacramento Bypass (ST0008), West Levee Yolo Bypass (ST0011), Willow Slough Bypass (ST0012), and Maintenance Area 4 (West Sacramento). These areas are facing many of the same flood management problems as other LMAs in Yolo County. In particular, from the FSRP, there are critical erosion sites along Cache Creek that need to be repaired. The following section describes proposed improvements for the DWR Maintenance Yard, which are summarized in Table 5-21. Figure 5-15 is a map of the location of the Cache Creek Maintenance Yard, which also encompasses the small community of Yolo.

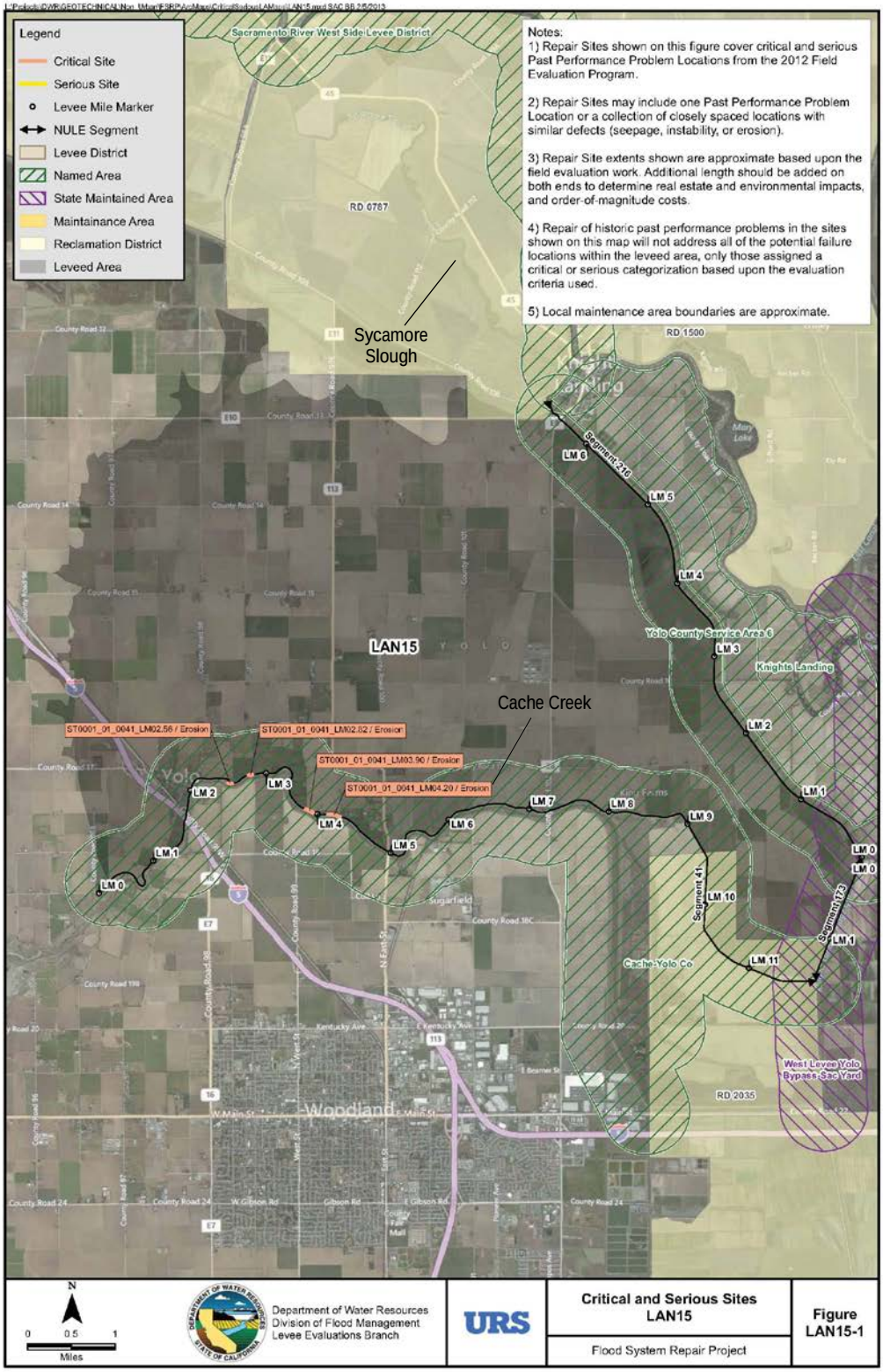
Cache Creek Erosion/Bank Protection Project

This project includes the rehabilitation of four critical erosion sites on Cache Creek. There is approximately 1,600 lineal feet of eroding levee along Cache Creek at levee miles 2.54 to 2.58, 2.8 to 2.84, 3.86 to 3.95, and 4.13 to 4.27.

Table 5-21. Sacramento Maintenance Yard – Cache Creek Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Cache Creek Erosion/Bank Protection Project	$1,814,351	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

Figure 5-14. Sacramento Maintenance Yard – Cache Creek Levees



DWR FSRP, 2013

5.2.3.4 Clarksburg Rural Improvements

Another option for Clarksburg are repairs to the perimeter levees around its rural areas (RD 307, and 150). Repairs to the rural RD levees and the construction of the South Cross Levee could provide the necessary flood management improvements to the larger Clarksburg District, thus protecting the entire population of approximately 1,500. The following sections describe repairs to the perimeter levees in the Clarksburg area.

It appears there could be great merit in pursuing relief for this area by modifying the status of the area within the NFIP's administrative structure. Toward this end, it might be possible for Clarksburg and the surrounding area to qualify for the FEMA Zone D designation rather than Zone AE. Zone D designation is used where there are possible, but undetermined, flood hazards but no definitive analysis of flood hazards has been conducted. Areas that are designated Zone D are often undeveloped and sparsely populated. There are no federal restrictions on building new structures in Zone D and flood insurance is not required, although it can be purchased through the NFIP at historically high rates that reflect the uncertainty of the flood hazard.

In this instance, the levees protecting Clarksburg and its surrounding area have generally performed reasonably well, having withstood the flood of record in 1986 and another large flood in 1997, and have not experienced a levee failure in the past 100 years. Although the State has recently collected some geotechnical data on these systems, no definitive analysis of flood hazards has been conducted. The affected levee systems are thought to meet NFIP freeboard requirements but may not meet the more rigorous levee embankment and foundation stability standards that have recently been applied in urban levee evaluations. This uncertainty supports the Zone D designation.

The argument for using Zone D in this and other rural areas in the Sacramento Valley with suitable levee systems would be as follows: Use of this designation in combination with appropriately priced insurance rates and local controls on new development would promote rural economic sustainability without subjecting the federal government or the nation's taxpayers to undue liability. Indeed, the affected areas would remain sparsely populated, but highly productive agriculturally, and would continue to function as buffer lands capable of absorbing the brunt of the most extreme floods in the Sacramento Valley without the kind of catastrophic damages that are associated with flooding in urban areas.

Given the State's overarching responsibility for managing the rural levee systems that might be eligible for the Zone D designation, it would make sense for the State, perhaps through its Central Valley Flood Protection Board, to play a formal role in the Zone D designation process. The State is a recognized NFIP community. In this instance, the State would seek recognition from FEMA of the rural areas within the State Plan of Flood Control that could qualify for Zone D designation. These areas would need to meet the following criteria:

- The levee system protecting the area meets FEMA 100-year freeboard requirements;

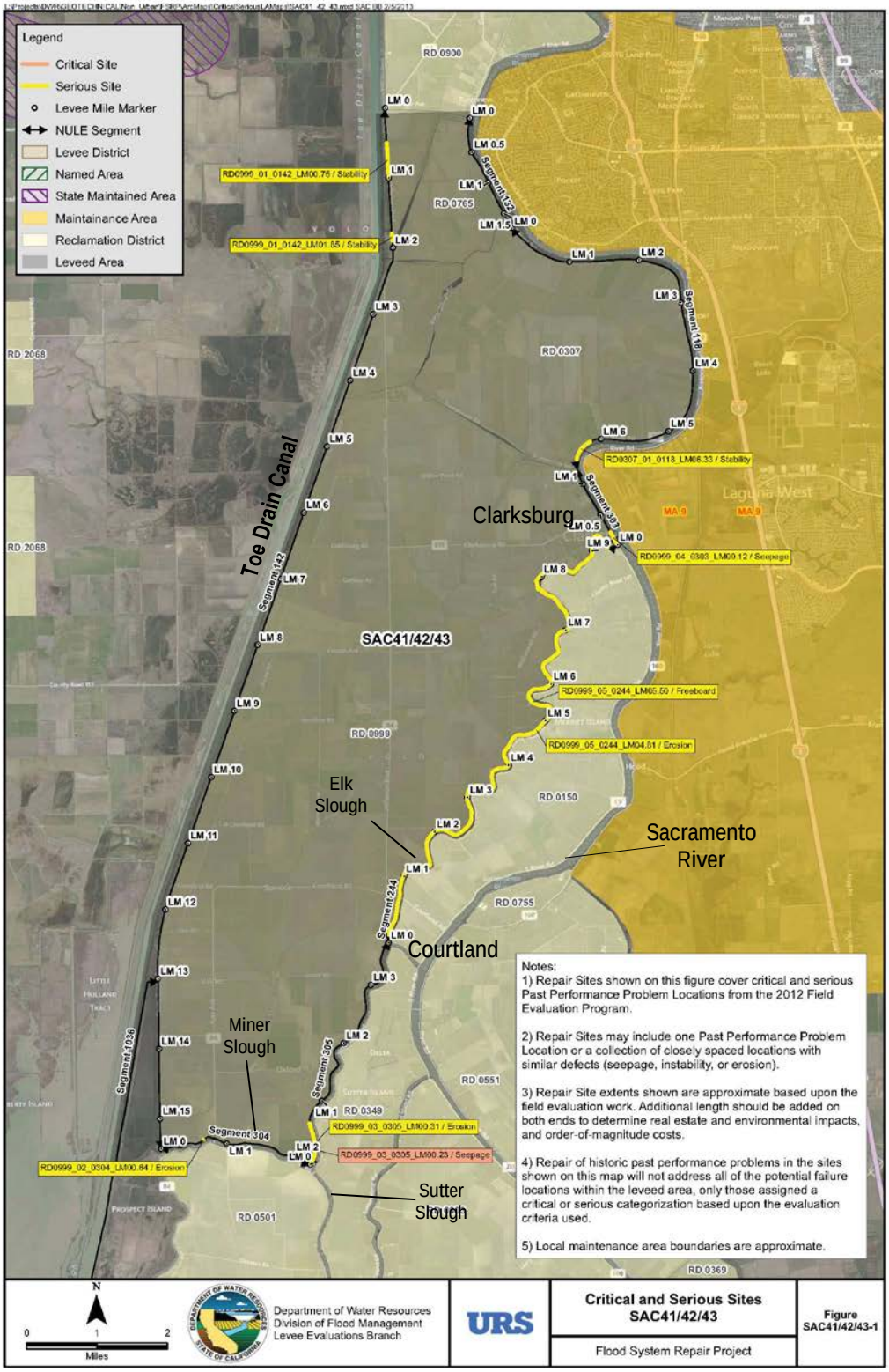
- The area has no history of substantial or repetitive flood loss claims; and
- The area is governed by a locally adopted floodplain management plan containing appropriate local land use controls, risk notification protocols, levee operation and maintenance standards, and emergency response plans which have been reviewed and approved by the State.

Once the potentially eligible areas are mapped, local communities would be able to request the designation through the State, to FEMA, by providing the requisite documentation of a State approved floodplain management plan. Insurance in the rural areas which qualify for the Zone D designation would be available through a group insurance program administered by the State based on rates established by FEMA. Zone D designations would be renewable on a 10 year cycle.

RD 765 – Glide

RD 765 has similar issues to the other LMAs in the region. Their primary issues however, are related maintenance activities. Because of this, there are no major improvements recommended for RD 765 in this RFMP. RD 765 will instead focus on vegetation and rodent control, seepage control, bank protection/erosion control, access road maintenance, and encroachment repairs and modifications. Figure 5-16 shows the levees around RD 765.

Figure 5-15. RD 765, 307, and 999 levees



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RD 307 – Lisbon

As stated in section 4.2, RD 307 at levee Segment 118 has seepage and erosion concerns that need to be addressed. A rock slope protection project and a vegetation control project are proposed to address these concerns. Information on these improvements was collected from the March 2012 Five Year Plan for Lisbon Island. These proposed improvements represent a comprehensive solution to RD 307's flooding problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for RD 307, which are summarized in Table 5-22. Figure 5-16 shows the levees around RD 307.

Rock Slope Protection Project

RD 307 plans first to ensure the protection of the existing levee by adding supplementary quarry stone riprap above the existing riprap to any portions of the waterside slope of the levee requiring additional rock slope protection. This will prevent erosion and avoid ongoing repairs.

Prior to submitting a project proposal, a thorough riprap inventory of the District must be completed to determine where supplementary riprap may be necessary and determine more definitive quantities and costs required to complete the project. Quantities and costs are based on the most recent survey and inspection

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the Rock Slope Protection Project. Assuming the financing is secured, the project will take approximately three years to complete.

Vegetation Control Project

In addition to the Rock Slope Protection Project, RD 307 will perform general vegetation removal from the levee slope and 15 feet from the levee toe including: the removal of invasive Arundo Donax, mitigation of elderberry bushes that currently impede visibility, thinning and trimming of existing trees, and removal of tree stumps if deemed necessary; as well as any other various vegetation related issues noted. The goal of this project is to meet, at minimum, the Central Valley Flood Protection Plan Levee Vegetation Management Strategy criteria.

Quantities and costs are based on the most recent survey and inspection. A thorough inspection of the District must be completed prior to submitting a project proposal to determine more definitive quantities and costs required to complete the project.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the Vegetation Control Project. Assuming the financing is secured, the project will take approximately two years to complete.

Table 5-22. RD 307 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Rock Slope Protection Project	$4,216,329	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Vegetation Control Project	$378,230	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

RD 999 – Netherlands

As stated in Section 4.2, RD 999 has similar issues to the other communities in the region. To address these issues, RD 999 plans to implement four specific projects that will incorporate major maintenance, repair, and rehabilitation components. None of the four projects have been funded at this time. Information on these improvements was collected from the June 2012 Five Year Plan for Netherlands. These proposed improvements represent a comprehensive solution to RD 999's flooding problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for RD 999, which are summarized in Table 5-23. Figure 5-16 shows the levees around RD 999.

There are two planned bank protection projects; one on the Sacramento River south of Clarksburg Marina and the other project includes several critical sites along Sutter Slough. The seepage control project plans along Miner Slough will likely be prepared within the next five years. The final project identified in this Plan is the continuation of many years of planning that the District has undertaken to evaluate the Elk Slough channel and levee, also known as the Elk Slough corridor. These projects will improve the integrity of the levee system; support the long-term goals of maintaining eligibility in the rehabilitation assistance program under PL 84-99, and supporting the operation of the SRFCP as the largest protected levee system in the North Delta Region.

Sutter Slough Erosion Repair Project

The Sutter Slough erosion repairs are along multiple sites that have developed over many years. The primary concern with repairing these sites is the heavy vegetation which could require expensive mitigation. This Plan recommends that the vegetation be avoided or, where not able to be avoided, the loss be mitigated. Prior to initiating the planning phase, the sites along Sutter Slough will be surveyed or evaluated. The unknown depths of the erosion scour at these sites are a major concern to the District.

The cost of the construction of the project includes: the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 10,000 tons of riprap quarry stone and 2,500 tons of imported fill will be used.

Assuming the financing is secured, the project will take approximately two years to complete.

Miner Slough Seepage Repair Project

The seepage locations along Miner Slough have not been evaluated by a geotechnical engineer to determine adequate sizing of materials for the seepage control berms, drains, or membranes that could be used to control, or stop the seepage concerns along this stretch of the levee. The adjacent landowners and the CVFPB would also be required to approve and allow the construction. This would likely require an easement by the landowner to be sold, or annexed by the District, and approval from the CVFPB to add the seepage control project to the levee design.

The cost of the construction of the project includes: the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 30,000 tons of gravel and 40,000 tons of imported fill will be used.

Assuming the financing is secured, the project will take approximately three years to complete.

Sacramento River Erosion Repair Project

The erosion site along the Sacramento River is a 1,600-foot area along the entire waterside slope, south of the Clarksburg Marina that also protects the City of Clarksburg from the highest flood and energy forces anywhere adjacent to the District. This project, at one time, ranked high on the repair schedule of the Sacramento River Bank Project, administered by the USACE. Since the project fell lower on the list, the District is considering including this project as part of its potential repair sites.

The cost of the construction of the project includes: the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 25,000 tons of riprap quarry stone, 35,000 tons of gravel, and 40,000 tons of imported fill will be used.

Assuming the financing is secured, the project will take approximately three years to complete.

Elk Slough Feasibility Study

The comprehensive study for Elk Slough will evaluate existing levee conditions and habitat types along the slough and evaluate alternatives for improvements and sustainability of the flood protection and habitat features of the levee system. The Elk Slough corridor is a critical component to the District's drainage and flood protection efforts. Elk Slough also is a large habitat corridor with valuable riparian forest and shaded riverine aquatic habitat types. The study will further evaluate possible projects to improve the District's flood protection and the sustainability of the existing habitat features.

Assuming the financing is secured, the project will take approximately four years to complete.

Deep Water Ship Channel Stability Project

There are additional serious stability sites in RD 999 from the FSRP that are not addressed by improvements from its five-year plan. RD 999 plans to construct a stability protection project along the Deep Water Ship Channel. The stability protection project would be 2,640 feet long from approximately levee mile 0.5 to 1.0 along the Deep Water Ship Channel and 500 feet long from levee mile 1.8 to 1.9.

Miner Slough Bank Protection Control

There is an additional serious erosion site in RD 999 from the FSRP that is not addressed by improvements from its five-year plan. RD 999 plans to construct a bank protection project along the Miner Slough. The project will rehabilitate 400 feet of the waterside bank at levee mile 0.64 and incorporate an enhanced lower waterside slope habitat area with possible riparian forest, scrub-shrub, and emergent/freshwater marsh features to mitigate for loss of habitat and enhance the habitat value along the slough.

Table 5-23. RD 999 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sutter Slough Erosion Repair Project	$775,061	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Ecosystem Restoration Contained in RD 999 5YR plan
Miner Slough Seepage Repair Project	$1,240,097	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Sacramento River Erosion Repair Project	$2,066,828	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Ecosystem Restoration Contained in RD 999 5YR plan
Elk Slough Feasibility Study	$775,061	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Deep Water Ship Channel Stability Project	$1,821,596 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Sutter Slough Erosion Repair Project – Netherlands	$775,000	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Ecosystem Restoration Contained in RD 999 5-yr plan
Miner Slough Bank Protection Control	$453,588 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Ecosystem Restoration

RD 150 – Merrit Island

Section 4.2, details the seepage issues RD 150 has along Elk Slough in multiple locations. To address these issues, RD 150 plans to implement a bank protection project and conduct a feasibility study to discover other potential issues. Information on these improvements was collected from the June 2012 Five Year Plan for Merritt Island. These proposed improvements represent a comprehensive solution to RD 150's flooding problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for RD 150, which are summarized in Table 5-24. Figure 5-17 show the levees around RD 150.

Elk Slough Bank Protection Project

RD 150 plans to construct a large bank protection project along four areas of Elk Slough. The project will rehabilitate the waterside bank and incorporate an enhanced lower waterside slope habitat area with possible riparian forest, scrub-shrub, and emergent/freshwater marsh features to mitigate for loss of habitat and enhance the habitat value along the slough. Elk Slough is one of the few remaining channels in the Delta where large riparian features still dominate the channel. With the rehabilitated lower slope, and vegetated features will be an improved transition between the open channel features and the higher riparian forest canopy along these areas.

The cost of the construction of the bank protection project includes: the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that between 120,000 and 160,000 tons of riprap quarry stone and 50,000 tons of imported fill will be used.

Assuming the financing is secured, the project will take approximately three years to complete.

Elk Slough Bank Feasibility Study

RD 150 also plans to complete a feasibility study for Elk Slough. The feasibility study will evaluate the Elk Slough channel and the adjacent levee features. The goal of the study will be to define the geometry of the system, catalog all features, and assess possible alternatives that can sustain, enhance, and protect both the flood protection and ecosystem values.

Assuming the financing is secured, the project will take approximately three years to complete.

Sacramento River Bank Protection Project

There are additional serious erosion sites in RD 150 from the FSRP that are not addressed by improvements from its five-year plan. RD 150 plans to construct a large bank protection project along the Sacramento River to protect 4 erosion sites. The project will rehabilitate the waterside bank and incorporate an enhanced lower waterside slope habitat area with possible riparian forest, scrub-shrub, and emergent/freshwater marsh features to mitigate for loss of habitat and enhance the habitat value along the slough. The four sites are located at levee mile 2.04 to 2.16, 3.38, 3.48, and 4.58 to 4.65 and have a total rehabilitated length of 1,200 feet.

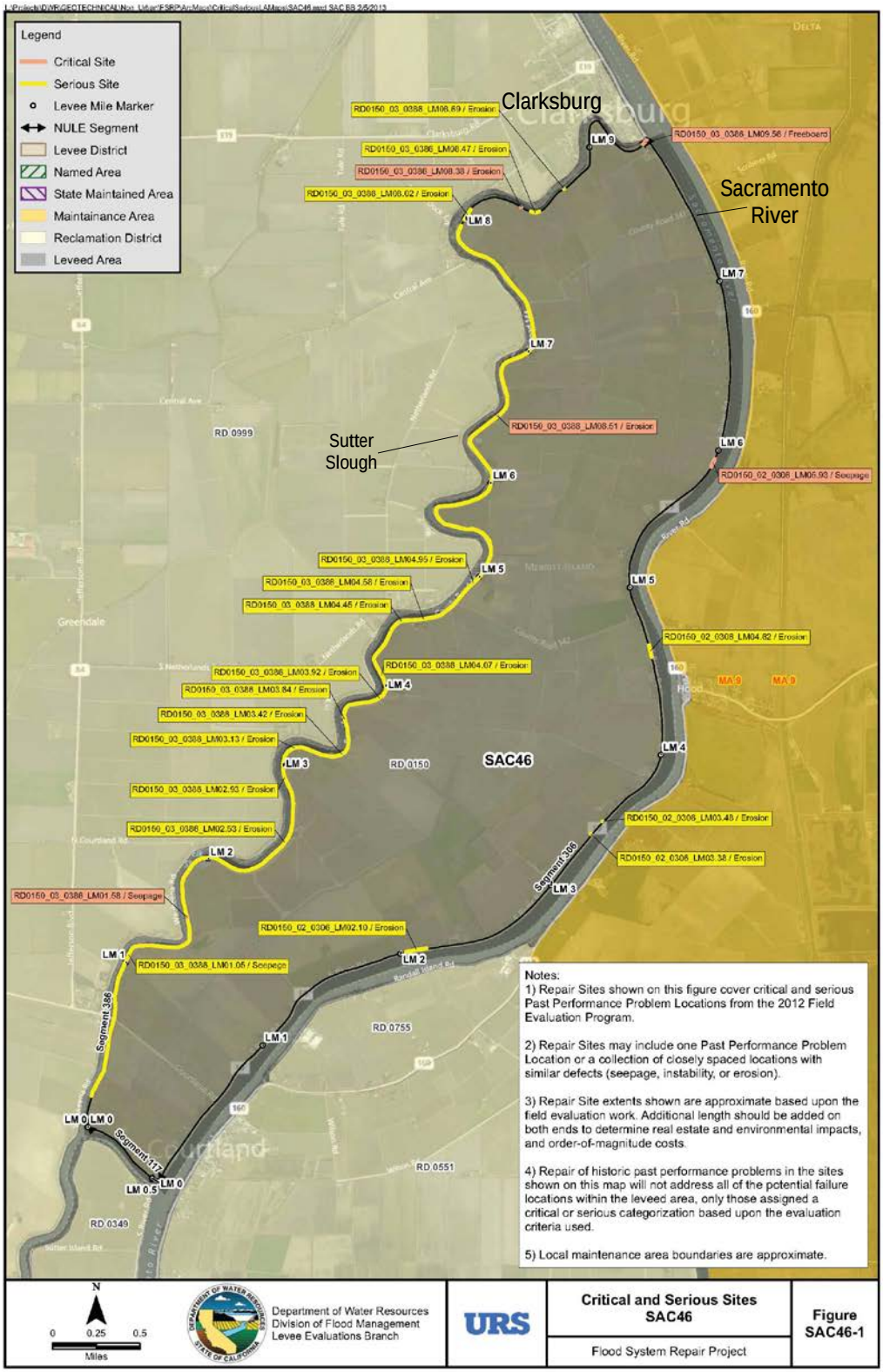
Sacramento River Seepage Protection Project

There is an additional critical seepage site in RD 150 from the FSRP that is not addressed by improvements from its five- year plan. RD 150 plans to construct a seepage protection project along the Sacramento River. The seepage protection project would be 275 feet long from approximately levee mile 5.9 to 5.95. The seepage control project would consist of multiple gradations of rock and fill to control the seepage.

Table 5-24. RD 150 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi-Benefit
Elk Slough Bank Protection Project	$4,960,387	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Ecosystem Restoration Contained in the RF150 5-yr plan
Elk Slough Bank Feasibility Study	$775,061	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Ecosystem Restoration Contained in the RF150 5-yr plan
Sacramento River Bank Protection Project	$1,360,764 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Sacramento River Seepage Protection Project	$177,610 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

Figure 5-16. RD 150 Levees



DWR FSRP, 2013

5.3 Sacramento County Improvements

5.3.1 Sacramento County Urban Areas

The following section presents flood management improvements for the Sacramento county urban areas within the Region. SAFCA's boundaries are shown in Figure 5-18.

5.3.1.1 SAFCA

The following discussion describes the projects that are necessary to provide a high level of flood protection (200-year or greater) to the urban and urbanizing areas in Sacramento and Sutter Counties along the lower Sacramento and American Rivers and their tributaries, based on current information and engineering. The described projects would be carried out either by the USACE or by SAFCA, in partnership with DWR and the CVFPB depending on the timing of federal authorization and the availability of non-federal funds. These projects are limited to improving existing flood risk management facilities within the affected counties. The proposed projects do include some "system wide improvements" such as the Folsom Joint Federal Project, Folsom Dam Flood Control Manual Update Project and Folsom Dam Raise Project. All three of these projects will provide flood management benefits for the entire LSDN and beyond. Some environmental enhancement projects are also included in the program.

SAFCA anticipates that the projects described herein will be federally authorized and will be subject to cost sharing by the federal Government and the State of California, under established State and federal cost sharing guidelines. However, timing of federal authorization and appropriations, in some cases, may lag the start-up of project construction. Achievement of the maximum federal cost contribution will depend on various federal crediting mechanisms and an evaluation of whether the region can wait for federal investment, in light of the high level of flood risk. As a general rule, the cost share to be provided by the federal government for projects authorized prior to 1999 is assumed to be 75 percent. For projects authorized in 1999 or after, this share is assumed to be 65 percent. Under State law, applicable to federally authorized projects, local sponsors must provide at least 30 percent of the remaining non-federal share while the State provides a maximum of 70 percent.

Folsom Dam Joint Federal Project (JFP)

The Folsom Dam Joint Federal Project (JFP) is federally authorized (2007) and consists of physical and operational modifications to Folsom Dam and Reservoir that would improve the efficiency and effectiveness of the dam's flood management operations and permit the dam to meet federal dam safety requirements. These improvements include a new, gated auxiliary spillway constructed on a natural ridge in the area east of the main dam at an elevation that will substantially increase the dam's low-level discharge capacity. This new facility includes a concrete-lined approach channel and discharge chute in the left abutment below the left wing dam leading down to Folsom Dam's existing stilling basin, which would be enlarged to handle the increased discharges through the spillway. These discharges would be controlled through the installation of six submerged tainter gates (23 feet wide by 33 feet high) that would be

operated conjunctively during flood events with Folsom Dam's five existing main spillway gates.

Construction of the Folsom Dam JFP was initiated in 2010 and is expected to be completed in the spring of 2017. The project was authorized by Congress in 2007 and is subject to 65 percent federal cost sharing with contributions of 24.5 percent and 10.5 percent respectively from the State and SAFCA. The federal funding is from both USACE and USBR. The USBR share covers the dam safety aspects of the project, while the USACE share covers flood management and is cost-shared with DWR and SAFCA. The total cost of the project is estimated to be $816.0 million of which $661.0 million will have been spent by the end of 2014. The remaining project cost of $135.0 million will be expended by the end of 2017.

Folsom Dam Raise Project

The Folsom Dam Raise Project is federally authorized (2007) and consists of raising Folsom Dam's earthen dikes and wing dams by 3.5 feet, so as to equal the height of the Folsom's main dam and modifying the dam's five main spillway gates and three emergency spillway gates so as to allow dam operators to add approximately 40,000 acre-feet of additional surcharge storage capacity to the flood management operation. Construction of the Folsom Dam Raise Project is expected to commence in 2018 and be completed in 2022. The projected cost of the project is $150.0 million. This cost includes improvements to Folsom Dam's facilities for managing the reservoir's cold water pool (discussed above under environmental enhancements). It is anticipated that the federal, State and local contributions to the project cost will be adjusted to reflect unreimbursed federal expenditures on the planning and design of the Auburn Flood Detention Dam Project.

Folsom Dam Flood Control Manual Update Project

The physical improvements to Folsom Dam, described above, would allow dam operators to continue the current variable storage space operation at Folsom Dam (also known as "Folsom Reoperation") but with a reduced demand for reservoir space seasonally-dedicated to flood management. The current operation was initiated in 1995 through an interim agreement between SAFCA and the U. S. Bureau of Reclamation (Reclamation). This agreement augmented the requirements of USACE's 1987 flood control manual by calling for an increase in the reservoir space dedicated to flood control based on storage conditions in the three largest non-federal reservoirs on the upper reaches of the American River watershed. Whereas the USACE manual requires up to 400,000 acre-feet of dedicated flood control space during the height of the flood season, the agreement calls for as much as 670,000 acre-feet of such space when the three upstream reservoirs have filled to the point where they have no creditable space left for incidental flood storage.

Anticipating these improvements to Folsom Dam, Congress has directed USACE to update the 1987 flood control manual to reflect the operational capacities created by these improvements and take advantage of the National Weather Service's improving ability to forecast extreme precipitation and runoff in the American River watershed. USACE is currently working with

Reclamation, SAFCA, DWR and the CVFPB to prepare an updated flood control manual. It is anticipated that the manual will shrink the maximum flood control space allocation to 600,000 acre-feet and will expand the criteria used to determine this space. The new criteria will include basin wetness and forecasted inflow in addition to upstream reservoir storage. The expected completion date of the new manual is fall of 2017, following completion of the Folsom Dam JFP. It will be adjusted, as necessary, to reflect the accomplishments of the Folsom Dam Raise Project when this project is completed in 2022.

American River Levee Improvements

Work to improve the levees along the lower American River has been ongoing for more than a decade as part of the federally authorized (1996 and 1999) American River Common Features (ARCF) Project. This project has included substantial improvements to the north and south levees of the American River to address identified levee embankment and foundation deficiencies. It is anticipated that the work covered by the current authorizations will be completed in 2015. However, USACE has initiated a General Reevaluation Report (GRR) to investigate the need for further improvements to the flood risk reduction system throughout the Sacramento region, including the levees of the American River.

The 1999 ARCF authorization anticipates with the improvements to Folsom Dam in place, releases from Folsom Dam to the American River channel could safely contain 160,000 cubic feet per second (cfs) in the event of a 200-year flood. This flow would exceed the maximum flow experienced during the record flood of 1986 (134,000 cfs) by about 20 percent, but be well below the flow that would occur under existing conditions. Recognizing the erosion damage that resulted from the 1986 flood, the GRR recommends an anticipatory erosion control program along the American River that would protect the improved levees from failure due to erosion from sustained high flows in the river. This program would be significantly larger than the erosion control program that was implemented along the American River in the 1990s.; however, it is anticipated that the actual scope of the work will be developed over time in a manner similar to the site-specific approach that was implemented in the 1990s. While some of this work could be initiated within the next five years depending on the timing of Congressional authorization, the challenges of working in the American River Parkway will likely extend the life of any new anticipatory erosion effort over more than decade.

Expenditures on currently authorized improvements to the American River levees are expected to total approximately $320.0.0 million, of which about 10 percent remains to be expended. The GRR estimates that the cost of the anticipatory erosion control program could total $350.0 million.

Sacramento River Levee Improvements

The east levee of the Sacramento River, downstream of the mouth of the American River, has been the focus of a substantial erosion control and seepage remediation effort over the past ten years. This segment of the flood management system is also being re-evaluated by the GRR. Analyses by USACE, DWR and, more recently, SAFCA indicate that additional work will be needed to address identified levee embankment and foundation vulnerabilities. As is the case of

the American River levees, USACE has also determined that a comprehensive anticipatory erosion control program should be considered for the Sacramento River east levee. The GRR estimates that the cost of the needed levee strengthening and erosion control work could total $600.0 million. SAFCA has concluded that the identified embankment and foundation improvements, and some relatively minor erosion work, must be completed to reestablish the accredited status of the Sacramento River east levee within the NFIP and/or comply with the urban levee design criteria adopted by DWR. Since it could take over a decade to complete the GRR and secure Congressional authorization and appropriations for USACE to undertake this work, SAFCA is actively working with DWR to address these problems as quickly as possible with available non-federal funding.

North Sacramento Streams Improvements

The North Sacramento Streams area is located east of Natomas and contains several urbanized floodplains that are threatened by peak flood flows in the streams that run through the area including Arcade Creek, Magpie Creek and the lower portion of the NEMDC. Substantial improvements to the levees along these streams were completed as part of SAFCA's North Area Local Project in the 1990's. However, this segment of the flood management system is also being re-evaluated as part of the GRR. Analyses by USACE, DWR, and SAFCA indicate that embankment and foundation stability vulnerabilities require additional improvements along portions of the north and south levees of Arcade Creek. In addition, work is required to prevent Magpie Creek from overtopping the diversion structure near Raley Boulevard that directs creek flows into the Magpie Diversion Channel. The GRR estimates that the required improvements could cost $150.0 million. As in the case of the Sacramento River east levee, SAFCA has concluded that the work along Arcade Creek is needed to reestablish the accredited status of the affected levees in the NFIP and/or comply with the urban levee design criteria adopted by DWR. Accordingly, SAFCA is actively working with DWR to initiate and complete the necessary improvements as quickly as possible with available non-federal funds.

Natomas Levee Improvement Project

The Natomas Levee Improvement Project is intended to address identified levee embankment and foundation stability issues, as well as levee height deficiencies in the perimeter levee system protecting the Natomas Basin east of the Sacramento River and north of the American River. The project was initiated by SAFCA in 2007 as an early implementation project (or EIP), under guidelines adopted by DWR for the expenditure of voter approved State bond funds in advance of the adoption of the Central Valley Flood Protection Plan (CVFPP). Under this arrangement, SAFCA has completed half of the project by improving approximately 18 miles of the levee system including the entire 5 miles of the Natomas Cross Canal and the upper 13 miles of the Sacramento River east levee north of Powerline Road. For its part, USACE has completed a Post-Authorization Change Report (PACR) linking the Natomas Project to the ARCF Project and identifying the terms and conditions under which USACE will complete the remaining half of the project. The PACR was authorized by Congress in June 2014 and it is anticipated that construction of the federal phase of the project will begin in 2016. This phase

of the project will include improvements to the lower 6 miles of the Sacramento River east levee, 2 miles of the American River north levee, 7 miles of the Natomas East Main Drainage Canal west levee and 3 miles of the Pleasant Grove Creek Canal west levee.

By the end of 2014, SAFCA and the State will have expended approximately $400.0 million on raising and strengthening the 18 miles of the perimeter levee system protecting the Basin as discussed above. Going forward, USACE anticipates that it will cost approximately $700.0 million to complete the federal phase of the project. A significant portion of the non-federal share of the remaining cost will be covered by credits accumulated by the State and SAFCA during the EIP phase of the project.

South Sacramento Streams Group Project

Improvements to the major levees included in the South Sacramento Streams Group (SSSG) Project have been underway for several years in order to provide increased flood protection to the southern portions of the City of Sacramento and relieve property owners in this area of the NFIP requirement to maintain high cost flood insurance. Authorized by Congress in 1999, the project includes levee, channel, and flood wall improvements along Morrison Creek and its tributaries generally west of Franklin Boulevard. Also included, is raising the ring levee that surrounds the Sacramento Regional Wastewater Treatment Plant. Floodwall improvements and a detention basin along Florin Creek are being constructed in 2014 and 2015 at a cost of approximately $15.0 million. This work will complete the project and raise total project expenditures to approximately $104.0 million.

Operations and Maintenance

In connection with the levee improvements being undertaken along the Lower American and Sacramento Rivers and their tributaries in North Sacramento and South Sacramento, SAFCA is working with its member agencies to develop a long-term operation and maintenance program. The program will address levee vegetation, encroachments, and landside levee access issues consistent with the requirements of the NFIP and DWR's urban levee design criteria and will be risk based. Vegetation and encroachments that are deemed to constitute an unacceptably high risk to ongoing levee inspection and maintenance efforts will be removed in connection with near-term levee improvement efforts. Lower risk vegetation and encroachments will be monitored and addressed over a longer timeframe pursuant to an adopted System Wide Improvement Framework (SWIF) for each segment of the levee system.

Environmental Enhancements

SAFCA flood risk reduction program also includes congressionally authorized environmental enhancements along the American River Parkway and at Folsom Dam. These projects reflect SAFCA's statutory mandate to carry out the Agency's flood management responsibilities in a manner that provides optimum protection to the environment. In the Parkway, the environmental enhancements would include grading and excavating soils on the floodplain and creating side channels off the main American River channel to provide hydrology supportive of

wetlands and riparian habitat in the Woodlake area on the north side of the river where nonnative vegetation would be removed and replaced with native trees and shrubs suited to riparian woodland, wetlands, and oak woodland/savannah landscapes. These enhancements could be created as part of an approved mitigation bank that would provide credits to compensate for vegetation removal carried out in connection with the above described levee improvement projects. Such a bank could also provide credits for a wider range of impacts associated with projects outside the scope of SAFCA's program.

At Folsom Dam, the environmental enhancements would involve improving the dam's facilities that are used to manage the temperature of water entering the dam's power-generating turbines for discharge to the lower American River. The current design and operation of these facilities is relatively inefficient, resulting in a sub-optimal temperature management regime that often requires releases through the dam's river outlets. These outlets draw water from lowest elevations in the reservoir (from below the intakes up to the turbines) where the stored water is the coldest. These releases bypass the turbines and result in lost hydropower, generally during the late summer and fall when power demand is at its height. It is anticipated that improvements to the dam's cold water management facilities will be implemented in connection with the Folsom Dam Raise Project. Managing cold water in the Lower American River is done to improve migratory fish habitat. It is anticipated that federally authorized enhancements to Folsom Dam's facilities for managing the reservoir's cold water pool will be implemented as part of the Folsom Dam Raise Project. The cost of these improvements is therefore embedded in the cost of that project.

Summary

Table 5-25 presents a summary of the project costs described above focusing particularly on the capital costs that are assumed to be incurred during the period 2015 to 2035.

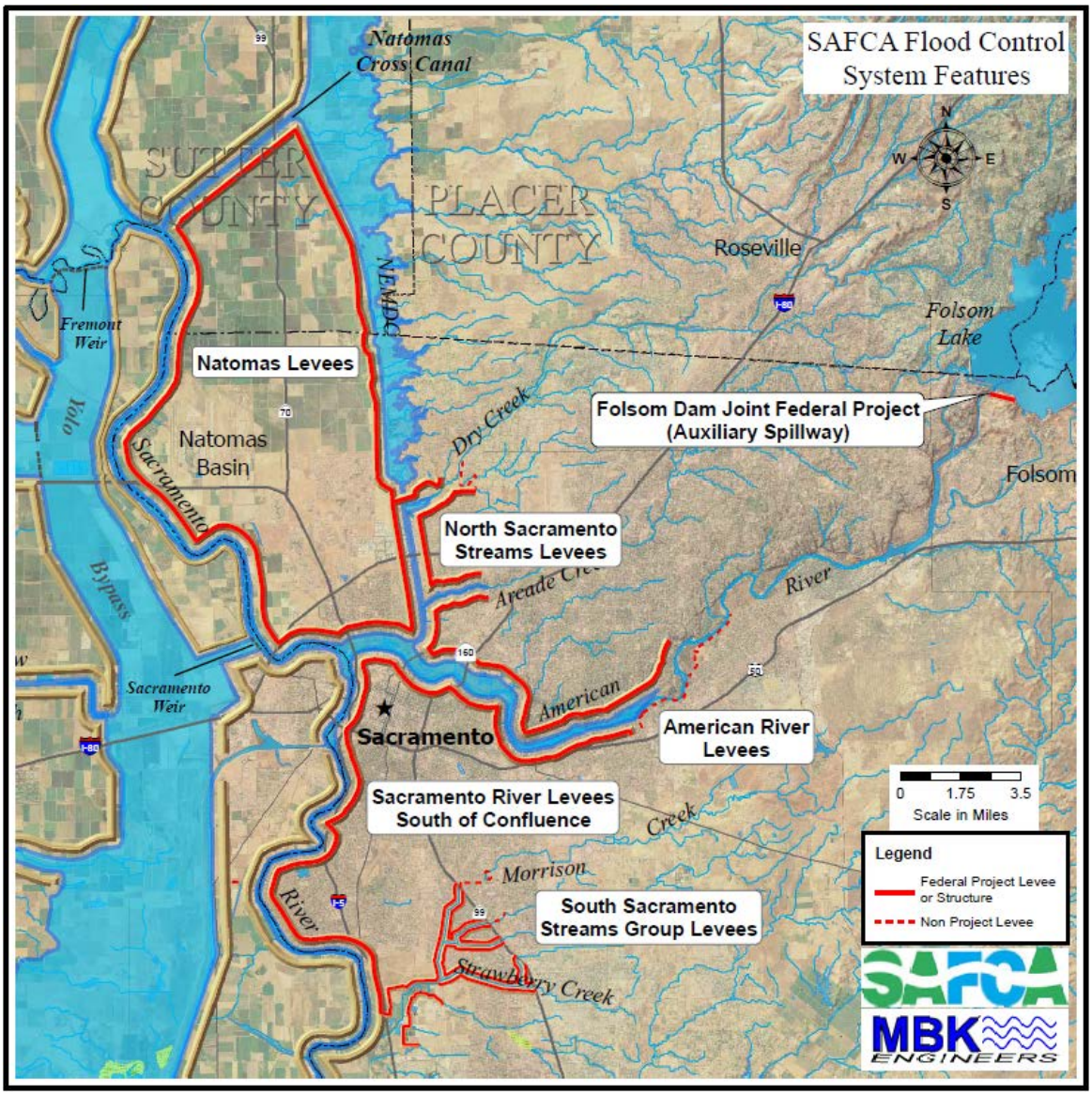
Table 5-25. SAFCA Project Costs and Cost-Shares: 2015 - 2035 ($M)

Project	Project Cost	Federal Share	State Share	SAFCA Share
Folsom Dam JFP	$161.00	$104.65	$39.45	$16.90
Folsom Dam Raise	$150.00	$97.50	$36.75	$15.75
American River Levee Improvements	$382.00	$251.50	$91.35	$39.15
Sacramento River Levee Improvements	$600.00	$390.00	$147.00	$63.00
North Sacramento Streams	$150.00	$97.50	$36.75	$15.75
Natomas Levees	$700.00	$455.00	$171.50	$73.50
South Sacramento Streams Group	$15.00	N/A	N/A	N/A
TOTAL	$21430.00	$1396.15	$522.80	$224.05

Table 5-26. SAFCA Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Folsom Dam JFP	$161,000,000	Plans and Specification under development for remaining 10% (90% under construction)	Complete	Local & State funding secured and federal authorization	Potential link to the RASP
Folsom Dam Raise	$150,000,000	Plans and Specifications under development	Complete	Local & State funding secured and federal authorization	Potential link to the RASP
Folsom Dam Flood Control Manual Update Project	TBD	N/A	Not complete (complex requirements)	Local & State funding secured and federal authorization	Potential link to the RASP
American River Levee Improvements	$32,000,000	Bid ready	Complete	Local & State funding secured and federal authorization	Potential link to the RASP
American River Levee Improvements (Erosion Control Component)	$350,000.000	Pre-Feasibility	Not complete (complex requirements)	Local funding source under development	Potential link to the RASP
Sacramento River Levee Improvements	$600,000,000	Feasibility	Not complete (complex requirements)	Local funding source under development	Potential link to the RASP
North Sacramento Streams	$150,000,000	Feasibility	Not complete (complex requirements)	Local funding source under development	Potential link to the RASP
Natomas Levees	$700,000,000	Plans and Specification under development for remaining 50% (50% under construction)	Not complete (complex requirements)	Local and State funding secured and federal authorization	Potential link to the RASP
South Sacramento Streams Group	$15,000,000	Bid ready	Not complete (standard or simple requirements)	Local and State funding secured and federal authorization	Potential link to the RASP
System Operation and Maintenance	TBD	Pre-Feasibility	Not complete (standard or simple requirements)	Local funding source identified	Potential link to the RASP
Environmental Enhancements	TBD	Feasibility	Not complete (complex requirements)	Local funding source secured and federal authorization state funding requested	Ecosystem Restoration

Figure 5-17. SAFCA Map



-Southport, SAFCA, 2012

5.3.2 Sacramento County Small Communities

The following sections present improvements for the Sacramento County small Delta communities of Hood, Courtland, West Walnut Grove, East Walnut Grove, Locke, and Isleton. As stated in Section 5.0, the improvements for small communities would be developed from four options: structure raising, ring levees, fixing of perimeter levees, and Zone D designation.

5.3.2.1 Hood

The community of Hood lies along the Sacramento River and is within DWR Maintenance Area 9. Because the RFMP analysis is pre-feasibility, a definite solution for Hood has not been

determined. Therefore, the recommended solution for Hood would be a feasibility study, shown in Table5-27, to determine the most appropriate solutions.

Table 5-27. Hood Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Hood Improvements Feasibility Study	TBD	Pre-Feasibility	Not complete (Complex Requirements)	Local funding sources not identified	Potential link to the RASP

The Feasibility study for Hood would investigate the four options discussed in Section 5.0: structure raises, ring levees, fix-in-place improvements of the perimeter levee, and Zone D designations. The improvements for Hood would be one of, or a combination of, those four options. The following sections provide more detailed information about the options for Hood. When available, existing data or analyses were used, such as NULE or the 2012 CVFPP.

Structure Raises

In Hood, there are an estimated 104 structures: 5 commercial, 8 industrial, 15 public, and 76 residential. It would cost $10,400,000 to raise the structures by one story at $100,000[5] per structure.

Ring Levee

A ring levee system was investigated in the 2012 CVFPP. It would include a ring levee and reconstruction in-place repairs to portions of Levee Segment 106, as well as construction of new levee on the north and replacement of existing levees with new levees on the east and south. The new levees would have a 12-foot crown, with an average height of 18 feet, spanning about 1.5 miles in total. The estimated cost of the ring levee option would be $31,177,348 (based on an escalation to 2014 dollars). The conceptual alignment of the ring levee system is shown in Figure 5-19.

Fix-in-Place of Perimeter Levees

The perimeter levee (Segment 106) around Hood would be remediated by either repairing critical or serious sites on those levees identified in the FSRP or remediating the entire levee segmented as calculated in NULE.

Repairs to critical or serious sites to Levee Segment 106 are described in Section 5.3.3.1 – DWR Maintenance Area 9.

A fix-in-place for deficiencies of the entire length of Levee Segment 106 was calculated through NULE. Costs for those repairs are shown in Table 5-28.

[5] $100,000 to raise a structure is from the 2012 CVFPP – Attachment 8J.

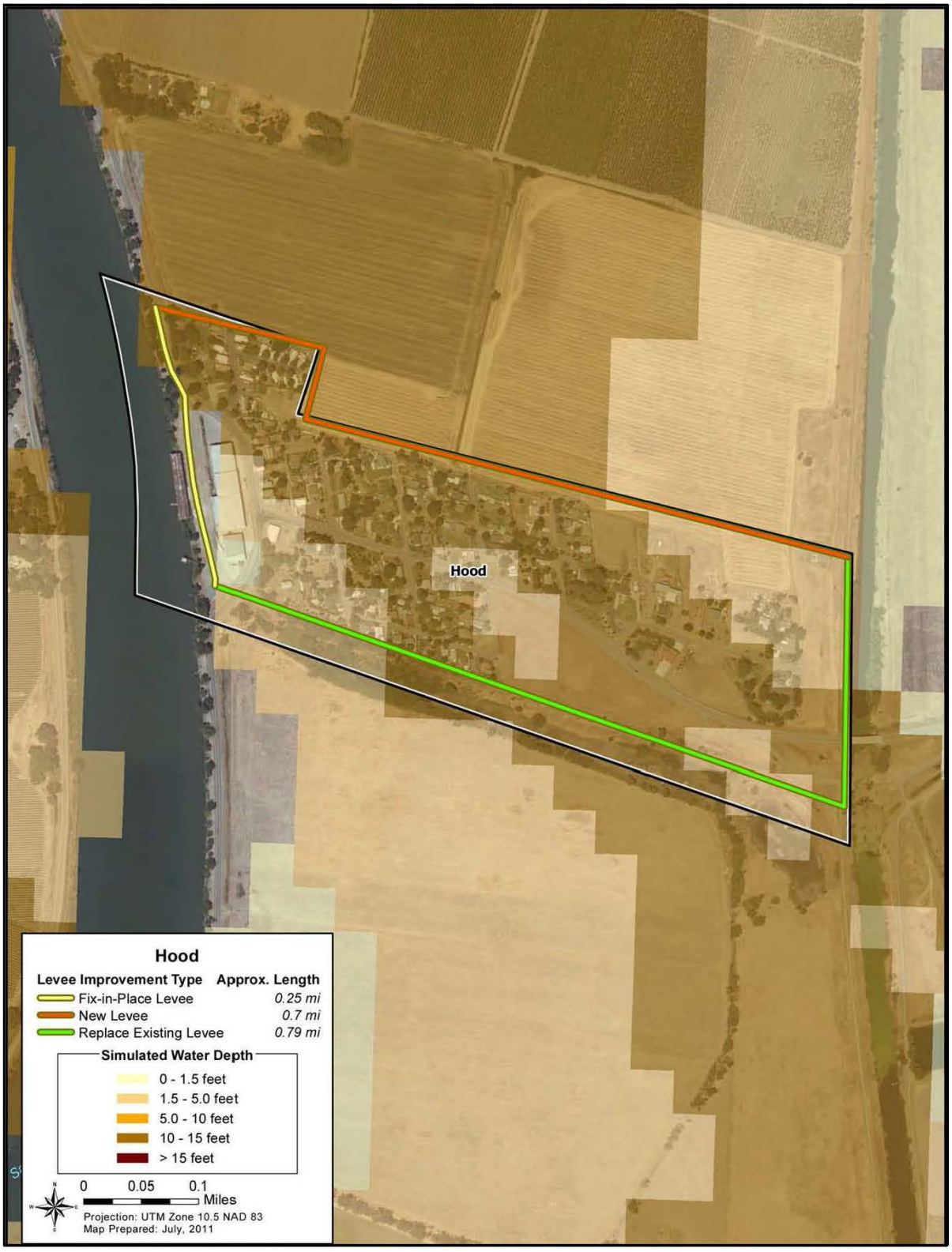
Table 5-28. Costs of Remediation of Perimeter Levee around Hood from NULE

Segment	Length (Feet)	Length (miles)	Total fix-in-place cost (2014 Dollars)
106	46,690	8.84	$161,100,000.00
Total	46,690	8.84	$161,100,000.00

Zone D

As stated previously, the Zone D designation would involve working with FEMA to designate Hood as Zone D, rather than Zone AE. The Zone D designation is used where there are possible, but undetermined flood hazards, but no definitive analysis of flood hazards has been conducted.

Figure 5-18. Hood Ring Levee



DWR CVFPP, 2013

5.3.2.2 Courtland

The community of Courtland lies along the Sacramento River and is within RD 551. Because the RFMP analysis is pre-feasibility, a definite solution for Courtland has not been determined. Therefore, the recommended plan of action for Courtland would be a feasibility study, shown in Table 5-29, to determine the most appropriate solution.

Table 5-29. Courtland Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Courtland Improvements Feasibility Study	TBD	Pre-Feasibility	Not complete (standard or simple requirements)	Local funding sources not identified	Potential link to the RASP

The feasibility study for Courtland would investigate the four options discussed in Section 5.0: structure raises, a ring levee, fix-in-place of the perimeter levees, and Zone D designation. The improvement for Courtland would be a one of, or a combination of those four options. The following sections provide more detailed information about these options. When available, existing data or analysis was used, such as NULE or the 2012 CVFPP.

Structure Raises

In Courtland, there are an estimated 174 structures: 11 commercial, 7 industrial, 28 public, and 128 residential. It would cost $14,020,806 to raise the structures by one story at $100,000[6] per structure.

Ring Levee

A ring levee system was investigated in the 2012 CVFPP. It would include a ring levee and reconstruction in-place repairs to portions of Levee Segment 126, as well as construction of new levee on the north, east and south. The new levees would have a 12-foot crown, with an average height of 18 feet, spanning about 1.9 miles in total. The estimated cost of the Ring Levee is $14,026,425. The conceptual alignment of the ring levee system is shown in Figure 5-20.

Fix-in-place of Perimeter Levees

The perimeter levees, Levee Segment 126, 131, 1041, and 1040 Courtland would be remediated by either repairing critical or serious sites on those levees identified in the FSRP or remediating the entire levee segments as calculated in NULE.

A fix-in-place of deficiencies of the entire length of segments was calculated through NULE. Costs for those repairs are shown in Table 5-30

[6] $100,000 to raise a structure is from the 2012 CVFPP – Attachment 8J.

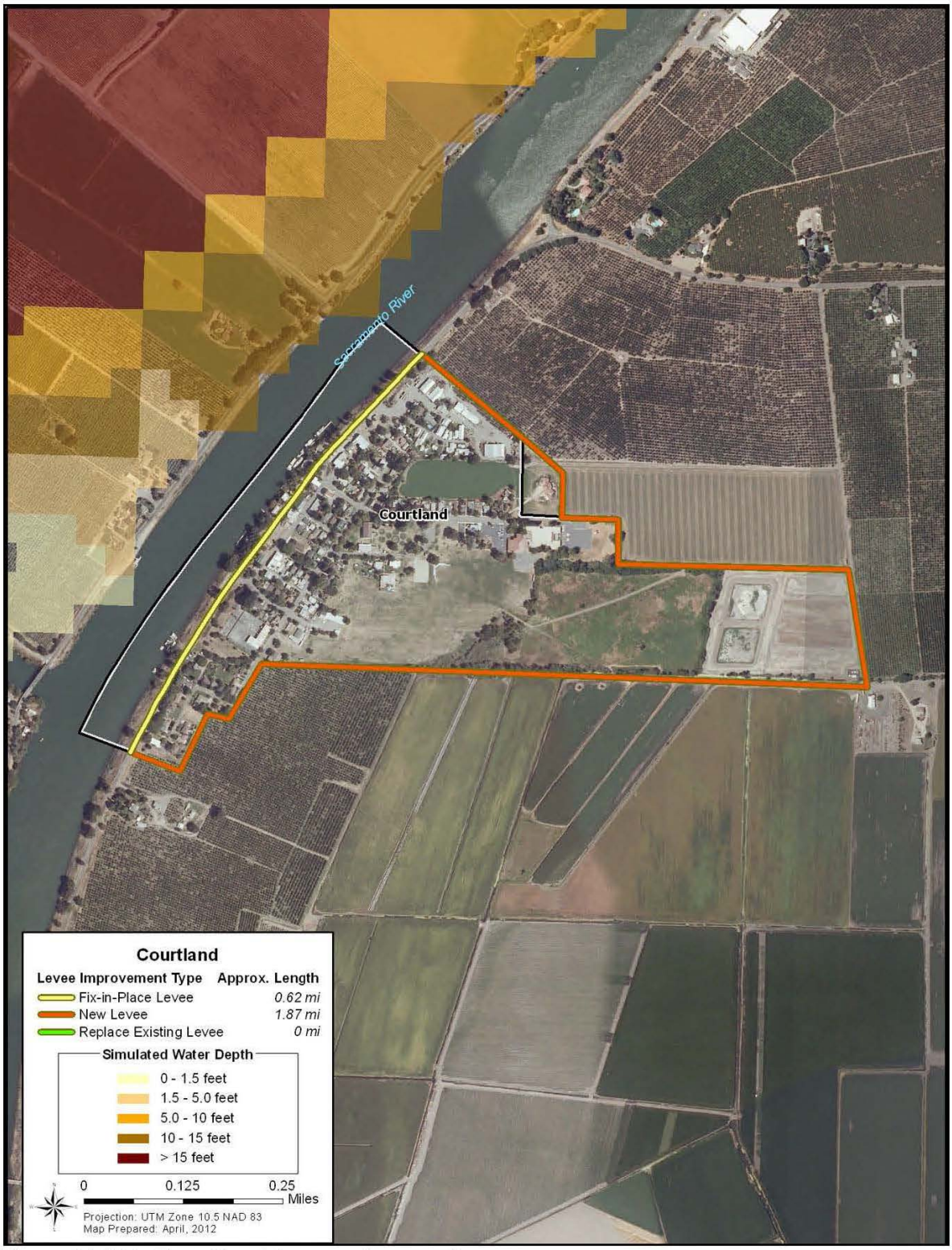
Table 5-30. Costs of Remediation of Perimeter Levee around Courtland from NULE

Segment	Length (Feet)	Length (miles)	Total fix-in-place cost (2014 Dollars)
126	35,830	6.79	49,629,102
131	9,700	1.84	25,605,751
1041	31,200	5.91	85,712,660
1040	7,300	1.38	18,559,540
Total	84,030	15.91	179,507,054

Zone D Designation

As stated previously, the Zone D designation would involve working with FEMA to designate the Courtland as Zone D rather than Zone AE. The Zone D designation is used where there are possible but undetermined flood hazards, but no definitive analysis of flood hazards has been conducted.

Figure 5-19. Courtland Ring Levee



DWR CVFPP, 2013

5.3.2.3 West Walnut Grove, East Walnut Grove, and Locke

The communities of West Walnut Grove, East Walnut Grove, and Locke lie along the Sacramento River. West Walnut Grove lies within RD 3, East Walnut Grove within RD 554, and Locke within RD 369. Because the RFMP analysis is pre-feasibility, a definite solution for these areas as not yet been determined. Therefore, the recommended course of action is a feasibility study, shown in Table 5-31, to determine the most appropriate solution.

Table 5-31. West Walnut Grove, East Walnut Grove, and Locke Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Walnut Grove Improvements Feasibility Study	TBD	Pre-Feasibility	Not complete (Standard or Simple requirements)	Local funding sources not identified	Potential link to the RASP

The feasibility study for the area would investigate the four options discussed in Section 5.0: structure raises, a ring levee, fix-in-place of the perimeter levees, and Zone D designation. The improvement for the area would be a one of or a combination of those four options. The following sections provide more detailed information about these options. When available, existing data or analysis was used, such as NULE or the 2012 CVFPP.

Structure Raises

In the area, there are an estimated 301 structures: 64 commercial, 12 industrial, 54 public, and 171 residential. It would cost $301,000,000 to raise the structures by one story at $100,000[7] per structure.

Ring Levee

A ring levee system was investigated in the 2012 CVFPP which would include a ring levee and reconstruction in-place repairs to portions of Levee Segments 384, 1040, 121, 127, and 128. It also includes an addition of a 0.8-foot levee raise to a portion of Segment 384, as well as construction of three new levees and replacement of seven existing levees. The new levees would have a 12-foot crown with an average height of 18 feet, spanning about 1.5 miles in total. The total estimated cost of the ring levee option would be $71,459,808. The conceptual alignment of the ring levee is shown on Figure 5-21.

Fix-in-place of Perimeter Levees

The perimeter levees, Levee Segments 130, 1043, 1051, and 1052 around East Walnut Grove, 113.1, 113.2, 384.1, and 384.2 around West Walnut Grove, and 1040, 1053, and 1054 around Locke would be remediated by either repairing critical or serious sites on those levees identified in the FSRP, or remediating the entire levee segments as calculated in NULE (Table5-32)..

[7] $100,000 to raise a structure is from the 2012 CVFPP – Attachment 8J.

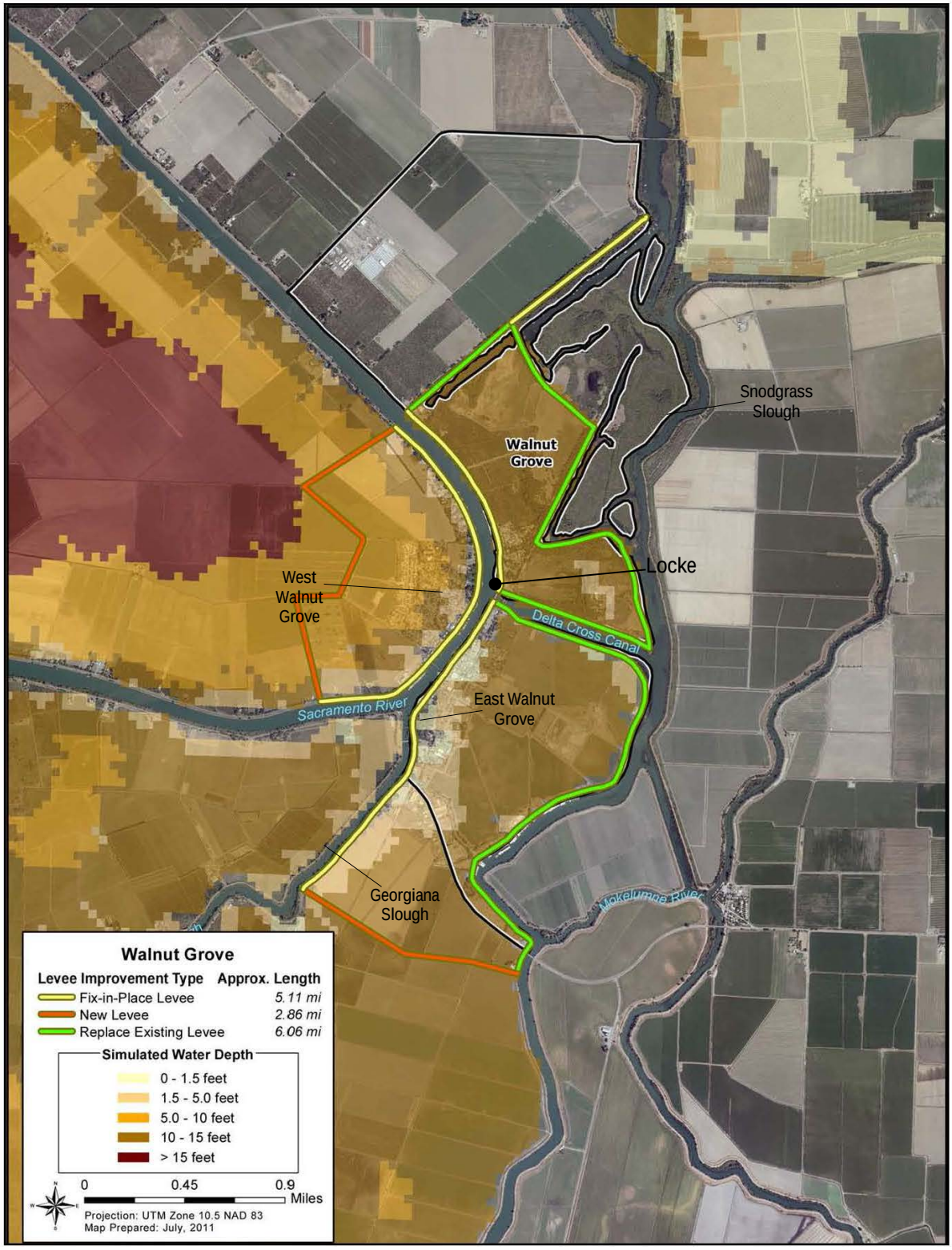
Table 5-32. Costs of Remediation of Perimeter Levee around West Walnut Grove, East Walnut Grove, and Locke from NULE

Segment	Length (Feet)	Length (miles)	Total fix-in-place cost (2014 Dollars)
East Walnut Grove			
130	64,111	12.14	134,306,729.72
1043	51,550	9.76	225,197,283.02
1051	8,880	1.68	27,052,757.14
1052	4,200	0.80	10,589,294.00
West Walnut Grove			
113.1	22,840	4.33	48,319,809.56
113.2	37,300	7.06	106,928,572.72
384.1	6,000	1.14	17,185,649.62
384.2	85,620	16.22	31,397,445.92
Locke			
1040	7,300	1.38	18,559,540.00
1053	3,918	0.74	6,618,784.16
1054	10,979	2.08	16,760,547.22
Total	302,695	57.0	41,938,871

Zone D Designation

As stated previously, the Zone D designation would involve working with FEMA to designate the area as Zone D rather than Zone AE. The Zone D designation is used where there are possible but undetermined flood hazards, but no definitive analysis of flood hazards has been conducted.

Figure 5-20. West Walnut Grove, East Walnut Grove, and Locke



DWR CVFPP, 2013

5.3.2.4 City of Isleton

The City of Isleton lies along the Sacramento River and is within BALMD. Because the RFMP analysis is pre-feasibility, a definite solution for Hood has not been determined. Therefore, the recommended solution for Isleton would be a feasibility study, shown in Table 5-33, to determine the most appropriate solution.

Table 5-33. Isleton Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Isleton Improvements Feasibility Study	TBD	Pre-Feasibility	Not complete (complex requirements)	Local funding sources not identified	Potential link to the RASP

The feasibility study for Isleton would investigate the four options discussed in Section 5.0: structure raises, a ring levee, fix-in-place of the perimeter levees, and Zone D designation. The improvement for the City would be a one of or a combination of those four options. The following sections provide more detailed information about these options. When available, existing data or analysis was used, such as NULE or the 2012 CVFPP.

Structure Raises

In Isleton, there are an estimated 692 structures: 73 commercial, 20 industrial, 117 public, and 482 residential. It would cost $69,200,000 to raise the structures by one story at $100,000[8] per structure.

Ring Levee

A ring levee system was investigated in the 2012 CVFPP which includes a ring levee and reconstruction in-place repairs to portions of Segments 40 and 378, with the addition of a 0.7-foot levee raise to a portion of Segment 378, as well as construction of two new levees on the east and west between existing Levee Segments 40 and 378. The new levees would have a 12-foot crown, with an average height of 18 feet, spanning about 2 miles in total. The estimated cost of this option would be $47,427,239 (escalated to 2014 dollars). The conceptual alignment of the ring levee is shown on Figure 5-22.

Fix-in-place of Perimeter Levees

The perimeter levee, Levee Segment 378, around Isleton would be remediated by either repairing critical or serious sites on those levees identified in the FSRP or remediating the entire levee segments as calculated in NULE.

Repairs to critical or serious sites to Levee Segment 378 are described in Section 5.3.3.10 – BALMD.

[8] $100,000 to raise a structure is from the 2012 CVFPP – Attachment 8J.

A fix-in-place of deficiencies of the entire length of Levee Segment 378 was calculated through NULE. Costs for those repairs are shown in Table 5-34.

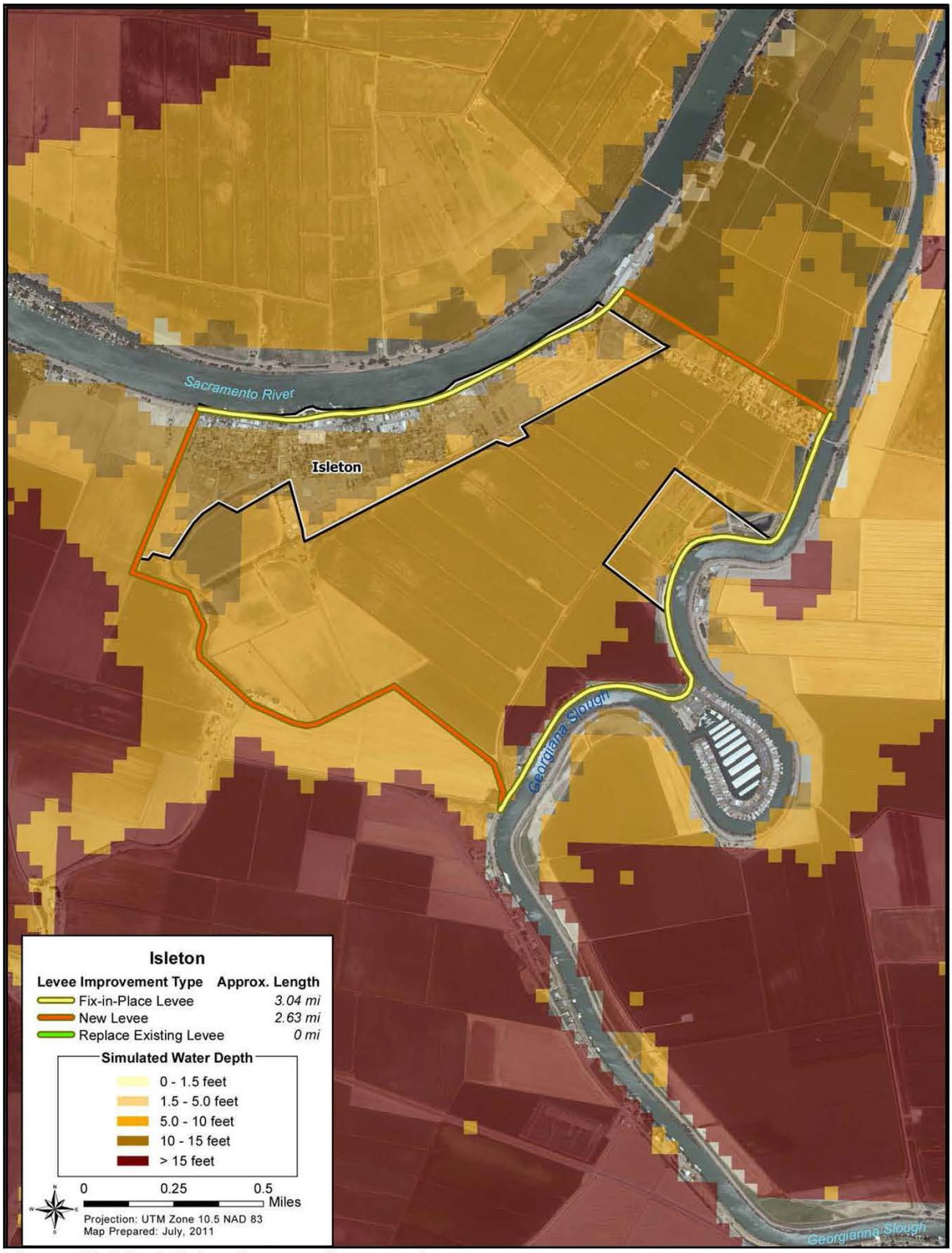
Table 5-34. Costs of Remediation of Perimeter Levee around Hood from NULE

Segment	Length (Feet)	Length (miles)	Total fix-in-place cost (2014 Dollars)
378	60,897	11.53	52,041,637
1048	24,125	4.57	80,119,372
1049	13,835	2.62	31,534,257
1050	15,305	2.90	29,734,084
40	31,798	6.02	59,819,835
Total	145,960	27.64	253,249,186

Zone D Designation

As stated previously, the Zone D designation would involve working with FEMA to designate the City of Isleton as Zone D rather than Zone AE. The Zone D designation is used where there are possible but undetermined flood hazards, but no definitive analysis of flood hazards has been conducted.

Figure 5-21. City of Isleton



DWR CVFPP, 2013

5.3.3 Sacramento County Rural Areas

The following sections present regional improvements for LMAs in the rural areas of Sacramento County. The sections are generally organized from north to south: DWR Maintenance Area 9, RD 755, RD 551, RD 349, RD 3, RD 369, RD 554, RD 563, RD 556, BALMD, RD 1601, and RD 341.

5.3.3.1 DWR Maintenance Area 9

As stated in section 4.2, the Sacramento Maintenance Area 9 which also encompasses the small community of Hood, has seepage concerns that need to be addressed. These proposed improvements represent a comprehensive solution to the Maintenance Area's seepage problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for Maintenance Area 9, which are summarized in Table 5-35. Figure 5-23 is a map of the location of the Maintenance Area.

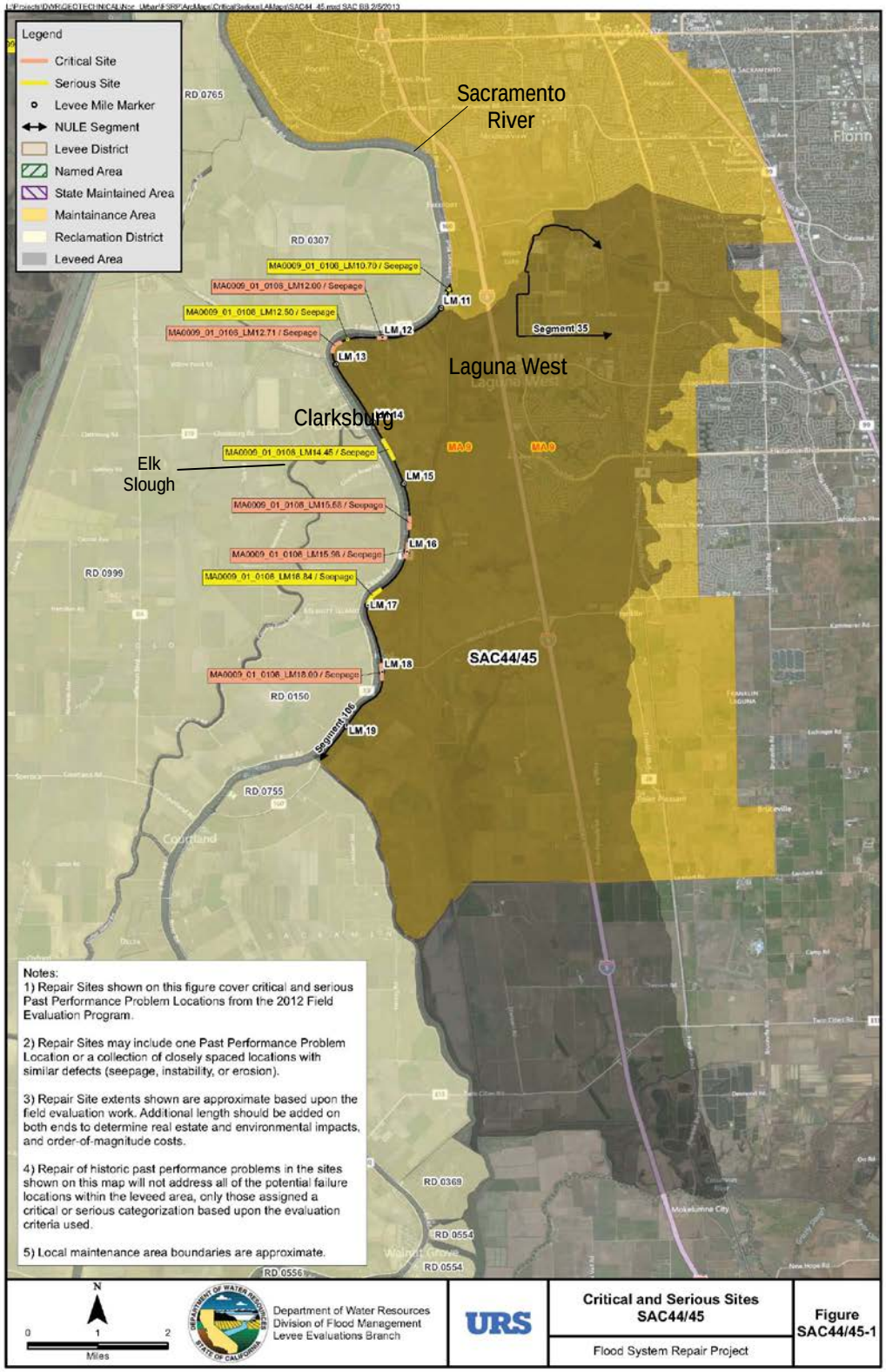
Sacramento River Seepage Protection Project

There are multiple serious and critical seepage sites in Maintenance Area 9 from the FSRP. DWR plans to construct a seepage protection project along the Sacramento River to repair the multiple locations. The seepage control project would consist of multiple gradations of rock and fill to control the seepage. The sites begin at levee mile 10.7 and end at levee mile 18.1 with a total rehabilitated length of 8,150 feet.

Table 5-35. DWR Maintenance Area 9 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sacramento River Seepage Protection Project	$5,263,710 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

Figure 5-22. DWR Maintenance Area 9 Levees



DWR FSRP, 2013

5.3.3.2 RD 755 – Randall

RD 755 – Randall has similar issues to the other LMAs in the region. Their primary issues however, are related maintenance activities. The following improvements include repairs to their system to sites identified in the FSRP. Table 5-36 summarizes these improvements and Figure 5-24 shows the levees around RD 755.

Sacramento River Seepage Repair Project

There are seepage sites in RD 755 identified in the FSRP. These seepage sites can be repaired through construction of a seepage protection project along the Sacramento River. The seepage protection project would be 4,000 feet long from approximately levee mile 0.1 to 0.9. The seepage control project would consist of multiple gradations of rock and fill to control the seepage.

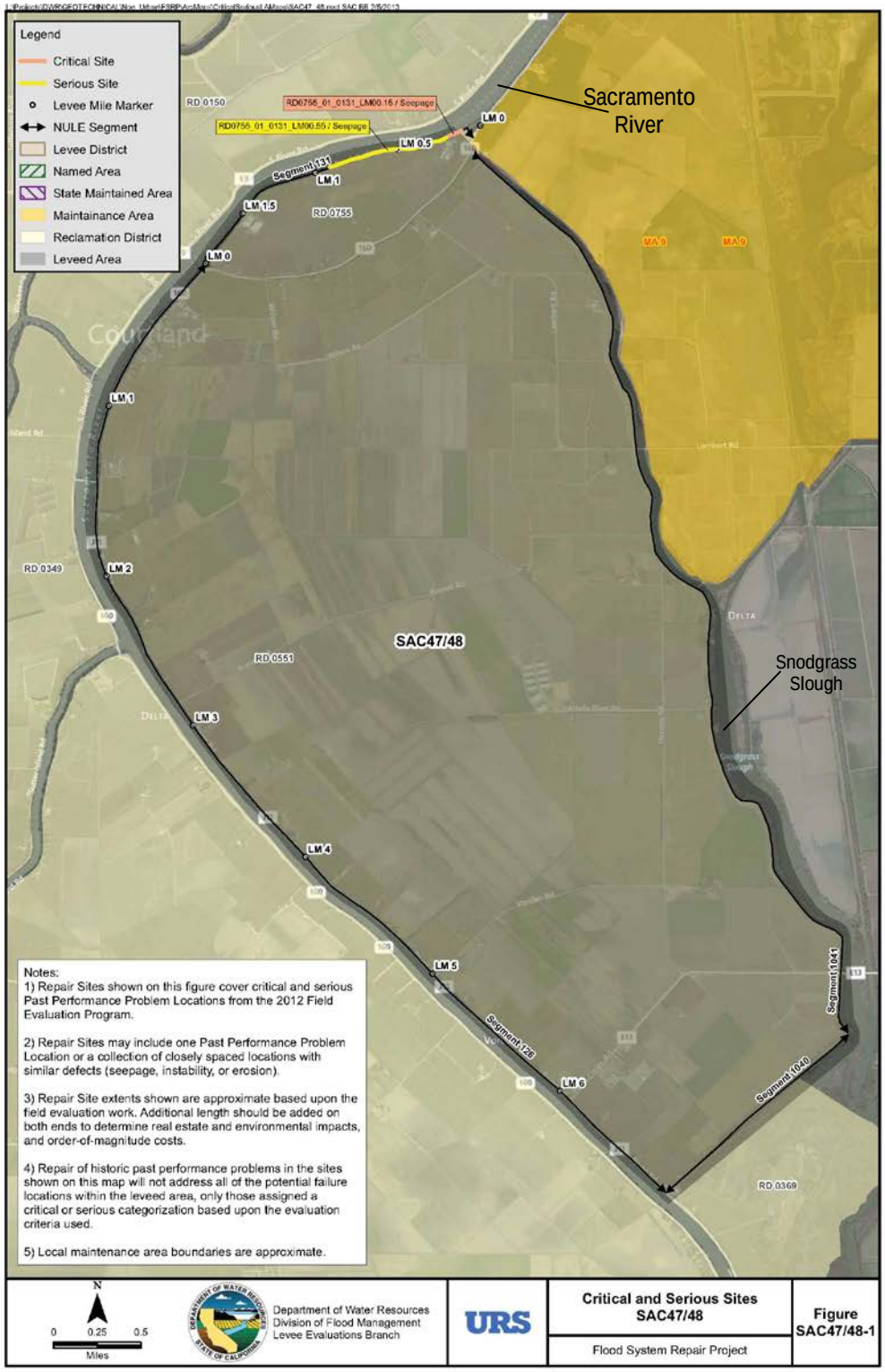
Table 5-36. RD 755 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sacramento River Seepage Repair Project	$2,583,416 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

5.3.3.3 RD 551 – Pierson

RD 551, which also encompasses the small community of Courtland, has similar issues to the other communities in the region. Its primary issues however, are related maintenance activities. Because of this, there are no major improvements recommended for RD 551 in this RFMP. RD 551 will instead focus on vegetation and rodent control, seepage control, bank protection/erosion control, access road maintenance, and encroachment repairs and modifications. Figure 5-24 shows levee around RD 551.

Figure 5-23. RD 755 and RD 551 Levees



DWR FSRP, 2013

5.3.3.4 RD 349 – Sutter Island

RD 349 – Sutter Island has similar issues to the other LMAs in the region. Its primary issues however, are related maintenance activities. The following improvements include repairs to their system to sites identified in the FSRP. Table 5-37 summarizes these improvements and Figure 5-25 shows the levees around RD 349.

Sutter Slough Seepage Repair Project

There are two critical seepage sites in RD 349 identified in the FSRP. The sites would be repaired with the construction of a seepage protection project along Sutter Slough. The seepage protection project would be 1,000 feet long from approximately levee mile 0.04 and 3.01 to 3.05. The seepage control project would consist of multiple gradations of rock and fill to control the seepage.

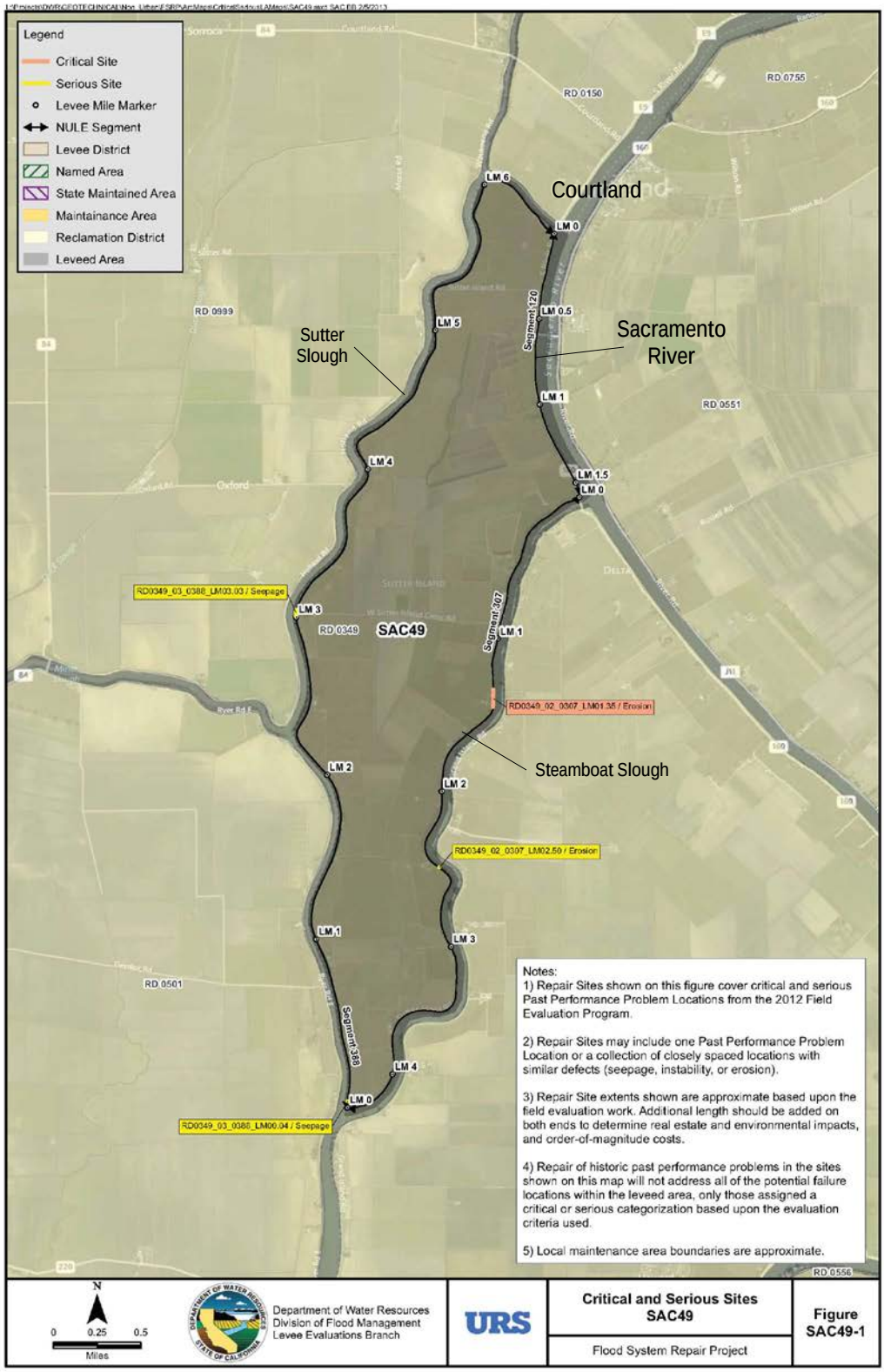
Steamboat Slough Bank Protection Project

There are two erosion sites along Steamboat Slough identified in the FSRP. The project will rehabilitate the waterside bank from levee mile 1.3 to 1.4 and 2.5, a total rehabilitated length of 300 feet.

Table 5-37. RD 349 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sutter Slough Seepage Repair Project	$645,854 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Steamboat Slough Bank Protection Project	$340,191 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

Figure 5-24. RD 349 Levees



DWR FSRP, 2013

5.3.3.5 RD 3 – Grand Island

As stated in section 4.2, RD 3, which also encompasses the small community of West Walnut Grove has seepage and erosion concerns that need to be addressed. Information on these improvements was collected from the June 2012 Five Year Plan for Grand Island. These proposed improvements represent a comprehensive solution to RD 3's flooding problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for RD 3, which are summarized in Table 5-38. Figure 5-26 shows the levees around RD 3.

Erosion/Bank Protection Projects

The first project includes the rehabilitation of three sites on Steamboat Slough and two sites on the Sacramento River. There is approximately 1,500 lineal feet of eroding levee on the waterside of Steamboat Slough at levee miles 0.18 to 0.25, 0.92 to 0.97, and 1.04 to 1.08 and approximately 600 feet on the Sacramento River at levee miles 11.3 to 11.4 and 16.8 to 16.9.

The quantity estimate for the erosion repair and bank protection project was generated using topographic data that was collected in the field to delineate the erosion at the multiple site locations. Because the project is in the design phase, these quantities may change. Due to the large amount of trees at four of the five project site locations, a substantial portion of this project will focus on preservation of trees and mitigation on or off-site.

The amount of material, imported fill and quarry stone, will range between five to ten tons per foot for the four site locations that have large scours. This includes three sites on Steamboat Slough, and one site south of Walnut Grove on the Sacramento River. The other site on the Sacramento River, north of Walnut Grove, will only require one to two tons per foot. All sites that have vegetation impacts and in-water work will have on-site mitigation considered as the primary mitigation component for the repair. The total anticipated cost for all aspects of the work, to repair the five sites totaling over 2,400 lineal feet of repair, is $1.5 million.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the Erosion/Bank Protection Project. Assuming the financing is secured, the project will take approximately two years to complete.

Another proposed bank protection project on the Sacramento River and Steamboat Slough is based on the District Trustees and engineer's knowledge of how the levees have performed, the District's knowledge of existing conditions at the southern end of the District, and the anticipated need for future work on both the Sacramento and Steamboat Slough levees that could be repaired if financial support is available.

The cost of the construction of the project includes: the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 10,000 tons of riprap quarry stone and 5,000 tons of imported fill will be used.

Assuming the financing is secured, the project will take approximately three years to complete.

Seepage Control Projects

The next project proposed is a seepage control project on Steamboat Slough, between levee miles 4.83 and 6.42 (Stations approximate 280+00 and 290+00). The project would consist of multiple gradations of rock and fill to control the flow to the drainage pipes that will capture seepage and discharge in the lateral, and eventually into a district canal. The project will require over 40,000 tons of fill, and 35,000 tons of well graded gravel materials.

The District has already received the permit from the CVFPB to construct the seepage berm. The cost estimate is based on a cursory review of similar projects in the past and should not be considered final. The erosion repair sites on the lower Sacramento River and Steamboat Slough have not been surveyed. Quantity estimates will be based on length of sites and assumed quantity.

Assuming the financing is secured, the project will take approximately three years to complete.

There is an additional critical seepage site in RD 3 from FSRP that is not addressed by improvements from its five-year plan. The site is located between levee mile 8.24 and 8.30 along the Sacramento River, with a total rehabilitated length of 300 feet. Consistent with other seepage control projects in RD 3, the project would consist of multiple gradations of rock and fill to control the seepage.

Encroachment Modification Project

An encroachment modification project is proposed just north of the Ryde Hotel, where the main pumping plant connects to the drainage canal along Highway 220. The encroachment modification project is in the planning phase.

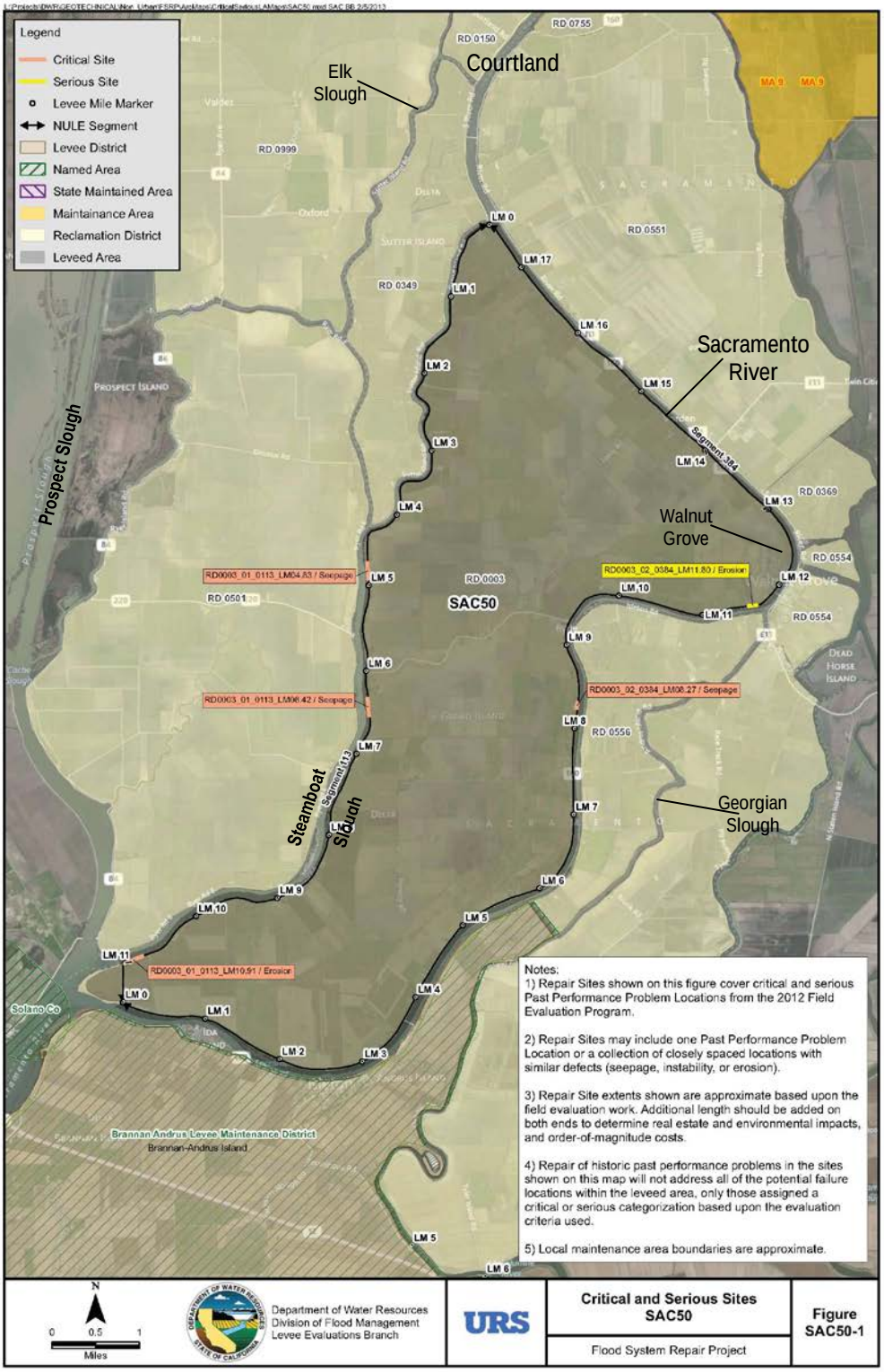
The cost of the construction of the project includes: the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 200 tons of riprap quarry stone, 500 tons of gravel, and 10,000 tons of imported fill will be used.

Assuming the financing is secured, the project will take approximately three years to complete.

Table 5-38. RD 3 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Erosion/Bank Protection Project – Grand Island	$1,550,121	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured	Ecosystem Restoration Contained in RD3 5-yr plan
Steamboat Slough Seepage Control Project – Grand Island	$1,756,804	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured	Potential link to the RASP
Encroachment Modification Project – Grand island	$2,635,206	Pre-Feasibility	Not complete (standard or simple requirements)	Local funding source secured	Potential link to the RASP
Erosion/Bank Protection Project 2 – Grand Island	$1,498,450	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured	Ecosystem Restoration Contained in RD3 5-yr plan
Sac R Seepage Control Project 2 – Grand Island	$193,756 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured	Potential link to the RASP

Figure 5-25. RD 3 Levees

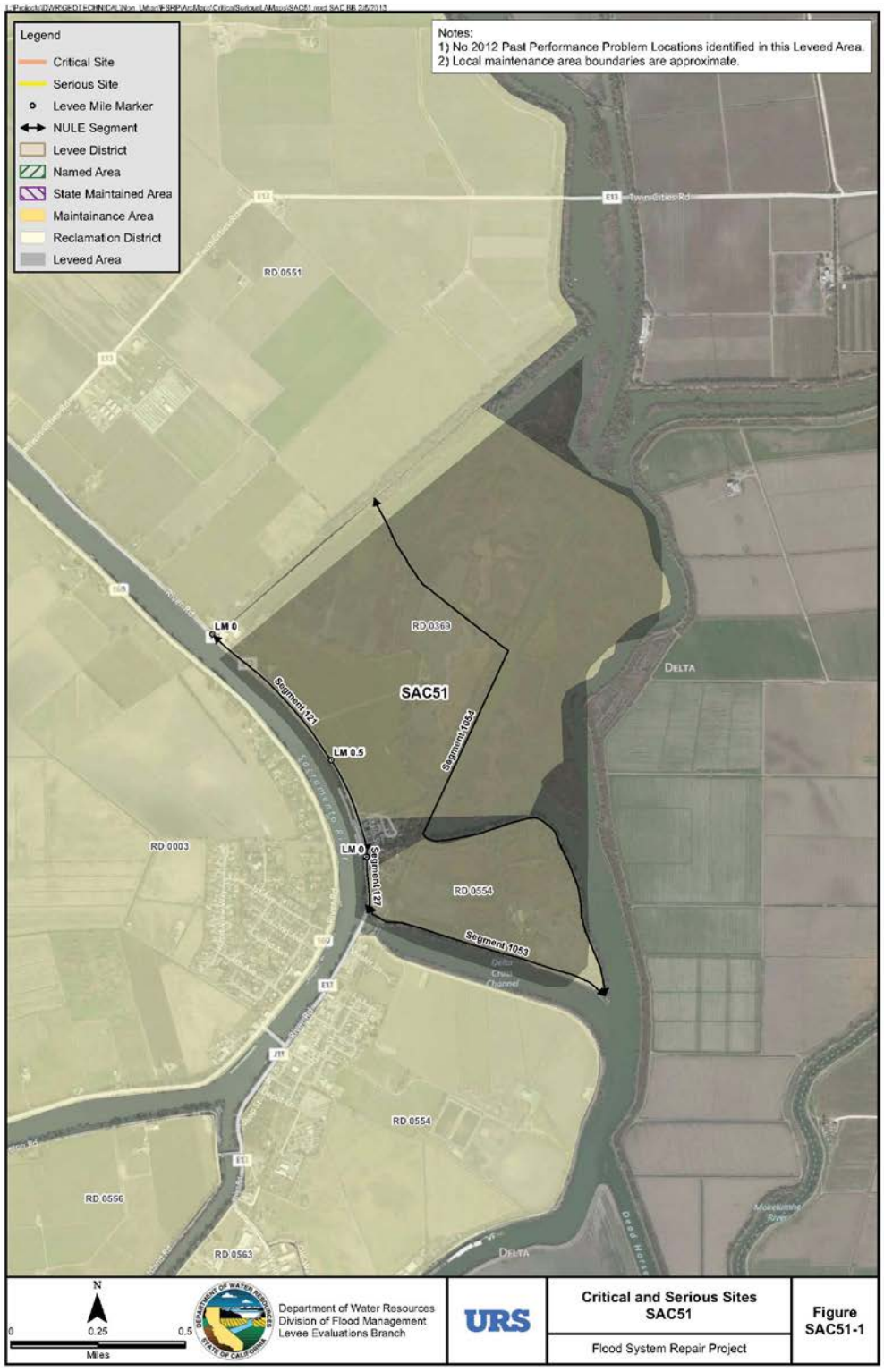


DWR FSRP, 2013

5.3.3.6 RD 369 – Libby McNeil

RD 369, which also encompasses the small community of Locke, has similar issues to the other communities in the region. Their primary issues however, are related maintenance activities. Because of this, there are no major improvements recommended for RD 369 in this RFMP. RD 369 will instead focus on vegetation and rodent control, seepage control, bank protection/erosion control, access road maintenance, and encroachment repairs and modifications. Figure 5-27 shows the levees around RD 369.

Figure 5-26. RD 369 Levees



DWR FSRP, 2013

5.3.3.7 RD 554 – Walnut Grove

RD 554, the upper portion of Tyler Island, manages the levee system that protects east Walnut Grove. This portion of Tyler Island has never flooded since the founding of Walnut Grove and the establishment of the RD in the late 1800s. RD 554 considers the protection of the east Walnut Grove a high priority. RD 554's long term goal is to maintain or exceed the FEMA Urban levee standard. Figure 5-28 shows the levees around RD 554 and solutions are described in this section and listed in Table 5-39.

There are two crucial long-term objectives for RD 554: maintain levee height and improve stability to increase the factor of safety. The District's first priority is to address any FEMA urban engineering standards or geometry deficiencies within the levee system. This objective requires maintaining levee height and adding back slope to minimize the risk of water over-topping and improve levee stability. The second priority is to fill the Old Tyler Island Slough to strengthen the dry levee toe and thereby improve levee stability if lower Tyler was to flood. RD 554 is proposing various additional projects to address observed erosion and slumping along the dry cross levee. These projects would reduce the RD's vulnerability to failure, raise the levee crown, and provide landside fill and landside toe strengthening.

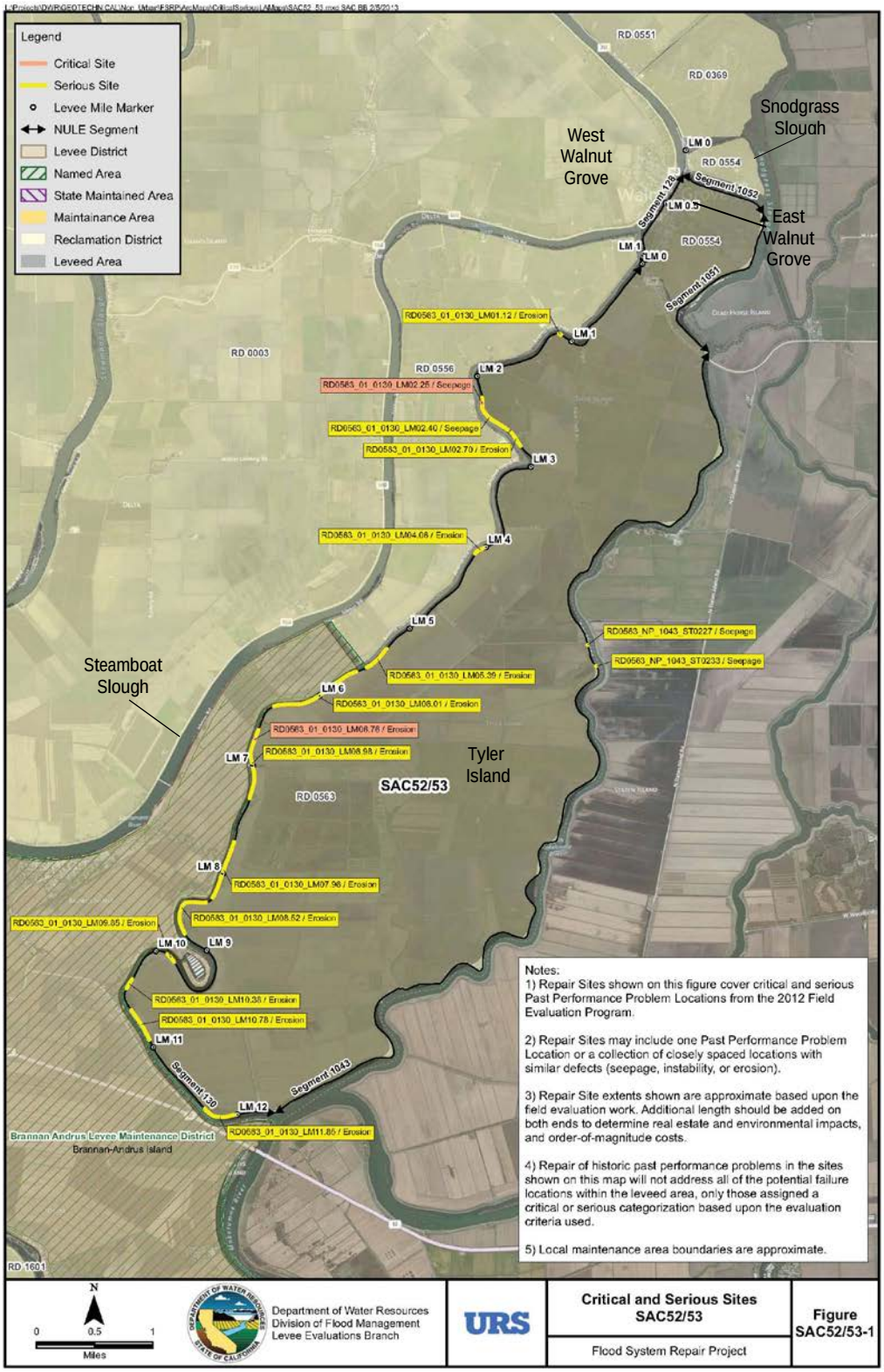
Levee Improvements

The proposed projects include landside fill and minor crown-raising on the Snodgrass Slough levee, crown-raising on the Snodgrass Slough Road and Old Walnut Grove Road, and fill of former Tyler Slough along Old Walnut Grove Road. RD 554 expects that all projects will require an Initial Study and mitigated negative declaration to meet CEQA, except for the crown-raising for Snodgrass Slough Road and Old Walnut Grove Road which would require a categorical exemption.

Table 5-39. RD 554 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Snodgrass Slough Landside Fill and Minor Crown Raising	$1,125,529	Bid ready	Not complete (standard or simple)	Local Funding source secured	Potential link to the RASP
Snodgrass Slough Road and Old Walnut Grove Road Crown Raising	$103,341	Plans and Specifications under development	Not complete (standard or simple)	Local Funding source secured	Potential link to the RASP
Fill of Fomer Tyler Slough along Old Walnut Grove Road	$274,526	Plans and Specifications under development	Not complete (standard or simple)	Local Funding source secured	Potential link to the RASP

Figure 5-27. RD 554 and RD 563 Levees



DWR FSRP, 2013

5.3.3.8 RD 563 – Tyler Island

RD 563 is facing many of the same infrastructure, funding, O&M, institutional, emergency response, environmental, agricultural sustainability, and climate change problems as many of the LMAs in the Region. There are four proposed improvements for RD 563 to address the problems the District is facing. Information on these improvements was collected from the March 2012 Five Year Plan for Tyler Island. These proposed improvements represent a comprehensive solution to RD 563's flooding problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for RD 563, which are summarized in Table 5-40. Figure 5-28 shows the levees around RD 563.

Rock Slope Protection Project

RD 563 plans first to ensure the protection of the existing levee by adding supplementary quarry stone riprap above the existing riprap to any portions of the waterside slope of the levee requiring additional rock slope protection. This will prevent erosion and avoid ongoing repairs.

Prior to submitting a project proposal, a thorough riprap inventory of the District must be completed to determine where supplementary riprap may be necessary and determine more definitive quantities and costs required to complete the project. Quantities and costs are based on the most recent survey and inspection.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the Rock Slope Protection Project. Assuming the financing is secured, the project will take approximately one year to complete.

HMP Levee Improvement Project

The Hazard Mitigation Plan (HMP) Levee Improvement Project will bring the portions of levee currently below the HMP Criteria to six inches above the PL 84-99 Standard using 2:1 landside slopes. If sufficient funding is available, the segments of levee improved during this phase will include portions of the levee that meet the HMP Criteria, but do not meet the design template for this project, due to the many relatively short stretches of levee that do not meet the PL 84-99 Standard in close proximity to longer stretches of levee that do not meet the HMP Standard. These smaller stretches of PL 84-99 improvements have been included in the HMP improvement projects to maximize the effectiveness of the HMP project. This will also increase the continuity of the improved segments of levee.

The HMP project sites are proposed to be limited to the locations as shown in Table 5-40.

Table 5-40. RD 563 HMP Project Sites

Start Station	End Station	Length in Feet
237+86	240+74	288
251+60	253+20	160
257+39	258+27	88
351+82	352+36	54
419+00	471+00	5,200
707+45	713+46	601
1050+82	1051+98	116
Note: Stations are defined by RD 563.		

These project sites may be addressed individually, or as a single project. The cost estimate provided in this report treats all HMP improvement sites as a single project, and costs are reported accordingly.

Quantities and costs are based on the most recent survey and inspection. A design-level survey and inspection of the District must be completed prior to submitting a project proposal to determine more definitive quantities and costs required to complete the project.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the HMP Levee Improvement Project. Assuming that financing is secured, the project will take approximately one year to complete.

PL 84-99 Levee Improvement Project (Improvement to PL 84-99 Standard)

After the entire levee meets or exceeds the HMP Criteria, the District will bring any remaining portions of levee below the PL 84-99 Standard to six inches above the PL 84-99 Standard. This work will likely be divided into several phases or projects, depending on the funding available.

The PL 84-99 project sites are proposed to be limited to the following locations as shown in Table 5-41.

Table 5-41. RD 563 PL-84-99 Project Sites

Start Station	End Station	Length in Feet
29+00	101+00	7,200
139+00	271+00	13,200
299+00	353+00	5,400
363+08	369+69	661
419+00	491+00	7,200
509+00	581+00	7,200
597+38	602+11	473
699+00	732+12	3,312
772+05	774+37	232
825+00	835+00	1,000
899+00	911+00	1,200
959+00	971+00	1,200
989+00	1001+00	1,200
1019+00	1132+76	11,376
1145+00	1155+00	1,000
1169+00	1191+00	2,200
Note: Stations are defined by RD 563.		

These project sites may be addressed individually, or as a single project. The cost estimate provided in this report treats all PL 84-99 improvement sites as a single project, and costs are reported accordingly.

No portions of the levee, which currently meet the PL 84-99 Standard, will be improved as a component of the projects recommended in this Plan.

Quantities and costs are based on the most recent survey and inspection. A design-level survey and inspection of the District must be completed prior to submitting a project proposal to determine more definitive quantities and costs required to complete the project.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the PL 84-99 Levee Improvement Project. Assuming the financing is secured, the project will take approximately 2 years to complete.

Vegetation Maintenance and Removal Project

In addition to the levee improvement projects, RD 563 will perform general vegetation removal from the levee slope and 15 feet from the levee toe including: the removal of invasive Arundo Donax, mitigation of elderberry bushes that currently impede visibility, thinning and trimming of existing trees, and removal of tree stumps if deemed necessary, as well as any other various vegetation related issues noted. The goal of this project is to meet, at minimum, the Central Valley Flood Protection Plan Levee Vegetation Management Strategy criteria.

Quantities and costs are based on the most recent survey and inspection. A thorough inspection of the District must be completed prior to submitting a project proposal to determine more definitive quantities and costs required to complete the project.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the Vegetation Maintenance and Removal Project. Assuming that financing is secured, the project will take approximately one year to complete.

Table 5-42. RD 563 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefit
Rock Slope Protection Project	$840,992	Bid ready	Not complete (standard or simple requirements)	Local funding source secured	Potential link to the RASP
HMP Levee Improvement Project	$728,454	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured	Potential link to the RASP
PL 84-99 Levee Improvement Project	$15,122,361	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured	Potential link to the RASP
Vegetation Maintenance and Removal Project	$1,481,296	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding sources not identified	Potential link to the RASP

5.3.3.9 RD 556 – Upper Andrus

RD 556 – Upper Andrus has similar issues to the other LMAs in the region. Their primary issues however, are related maintenance activities. The following improvements include repairs to their system at sites identified in the FSRP. Table 5-43 summarizes these improvements and Figure 5-29 shows the levees around RD 556.

Sacramento River Seepage Repair Project

There is a critical seepage site in RD 556 identified in the FSRP that is not addressed by improvements from its five-year plan. These sites would be repaired with the construction of a seepage protection project along the Sacramento River. The seepage protection project would be 1,950 feet long from approximately levee mile 3.58 to 3.95. The seepage control project would consist of multiple gradations of rock and fill to control the seepage.

Georgiana Slough Stability Project

There are four stability sites in RD 556 identified in the FSRP. These sites would be repaired through the construction of a stability protection project along Georgiana Slough. The stability protection project would be 1,720 feet from levee mile 1.8 to 4.9.

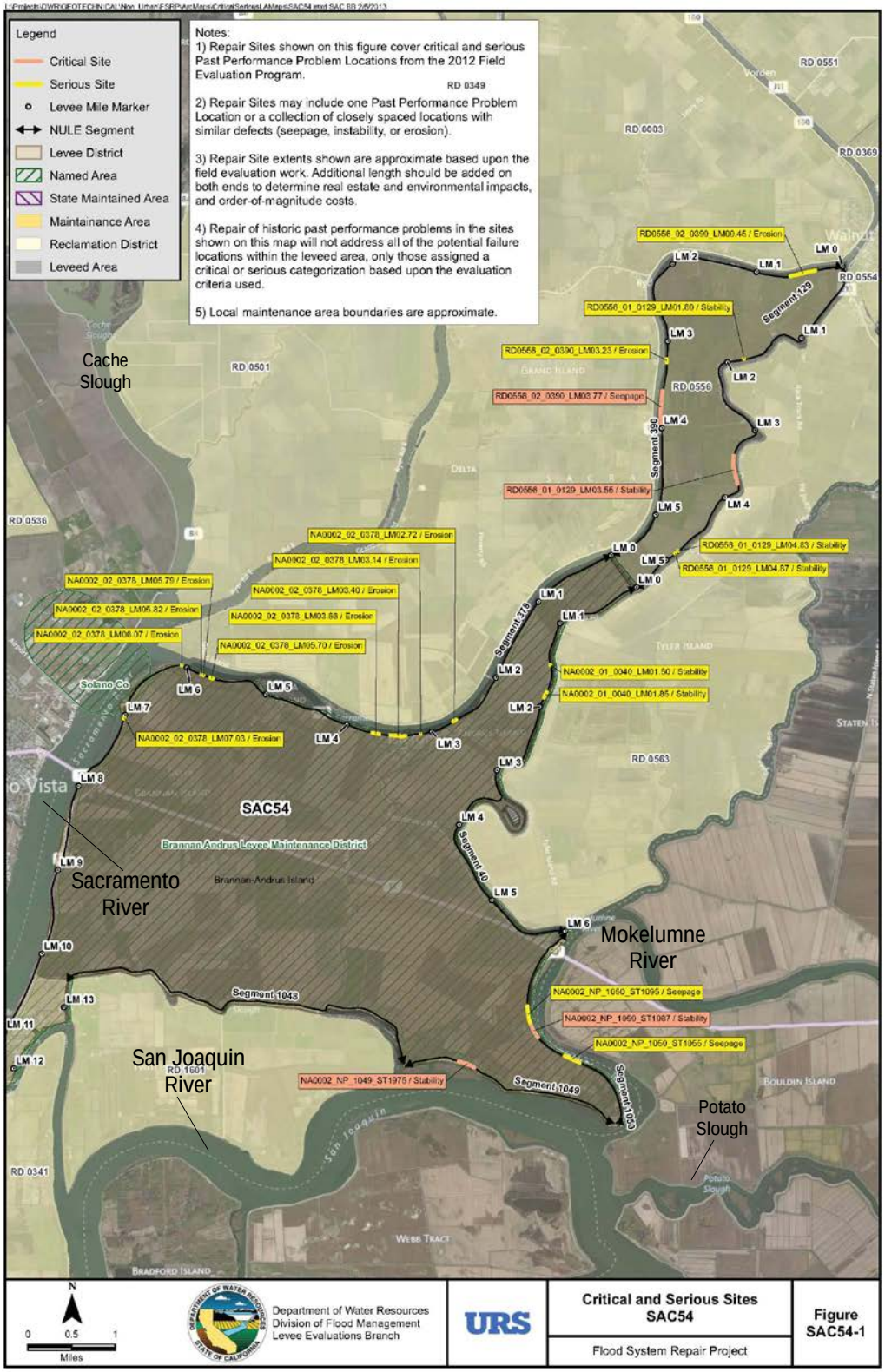
Sacramento River Bank Protection Project

There are two erosion sites along the Sacramento River identified in the FSRP. These erosion sites can be improved through the construction of a bank protection project along the Sacramento River. The project will rehabilitate the waterside bank from levee mile 0.31 to 3.25, a total rehabilitated length of 1,700 feet.

Table 5-43. RD 556 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sacramento Seepage Repair Project	$1,259,415 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding sources not identified	Potential link to the RASP
Georgiana Slough Stability Project	$997,817 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding sources not identified	Potential link to the RASP
Sacramento River Bank Protection Project	$1,927,748 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding sources not identified	Potential link to the RASP

Figure 5-28. RD 556 and BALMD Levees



DWR FSRP, 2013

5.3.3.10 BALMD

The Brannan-Andrus Levee Maintenance District (BALMD) levees meet or exceed the PL 84-99 levee standard geometry, with the exception of the non-tidal area by dams on Sevenmile Slough. The long-term goals for the maintenance and improvement of the levee system are to: maintain or exceed levee geometry minimums, increase slope stability to meet PL84-99 engineering standards, construct additional seepage management system, maintain existing revetment, and address some deeper water erosion sites that could eventually threaten the critical levee cross-section. Information on these improvements was collected from BALMD's Five Year Plan. These proposed improvements represent a comprehensive solution to BALMD's flooding problems including the critical and serious sites identified in the FSRP. Figure 5-29 shows the levees around BALMD and solutions are described in this section and listed in Table 5-44.

BALMD believes that the most vulnerable levee sections in the system are along Georgiana Slough, a small segment of Sevenmile Slough, and the Mokelumne River reach extending from the tip of Perry's Resort Island to Rancho Marina Resort. BALMD's long-range plan is to reduce vulnerability to failure by concentrating on these priorities and continuing with seepage management projects on Georgiana Slough.

Levee Improvements

BALMD has proposed projects specifically to improve flood protection and to address observed erosion, seepage, and slumping. The projects include the following:

- Mokelumne River: A stability berm approximately 80' wide by 5' high on the landside toe,
- Mokelumne River: A French drain (also called a Rock Drain). The existing toe ditch will be removed and a drain will be placed in the existing irrigation ditch and the toe ditch will be replaced with a French drain and slope drainage blanket.
- Mokelumne River: Raising of the levee crown to repair PL 84-99 deficiencies.
- Seven Mile Slough: A stability berm 60' wide by 5' high along the landside levee toe.
- Seven Mile Slough: A French drain (also called a Rock Drain). The existing toe ditch will be removed and a drain will be placed in the existing irrigation ditch and the toe ditch will be replaced with a French drain and slope drainage blanket.
- Seven Mile Slough: A French drain. The existing ditch will be filled with gravel and an 8" diameter drain line placed in the lowered existing ditch and a drainage blanket will be constructed on the levee slope. If necessary, a new irrigation ditch will be placed away from the toe to separate functions.
- Crown-raising on the Mokelumne River levee; a stability berm and French drain on the Sevenmile Slough levee; and a French drain on the Georgiana Slough levee. BALMD

anticipates that an Initial Study and Mitigated Negative Declaration would be required for all of these projects.

Multi-benefit Improvements

BALMD has also proposed a series of multi-benefit projects for repairing erosion, creating Shaded Riverine Habitat (SRA), and providing for future habitat expansion. These projects include a revetment on the Sacramento River levee to rebuild the slope and create a stable foundation for an eco-berm and an SRA habitat bench. Another project would be to develop tidal marsh, shrub upland, and tree upland habitat in a portion of a dredge disposal site for mitigation for current and future projects and allow for future habitat expansion. BALMD anticipates that an Initial Study and Mitigated Negative Declaration would be required for both of these projects.

Sacramento River Bank Protection Project

Additional sites along the Sacramento River require bank protection, as identified in the FSRP. Levee mile 3 to 7 requires bank protection, with a total rehabilitated length of 2,145 feet.

Georgiana Bank Protection Project

Along the Georgiana slough there is a 700 lineal foot, water-side levee toe erosion issue on the from BALMD station 17+00 to station 24+00, which was identified through a bathymetry survey.

Table 5-44. BALMD Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sacramento River Revetment and Shaded Riverine Aquatic (SRA) Habitat Enhancement	$2,583,535	Bid ready	Not complete (standard or simple requirements)	Local funding source secured	Ecosystem Restoration Contained in BALMD 5-yr plan
Dredge Material Rehandling Site Habitat Bank Development	TBD	Bid ready	Not complete (standard or simple requirements)	Local funding sources not identified	Ecosystem Restoration
Mokelumne River Stability Berm	$930,073	Bid ready	Not complete (standard or simple requirements)	Local funding source secured.	Potential link to the RASP
Mokelumne River French Drain	$258,351	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured.	Potential link to the RASP
Mokelumne River Crown Raising	$516,707	Bid ready	Not complete (standard or simple requirements)	Local funding source secured.	Potential link to the RASP
Sevenmile Slough Stability Berm	$826,731	Bid ready	Not complete (standard or simple requirements)	Local funding source secured.	Potential link to the RASP
Sevenmile Slough French Drain	$413,366	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured.	Potential link to the RASP
Georgiana Slough French Drain	$2,066,828	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured.	Potential link to the RASP
Sacramento River Bank Protection Project	$2,432,365 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP
Georgiana Bank Protection Project	$793,779 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local Funding sources not identified	Potential link to the RASP

5.3.3.11 RD 1601 – Twitchell

RD 1601 is facing many of the same infrastructure, funding, O&M, institutional, emergency response, environmental, agricultural sustainability, and climate change problems as many of the LMAs in the Region. There are three proposed improvements for RD 1601 to address the problems the District is facing. Information on these improvements was collected from the October 2010 Five Year Plan for Twitchell Island. These proposed improvements represent a

comprehensive solution to RD 1601's flooding problems including the critical and serious sites identified in the FSRP. The following sections describe proposed improvements for RD 1601, which are summarized in Table5-45. Figure 5-30 is a map of RD 1601.

San Joaquin River Levee Improvement Project

Several waterside embankments were identified during a 2009 Geotechnical Investigation and Evaluation Report as having steep slopes that may be susceptible to deterioration with further slope erosion. The most critical section, Station 381+00 was shown by analysis to be marginally stable. Repair of these critical waterside slope areas should be initiated as soon as possible. The approximate areas of waterside concern are: Station 381+00; Station 456+00; Station 569+00; and Station 599+00. All stations described in this section are defined by RD 1601.

Four seriously deficient high-priority areas on the landside have been identified as having seepage problems. The areas are: Station 615+50; Station 524+80 to 530+70; Station 510+00; and Station 450+30 to 452+30.

An interim approach to reduce the risk of a major, catastrophic waterside failure is to extend the levee landward and then excavate a portion of the waterside embankment to achieve a 2:1 slope. Such a slope would increase stability and provide a waterside slope such that erosion protection might reasonably be achieved using riprap. A berm with a minimum width of at least 60 feet beyond the levee toe should be present or constructed at these locations, and the crown should be widened as necessary to meet the required standards after waterside flattening.

Medium-priority levees are those segments that are potentially substandard with regard to landside stability, but that do not have steepened waterside slopes. The establishment of an 8 foot thick berm and setback levee is required for this category of levees. These levees include the entire levee along the San Joaquin River, from Station 365+00 to Station 627+79.01, with the exception of areas specifically noted as high- or low- priority areas.

Low-priority levees are those segments which have been setback during the 1999-2000 Setback Levee Habitat Restoration Project, from Station 570+00 to Station 600+00. The slopes in this area are designed to allow for erosion and slope failure on the waterside without compromising the integrity of the setback levee.

Stability analysis on the landside of this reach of levee showed that raising the proposed levee to an elevation of 11.5 feet is obtainable without a stability berm. Low-priority levees range from Station 570+00 to 599+00. Closer surveys are recommended in the vicinity of Station 599+00 to define the extent of erosion.

Quantities and costs are based on the most recent survey and inspection. These areas should be defined more accurately by means of additional surveys.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the San Joaquin River Levee Improvement Project. Assuming the financing is secured, the project will take approximately 10 years to complete.

Sevenmile Slough Crown Raising to HMP Project

The Sevenmile Slough Crown Raising to HMP Project will bring the portions of levee, currently below the HMP Criteria, above the PL 84-99 Standard using 2:1 landside slopes.

Quantities and costs are based on the most recent survey and inspection. These areas should be defined more accurately by means of additional surveys.

The proposed schedule is based on the anticipated length of time required to complete the design and construction of the Sevenmile Slough Crown Raising to HMP Project. This project is a long-term goal for RD 1601, and would likely not be initiated until the Lower San Joaquin River Feasibility Study is complete, which could take approximately 10 years.

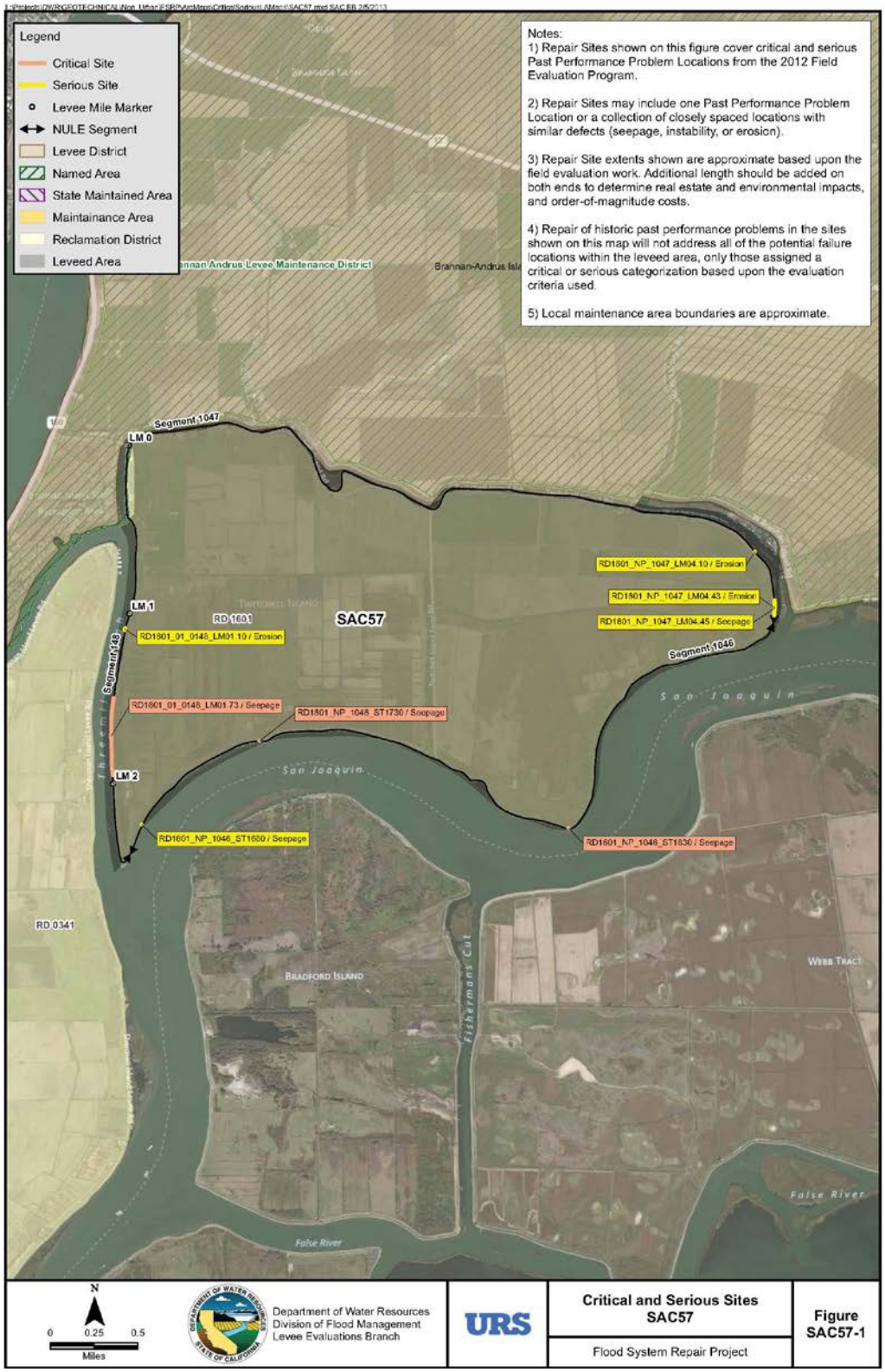
Threemile Slough Bank Protection Project

There are additional critical and serious erosion and seepage sites in RD 1601 from the FSRP that are not addressed by improvements from its 5 year plan. RD 1601 plans to construct a large bank protection project along Threemile Slough to protect erosion and seepage sites. The project will rehabilitate the waterside bank and incorporate an enhanced lower waterside slope habitat area with possible riparian forest, scrub-shrub, and emergent/freshwater marsh features to mitigate for loss of habitat and enhance the habitat value along the slough. The erosion protection will be approximately 1,320 feet from levee mile 1.09 to 1.1, and the seepage protection will be approximately 2,500 feet from levee mile 1.5 to 1.95.

Table 5-45. RD 1601 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
San Joaquin River Levee Improvement Project	$121,519,167	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured	Ecosystem Restoration Contained in RD 1601 5-yr plan
Sevenmile Slough Crown Raising to HMP Project	$22,330,528	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding source secured	Potential link to the RASP
Threemile Slough Bank Protection Project	$4,331,764 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Local funding sources not identified	Ecosystem Restoration

Figure 5-29. RD 1601 Levees



DWR FSRP, 2013

5.3.3.12 RD 341 – Sherman Island

RD 341 – Sherman Island has similar issues to the other communities in the region. Its primary issues however, are related maintenance activities. The following improvement includes a repair to their system to a site identified in the FSRP. Table 5-46 summarizes the improvement and Figure 5-31 shows the levees around RD 341.

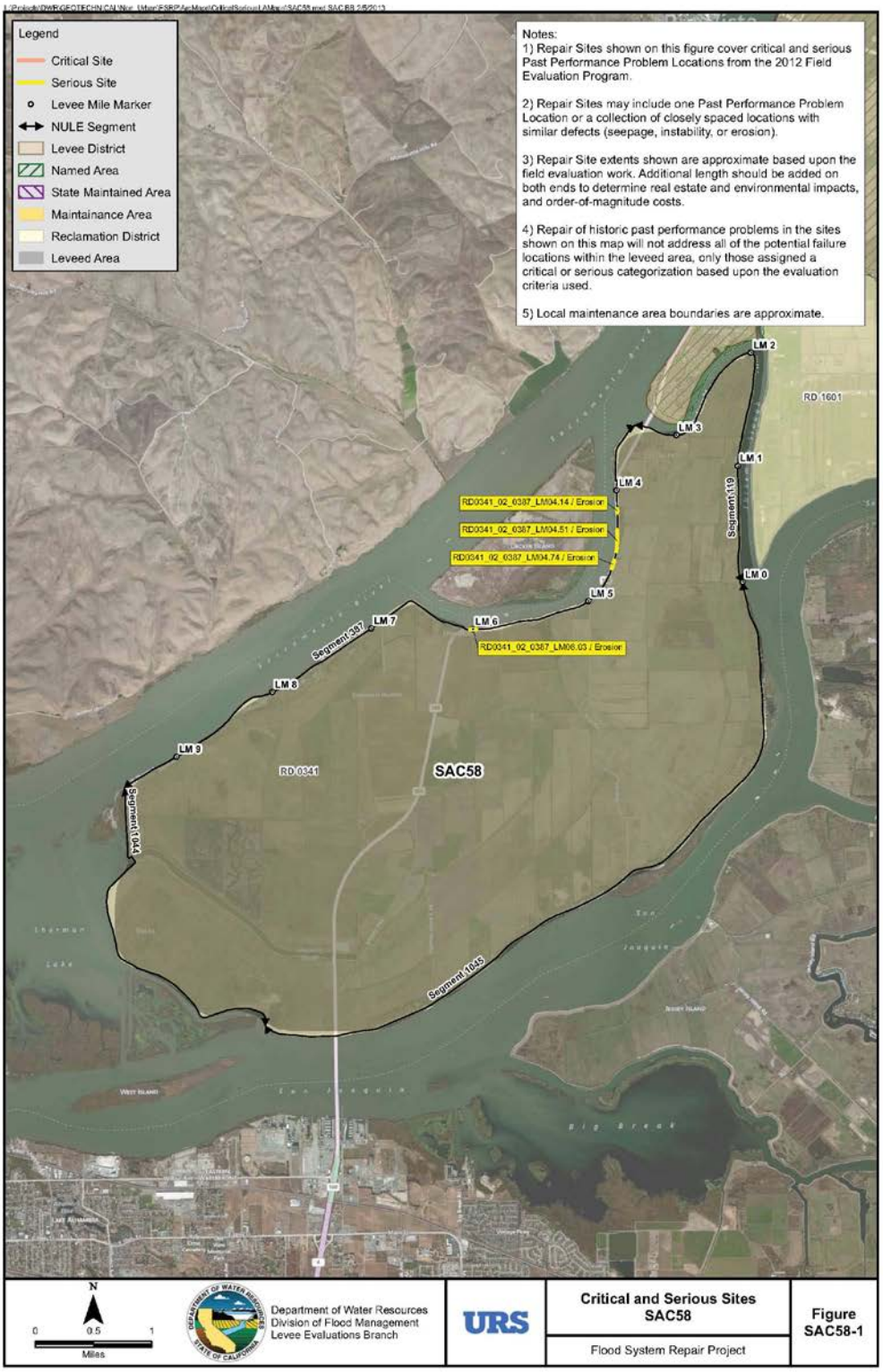
Sacramento River Bank Protection Project

There are four erosion sites along the Sacramento River identified in the FSRP. These erosion sites can be improved through the construction of a bank protection project along Cache Slough. The project will rehabilitate the waterside bank from levee mile 4.12 and 6.09, a total rehabilitated length of 1,994 feet.

Table 5-46. RD 341 Improvements

Solution	Estimated Cost (Incl O&M)	Design Readiness	Permitting Readiness	Funding Readiness (Incl O&M)	Multi Benefits
Sacramento River Bank Protection Project	$2,261,136 (PCET)	Plans and Specifications under development	Not complete (standard or simple requirements)	Funding sources not identified	Potential link to the RASP

Figure 5-30. RD 341 Levees



DWR FSRP, 2013

5.4 Residual Risk Management Improvements

The flood management systems within the Region have drastically reduced flood risks. Overtime, many improvements and repairs have been constructed further reducing risks to flooding. Despite these and future protection measures, flood risk cannot ever be completely eliminated. Severe weather, unanticipated failure, and negligence can all lead to potential failure.

The additional flood risk, after structural and non-structural flood management actions are taken, is referred to as "residual risk." There are still actions that agencies and communities can take to reduce residual risk. Some specific ways of approaching the application of management actions to reduce residual risk are through Flood Emergency Preparedness, Response, and Recovery, and Operations and Maintenance.

5.4.1 Flood Emergency Preparedness, Response, and Recovery (FEPRR):

As noted in Section 4.1.8, the region has a number of FEPRR problems which need solutions. Resourcing is one of the challenges each Operational Area and LMA faces in order to properly address their problems. The Region has shown some success in identifying, applying for, and receiving State funding to address some of the problems.

DWR has two types of grant programs specific to the Delta for improving local emergency response capabilities including: enhancing local emergency response plans, stockpiling flood fight materials and equipment, training and exercises, and making critical improvements.

In 2012, through the Delta Communications Equipment Grant Program, DWR awarded grants to the three Delta Counties in the region. Sacramento County received $1.7 million, Solano County received over $587 thousand, and Yolo County received $1.3 million. This funding was provided to help ensure a robust regional communication system for effective response to high water and flood emergencies and to improve communication between emergency response agencies on a regional basis. This recent funding should go a long way toward helping each of the region's OAs address some of the communications deficiencies.

Additionally, in 2013, through the Flood Emergency Response – Statewide Grant Program, DWR awarded Sacramento County OES almost $1 million for ER plans, exercises, and sensor upgrades. DWR also awarded the City of West Sacramento over $270 thousand for ER plans and mapping.

Currently, DWR has plans to make up to an additional $15 million in Delta ER Grants available by 2017.

While some regional agencies have been able to take advantage of the State grant funding opportunities, several LMAs lack the institutional capacity to secure grant funding.

5.4.2 Operations and Maintenance (O&M):

Existing O&M activities are often fragmented, underfunded, and thus ineffectual. Funding has been more difficult to secure because routine maintenance has increased in cost in recent years, due to escalating design and construction costs. Additional permitting restraints and requirements have also increased administration and field maintenance costs while decreasing periods when maintenance can be done. Establishing stable, adequate funding will be essential to longer success of O&M goals.

Efficiently consolidating reclamation districts can lead to some cost savings. Future consolidation will require local support amongst districts, residents, and affected property owners. Historically, consolidation of these independent districts with different structures, legal descriptions, authorities, funding sources, liabilities, Proposition 218 restrictions, etc. has proven to be a complex process.

Other options for improving the efficiency of O&M activities include supporting the State consolidating and expanding their responsibilities for the weirs and bypass channels of the SRFCP, streamlining regional permitting efforts through flood corridor management to reduce costs for individual RDs, and implementing Best Management Practices.

Coordinated partnership programs between regional agencies and the State and federal government can also be explored for waterside erosion repair. Projects such as the SRBPP have effectively been in place for critical erosion sites for over fifty years. SRBPP repairs, however, have been relatively costly due to the fact repairs are deferred until a site is critical. A new program, focused on a more proactive approach to erosion, could help lower costs.

Access to patrol roads for maintenance inspections and flood fighting need to be maintained year round, especially in areas where levees do not meet current levee criteria.

O&M will be conducted to keep regional flood management facilities in good, working condition to maintain their design-level of functionality. O&M activities will include levee repairs, inspections, evaluation, and other standard maintenance practices; channel maintenance such as hydraulic assessments, dredging, and vegetation compliance; and repair and replacement of hydraulic structures.

Knights Landing Operations and Maintenance

Specific to the Knights Landing area, Knights Landing Ridge Drainage District, working closely with its neighboring local levee maintaining agencies, the County of Yolo County and the Department of Water Resources, have taken the lead in coordinating and developing the supporting materials for a Letter of Intent (LOI) for a SWIF plan in order for the Knights Landing Levee system to regain eligibility for rehabilitation assistance authorized under Public Law 84-99. If the LOI is approved by USACE, the basin LMAs intend to develop a SWIF which will address flood hazards and consequences in a risk-prioritized manner over time, on a system basis with the objective to correct the worst (highest risk) deficiencies first.

5.5 Ecosystem Restoration/Agricultural Sustainability Improvements

5.5.1 Central Valley Flood Protection Plan Conservation Framework and Strategy

The Central Valley Flood Protection Act (California Water Code, Section 9616[a]) identifies three key environmental objectives. These environmental objectives provide the overall context for the identification, prioritization, and implementation of habitat enhancement and restoration opportunities within the FloodProtect region. The objectives include the following:

- **Objective 1** - Promote natural dynamic hydrologic and geomorphic processes.
- **Objective 2** - Increase and improve the quantity, diversity, and connectivity of riparian, wetland, floodplain, and shaded riverine aquatic habitats, including the agricultural and ecological values of these lands.
- **Objective 3** - Promote the recovery and stability of native species populations and overall biotic community diversity.

The long-term vision of the 2012 (January) CVFPP Public Draft Conservation Framework (Conservation Framework) is sustainable management of Central Valley floodways that achieves multiple environmental objectives by integrating environmental stewardship into all flood management activities during project planning, design, operation, and maintenance. Consistent with this vision, the Conservation Framework has four ecological goals that are intended to be addressed through habitat enhancement and restoration actions integrated into flood risk reduction projects.

- **Ecosystem processes**. Improve and enhance natural dynamic hydrologic (flow) and geomorphic processes in the flood management system.
- **Habitats**. Increase and improve quantity, diversity, quality, and connectivity of riverine habitats including the agricultural and ecological values of these lands.
- **Species**. Contribute to the recovery and stability of native species populations and overall biotic community diversity.
- **Stressors**. Reduce stressors related to the development and operation of the flood management system that negatively affect important species.

Finally, the Conservation Framework identifies several potential projects within the Yolo Bypass and the Lower Sacramento River Planning Area. These projects include improving fish passage at critical locations—the Fremont Weir, Putah Creek, the Knights Landing Ridge Cut, and Cache Creek—in coordination with the Bureau of Reclamation and other agencies and stakeholders. The draft Conservation Framework also supports a collaborative effort to examine opportunities to increase the inundation frequency of the Yolo Bypass to create seasonal floodplain habitat for salmonids, consistent with the requirements of the June 4, 2009

NMFS Biological Opinion and Conference Opinion on the Long-term Operation of the CVP and SWP.

The environmental objectives of the Conservation Framework are intended to provide the basis for the development of the 2017 Central Valley Flood System Conservation Strategy (Conservation Strategy). The Conservation Strategy will provide the system-wide context and direction for the California Department of Water Resources' (DWR's) environmental stewardship activities related to improving integrated flood management in the Central Valley. It will be implemented primarily through multi-benefit projects identified during the development of locally-driven regional flood management plans (including this Plan) and through State-led, basin-wide feasibility studies.

The long-term vision of the Conservation Strategy is the sustainable management of Central Valley floodways which achieves multiple environmental objectives by integrating environmental stewardship into all flood management activities during project planning, design, operation, and maintenance. By improving the Central Valley flood management system, through enhancing environmental stewardship, restoring native riverine and terrestrial habitat, and promoting natural geomorphic and hydrologic processes, flood risks can be reduced and riparian habitats can be substantially increased and improved. This will contribute to the recovery of special-status species and can lessen the need for overall flood system operations and maintenance, reduce environmental impacts, decrease project delays, and reduce regulatory compliance and operating costs. It will also contribute to creating a more flexible, resilient, and sustainable flood management system for the Central Valley.

5.5.2 Other Habitat Restoration Efforts

Several large-scale habitat restoration planning initiatives have been approved, or are underway, within the FloodProtect region. If fully implemented, these initiatives will contribute substantially to achieving the goals of the Conservation Strategy. They include the following:

- Bay Delta Conservation Plan;
- Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project;
- Fish Restoration Program Agreement;
- Natomas Basin Habitat Conservation Plan;
- Solano Multispecies Habitat Conservation Plan;
- South Sacramento Habitat Conservation Plan;
- Yolo Natural Heritage Program; and

- Coalition to Support Delta Projects, a voluntary effort that includes many agencies and stakeholders with an interest in Delta habitat restoration and related activities.

Implementation of the regional restoration planning efforts is anticipated to result in an overall net improvement in ecological function and species recovery within the region.

The FloodProtect team worked closely with the DWR to integrate the CVFPP's ecological goals into the proposed flood risk reduction projects, while at the same time identifying strategies for ensuring the existing agricultural operations within the region are sustainably maintained and protected. These efforts culminated in the development of the Resources and Agricultural Sustainability Plan described below.

5.5.3 Resources and Agricultural Sustainability Plan

The FloodProtect team worked closely with stakeholders to identify multi-benefit flood management projects that combine flood risk reduction with habitat restoration, agricultural sustainability, recreational opportunities, and cultural resource protection. However, not all flood risk reduction projects can incorporate these multiple benefits either due to their limited size, cost constraints or the particular design demands of the project. The FloodProtect team developed the Resources and Agricultural Sustainability Plan (RASP) specifically to identify potential conservation opportunities within or adjacent to the region that could be implemented to offset the adverse ecological impacts associated with single-purpose flood projects. Although not geographically directly connected, the potential conservation sites are intended to provide opportunities for linkages between conservation projects and flood management projects. By pairing, or bundling, single-purpose flood management projects with conservation sites, a more integrated multi-function flood management system will be developed. This approach would also have the added benefit of offsetting the ongoing operations and maintenance activities required to be implemented by local maintaining agencies.

The RASP is also intended to create ecological enhancement to the degree that a net overall increase in the region's ecological values will be created. This approach is consistent with the ecological goals of the Conservation Framework, including specifically increasing and improving the quantity, diversity, quality, and connectivity of riverine habitats including the agricultural and ecological values of these lands, and contributing to the recovery and stability of native species populations and overall biotic community diversity.

Finally, the RASP has been developed to ensure the inherent benefits provided by agricultural land uses in achieving flood risk reduction and providing wildlife-friendly land areas are appropriately integrated into the flood planning and regional conservation efforts. Agriculture has long been recognized as an appropriate use within floodplains because it affords an economically viable way of maintaining the landscape consistent with the operations of flood risk management infrastructure. A healthy agricultural economy also provides a viable use for lands that otherwise could be converted to urban uses; therefore, limiting the expansion of residential land practices within flood-prone areas.

A good example of the ecological and flood management benefits of agriculture occurs in the Yolo Bypass, a productive agricultural landscape that provides inundated flood plain habitat for listed fish species. Agriculture within the Yolo Bypass maintains the floodplain's flood conveyance capacities by managing emergent vegetation. The dense riparian canopy that would emerge within the Yolo Bypass if the land was not managed by farmers would substantially increase the flood plain's roughness and reduce its capacity to pass peak flood flows. Farmers have the on-the-ground land management knowledge that is necessary to maintain vegetation consistent with flood system requirements and are the key resource stewards within the region. Within the Yolo Basin Wildlife Area in the Yolo Bypass, the funds generated from agricultural leases directly support the ecological restoration and habitat management within the wildlife area. These wildlife areas allow for the extensive environmental education efforts of the Yolo Basin Foundation, an organization with over 24 years of experience working collaboratively with the California Department of Fish and Wildlife and local landowners and farmers in the Bypass.

The RASP can be divided into four primary components: ecological enhancements, agricultural sustainability, drainage and infrastructure improvements, and cultural resources protection. These components are described in detail below.

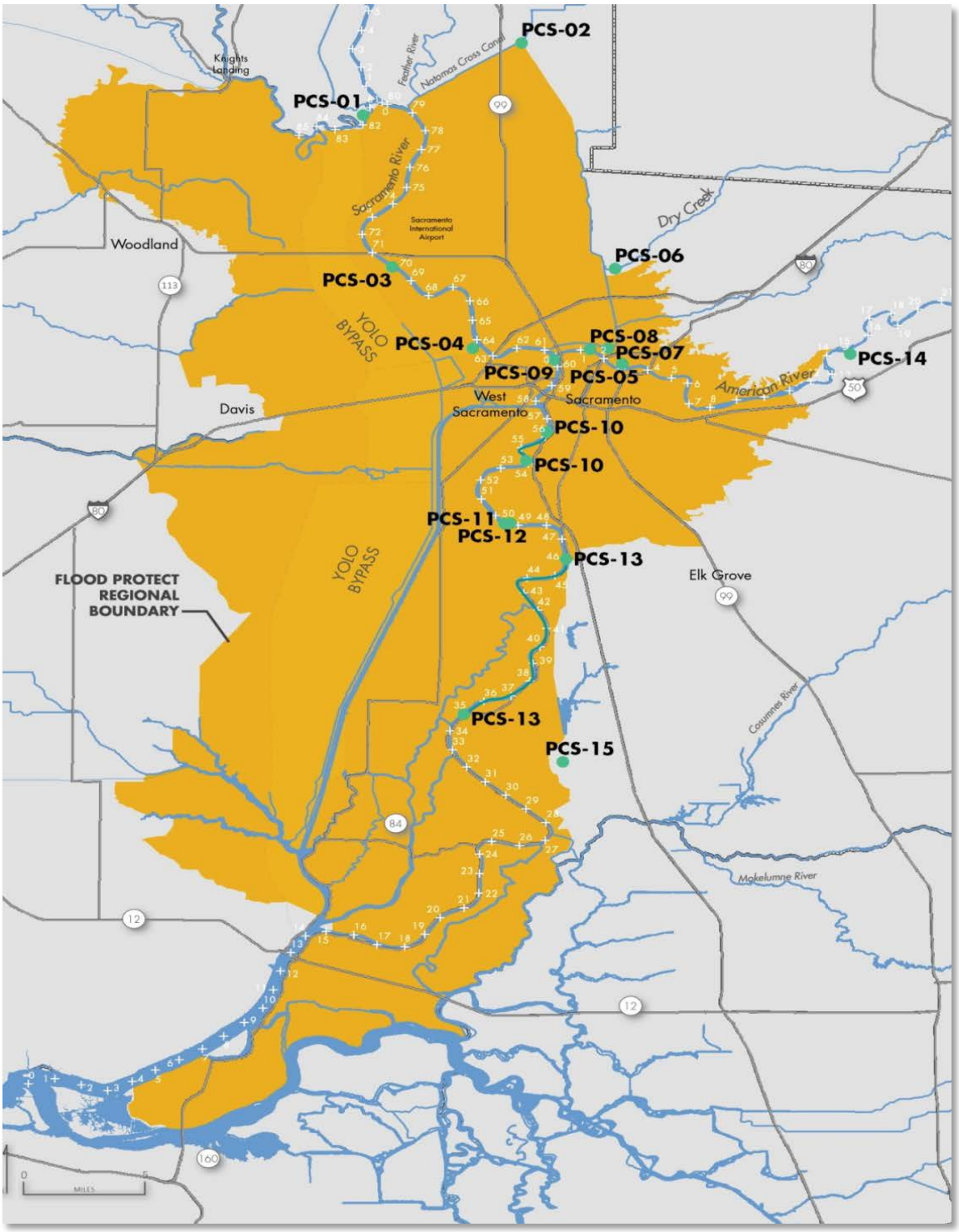
Ecological Enhancements

In January 2014, the FloodProtect team gathered a group of experts to discuss potential conservation opportunities within, or adjacent to, the FloodProtect region. This group included staff from DWR's Floodsafe Environmental Stewardship and Statewide Resources Office (FESSRO), SAFCA staff, representatives from American Rivers, and consultants with expertise in hydrology, restoration ecology, geomorphology, biology and land use planning. Because the construction and operation/maintenance of flood management projects primarily affect aquatic habitat, the group focused specifically on opportunities to restore aquatic habitat. Also, because of the number of large-scale habitat restoration planning initiatives being pursued within the Yolo Bypass/Cache Slough Complex, and the complexity of these efforts, the team focused on opportunities outside of these areas, particularly along the main stems of the Sacramento and American rivers.

The group met over several months in a series of meetings and workshops. The purpose of these meetings was to ask for participant feedback on preliminary conceptual designs, to provide input on the conceptual design process, and provide initial feedback for the prioritization process. Following these meetings, the study team continued to collaborate with additional participants by phone and email correspondence, as well as follow up with additional questions based on the initial findings.

The group synthesized the inputs received during this process into a report that identifies fifteen (15) Potential Conservation Sites (PCS) within or near the region. A location map of the 15 sites is provided in Figure 5-31 and Table 5-47 provides a description of each site, its potential habitat benefits, and the estimated timeframe necessary to complete detailed restoration design and permitting.

Figure 5-31 Potential Conservation Sites



Map not scale

The report, which is included in Appendix A, includes conceptual-level project designs for each of the sites. The report also includes assessment and prioritization data for each of the sites within a series of graphics, evaluation matrices and data sheets that describe the location and setting, the existing conditions, and the potential for conservation, including the type and acreage of mitigation credits that may be available. In addition, approximate cost estimates for design, permitting and construction are provided.

Table 5-47 Potential Conservation Sites (PCS)

PCS# and Name	Description of Design Concept	Description of Habitat Values	Timeline*
PCS-1 Confluence of Sutter Bypass and Sacramento River	Improvements could include excavating a floodplain bench along the channel margins and oxbow to accommodate planting with riparian species. Riparian forest should propagate naturally with increased flooding. Because it is a backwater area, changes in roughness would likely not affect flood stages. Additionally, the disconnected oxbow channel could be lowered to increase connectivity to mainstem river flows and reduce stranding risks.	Opportunity to enhance nearly 1,000 acres of floodplain habitat (1,000's of acres more if expanded north of Sacramento Slough) and reduce stranding risks associated with the oxbow. Provides habitat connectivity from Sutter Bypass to Yolo Bypass for anadromous fish species, migratory birds, and riparian species.	Medium term, three to five years
PCS-2 Natomas Cross Canal	Several multi-benefit design concepts could be adopted to improve habitat values at this site while still maintaining agricultural production including: Maintaining existing rice fields while allowing seasonally inundation prior to spring planting, thus providing habitat value for waterfowl and simulated rearing habitat for salmonids. The installation of several egress areas for juvenile salmonids would be required within the rice fields to ensure the entrainment of salmonids does not occur. Creating seasonal wetlands at the confluence of the East Side and Pleasant Grove Creek Canals, while also potentially allowing concurrent rice production. Installing seasonal wetland enhancements at the confluence of Pleasant Grove Creek and Pleasant Grove Creek Canal to add flood detention for Sankey Gap. Installing floodplain benching and terracing and riparian enhancements along Pleasant Grove Creek. Feathering the edges of the Natomas Cross Canal in a way that is flood neutral to enhance shaded riverine aquatic (SRA) habitat.	The site provides an opportunity for over 3,400 acres of multi-benefit use including providing habitat for salmonids, migratory birds and waterfowl while maintaining a proportion of the site in agricultural production.	Medium term, three to five years
PCS-3 Sacramento River Mile 70 Right Floodplain Lowering and	The design concept is to excavate the existing floodplain to create more frequently activated floodplain (FAF) and enhance the existing backwater slough. This would require the removal of onsite vegetation, which includes a mix of mature riparian vegetation and non-	Opportunity to create approximately 12 acres of frequently activated floodplain and enhance approximately 2,000 linear feet of backwater slough.	Medium term, three to five years

PCS# and Name	Description of Design Concept	Description of Habitat Values	Timeline*
Backwater Slough Enhancement	native vegetation. Due to the vegetation density, the removal of some mature riparian vegetation would be inevitable and would require mitigation.		
PCS-4 Habitat Enhancements in the Yolo Bypass	The U.S. Army Corps of Engineers, in partnership with the State of California and the Sacramento Area Flood Control Agency, have been evaluating the potential flood control benefits of widening the Sacramento Weir and Bypass. The widening being contemplated would expand the Bypass to the north, replacing what is currently agricultural land. If this widening occurred, habitat restoration could be implemented within the expanded Bypass footprint. Low-flow sluice gates could be constructed at the Sacramento Weir and a terraced low-flow channel (or swale) could be excavated to allow more frequent flow exchange between the Sacramento River and the Sacramento and Yolo Bypass areas, particularly the Tule Canal/Toe Drain. Creation of this low flow swale would allow increased connectivity for anadromous fish passage between the Tule Canal/Toe Drain and the Sacramento River. Currently there is no anadromous fish passage through the Sacramento Bypass until the 27.5-foot elevation in the Sacramento River is topped. Seasonal wetland areas would be constructed, and if it could be implemented in a way that is flood neutral, riparian vegetation would be established along the wetlands and low-flow channel margins.	If the Sacramento Weir and Bypass are expanded, the expansion area would provide an opportunity to add between 200 and 400 acres of permanently and seasonally inundated wetland and riparian habitat within the Sacramento Bypass. This enhancement is particularly important in the eastern portion of the Bypass, which currently has low habitat value. Seasonal connectivity for fish species between the Tule Canal / Toe Drain in the Yolo Bypass and the Sacramento River would be increased.	Medium to long-term, three to seven years
PCS-5 Woodlake	The potential concepts for this site are organized into three priority levels and/or phases: Excavate floodplain terrace and lower high ground adjacent to the river along the right bank to introduce higher inundation frequency. Enhance shaded riverine aquatic (SRA) habitat along the right bank and secondary channel. Restore recently burned perennial native grassland, oak savanna, and riparian woodland habitats. Lower 10-year floodplain elevation in eastern portion of the project site.	Opportunity to enhance approximately 270 acres of floodplain habitat and native perennial grassland and oak savanna. Habitat could be provided for anadromous fish juvenile rearing and valley elderberry longhorn beetle.	Short-term, two to three years
PCS-6 Dry Creek Floodplain Grazing Unit restoration Projects	The project consists of several restoration concepts. These include: *Dry Creek:* Install a cattle exclusion fence along Dry Creek and plant with riparian vegetation. Grade the channel at several locations to create more inset floodplain and promote riparian habitat. Enhance the riparian	Opportunity to enhance 1.6 miles of Dry Creek and 1.5 miles of Robla Creek, while reducing public health issues associated with mosquitoes. Enhancing approximately 125 acres of upland grassland and vernal pool habitat.	Short term, one to three years

PCS# and Name	Description of Design Concept	Description of Habitat Values	Timeline*
	corridor of the secondary channel with native riparian planting. *Robla Creek:* Enhance connectivity to Steelhead Creek at outlet to allow proper drainage. Remove non-native vegetation and plant native riparian species. Enhance upland areas on Hansen and Coyle ranch by restoring native grasses (while avoiding vernal pools). Remove berms and fill ditches throughout the properties.		
PCS-7 Northgate Culvert Replacement	The principal project would be to construct a bridge spanning 25 feet along the northern levee in the basin, replacing the existing undersized culvert. Additionally, a new culvert would be constructed under the bike trail in the southeast portion of the basin to increase circulation. The project would include basin grading to improve positive drainage and minimize stranding hazards, as well as native riparian vegetation planting.	Opportunity to enhance up to 20 acres of seasonally inundated wetland and floodplain habitat. The proposed project would increase access for anadromous fishes and reduce stranding risks.	Short-term, one to three years
PCS-8 Urrutia Pit Reclamation and Enhancement	The potential project includes regrading approximately 10 acres of the property between the river and pond to allow more frequent inundation and development of shaded riparian aquatic habitat (SRA). The shoreline, which is currently at approximately a 10-year floodplain elevation, would be re-contoured to three terrace elevations to create topographic heterogeneity. The cut material would be used to construct a berm along the southern pond margin to minimize connectivity between the river and the pond, and to fill the southeast portion of the pond. Riparian enhancement along the pond margins would be completed, and access to the pond for fish from the Natomas East Main Drain Canal (NEMDC)/Steelhead Creek, which runs along the northern boundary of the site just south of the Garden Highway, would be minimized.	The project would protect a 123-acre portion of the active floodplains of the American River and NEMDC/Steelhead Creek. It would improve shaded riparian aquatic habitat and rearing habitat for anadromous fish and provide better riparian, wetland, and upland habitat for several species including the valley elderberry longhorn beetle. The project would improve structure and function of both terrestrial and aquatic habitats by providing riparian and upland vegetation of varying heights. The project would connect the two large riparian forest habitat patches on the Lower American River, and would increase river access to the floodplain by creating low terraces. It would also lessen the risk of site erosion and potential mine pit capture.	Short-term, one to three years
PCS-9 Yolo County Park Gravel Pit Connection and Riparian Enhancement	The proposed project would involve construction of frequently inundated inflow and outflow channels between Sacramento River and the pit to provide off-channel habitat and minimize stranding hazards. Design considerations should include whether to passively or actively control connectivity and ensuring the project design does not increase the exposure of salmonids to warm water fish predators within the gravel pit.. Riparian vegetation would be planted along the margins of the pond and inflow / outflow	Opportunity to provide nearly 11 acres of off-channel habitat.	Medium term, three to five years

PCS# and Name	Description of Design Concept	Description of Habitat Values	Timeline*
	channels. The terrace to the east of the pond and adjacent to the river would be lowered to inundate more frequently and support riparian vegetation.		
PCS-10 Southport Early Implementation Project (EIP) Riparian Enhancement	The potential project involves enhancing the levee setback areas by planting native riparian species. The north setback area encompasses approximately 36 acres, the south setback area encompasses approximately 113 acres. These setback areas would be frequently inundated with implementation.	Approximately 5.6 miles of levee setback that will expose up to 150 acres of frequently inundated floodplain with floodplain lowering, SRA and riparian habitat.	Medium term, three to five years
PCS-11 Sacramento River RM 49.5 Left Bank Enhancements	The potential project involves planting riparian species in the unvegetated gaps along the left bank of the Sacramento River.	Opportunity to enhance and connect approximately 8,000 linear feet of river bank habitat, adjacent to areas of high quality habitat at the Babel Slough confluence when combined with PCS-12.	Short-term, one to three years
PCS-12 Sacramento River RM 49.5 Right Bank Enhancements	The potential design concept includes creating a shallow water bench and planting riparian species in unvegetated gaps along the right bank downstream of the existing riparian forest at the Babel Slough confluence.	Opportunity to enhance and connect approximately 8,000 linear feet of river bank habitat, adjacent to areas of high quality habitat at the Babel Slough confluence when combined with PCS-11.	Short-term, one to three years
PCS-13 Sacramento River RM 35 to 46 Left Bank and Right Bank Enhancements	The project involves the planting of small trees and shrubs along the shoreline of the cobble lined banks of the Sacramento River. Potential exists for the narrow but extensive creation of shallow cover for juvenile fish along currently barren banks.	Opportunity to enhance and connect 11 miles of riparian corridor along the Sacramento River.	Short-term, one to three years
PCS-14 Cordova Creek Naturalization Project	The objectives of the Naturalization Project are to create a functioning, living stream; to improve the creek habitat; and to create a place for people to gather, learn, and enjoy nature. The project includes replacing the existing Clifton's Drain with a naturalized channel that will restore natural function to the stream. The channel design includes installing a low flow channel with inset floodplain terraces of gently varying width on both the left and right sides. Habitat restoration would take place along the channel boundary and within the floodplain terraces. Preliminary 15% designs have been completed for this project.	Benefits to habitat values include increased floodplain connectivity and an expanded variety of aquatic and riparian habitats, increased main channel complexity through geometry enhancements that promote ecological variability, reduced potential for excessive stream channel erosion.	Very short term. Construction planned for summer and fall 2014.
PCS-15 Zacharias Island / Snodgrass Slough Enhancements	The concept design includes breaching the western levee to allow a connection to Snodgrass Slough. The existing farmland would be excavated and terraced to create backwater sloughs, SRA, riparian forest, and frequently inundated floodplain. Potential also exists for other beneficial uses of the property.	Opportunity to convert 3,500 acres of existing farmland to off-channel habitat, which would provide rearing habitat for endangered salmonids.	Long-term, five to seven years
*The timeline generally indicates the anticipated time to acquire permits and initiate construction, assuming funding is available. The duration of construction will vary depending upon the level of restoration.			

The ability to implement these Potential Conservation Sites will depend, to a large degree, on the availability of funding. Because these projects are intended to implement the ecological goals of the Central Valley Flood System Conservation Strategy, DWR may have an interest in directly funding some of these restoration activities. In addition, DWR may provide grant opportunities with a local funding match for single-purpose flood protection projects if they are linked with these Potential Conservation Sites. Funding may also be available from other Federal, State or regional agencies or organizations that are required to implement restoration within the region.

Agricultural Sustainability

The FloodProtect region possesses a bounty of agricultural riches sustained by innovative growers, supported by the efforts of local governments to preserve agricultural land, and buoyed by local communities increasingly supportive of the "farm-to-table" and "locovore" movements. Agriculture is consequently an essential part of the rural economy within the region, as well as a strong component of the local heritage.

The CVFPP Conservation Framework acknowledges the importance of agricultural lands in sustaining ecological values by specifically identifying the need to increase and improve the agricultural values of riverine habitats in one of its four ecological goals. The Conservation Framework further states that the successful achievement of the ecological goals would result in a more sustainable and resilient flood management system that provides greater long-term viability for ecosystems and agriculture. In addition, the long-term vision of the Conservation Strategy is, in part, a sustainable system of managed Central Valley floodways that embodies environmental and agricultural stewardship as an integral part of flood management.

An Agricultural Stewardship Scope Definition Joint Subcommittee was chartered during the CVFPP planning process. The role of this group was to describe major agricultural contributions, challenges, and opportunities and receive input from the agricultural community. The subcommittee developed a framework, included in the draft report, *Important Considerations for the Central Valley Flood Protection Plan Related to Sacramento-San Joaquin Valley Agriculture* (DWR, 2010), that (1) aims to balance habitat and ecosystem goals with agricultural preservation, and (2) identifies agricultural stewardship opportunities consistent with the goals of the CVFPP. The report highlights the need to ensure understanding of how flood system improvements may affect potential financing opportunities, and identifies principles for promoting crop diversity, sustainable farm operation and production, and continued growth.

Sustainability Initiatives

A number of other initiatives are being pursued to ensure agricultural sustainability is integrated into flood risk reduction projects in the region. DWR has prepared a Draft Agricultural Land Stewardship Strategies Discussion paper (ALS Strategies Paper) (DWR, November 2013) that sets forth a menu of potential agricultural land stewardship strategies that can be considered by decision makers when discussing appropriate mitigation measures or

enhancements that can offset the impacts of flood management projects on agricultural lands. The ALS Strategies Paper identifies a tool box of potential agricultural land stewardship strategies that are included in four groups including the following:

- Group A: Potential strategies to help maintain farming
- Group B: Potential strategies that provide incentives for conservation on farmland
- Group C: Potential strategies to manage land for purposes other than conventional crop production
- Group D: Potential strategies that focus on economic development and other benefits

Although the ALS Strategies Paper has been developed to address the agricultural impacts associated with BDCP implementation, the ALS Strategies Paper identifies strategies that would be appropriate for any large-scale State project that affects large areas of agricultural land, including the Basin Wide Feasibility Studies being developed by DWR. The strategies included in these groups are intended to provide a variety of approaches that can be used, depending upon the situation, to offset large-scale agricultural land conversion.

The Sacramento Regional Rural-Urban Connections Strategy (RUCS), which was completed in December 2010 by the Sacramento Area Council of Governments (SACOG), was developed as an economic and environmental sustainability strategy for rural areas. Its intent is to form strategies that enhance agriculture, rural economies, resource conservation, recreation, quality of life, and regional sustainability. Four areas of focus applicable to the region were studied in RUCS including land use and conservation, agricultural infrastructure, economic opportunities, and regulations. Specific innovations were then identified to address the studied focus areas. The ongoing work being conducted by SACOG in further developing RUCs can help ensure the long-term integration of flood risk reduction with agricultural sustainability.

Agricultural Sustainability Fund

The State and Federal governments are proposing to achieve state-wide policy objectives of reducing the flood risks within the Central Valley while also increasing the Valley's overall ecosystem values. These efforts include potentially expanding the Yolo Bypass to improve flood management, increasing the Bypass's inundation frequency to create seasonal floodplain habitat for salmonids, and converting agricultural lands to tidal habitat. These efforts are being focused in the Yolo Bypass and Cache Slough Complex, areas of highly productive agricultural land, and are anticipated to reduce the total area of land in agricultural production and to potentially diminish the productivity of additional agricultural lands.

The loss of agricultural lands would adversely affect the economy of the region through the loss of high-value crops and the decrease in the critical mass of agricultural production necessary to support agriculture-related industries. The loss of agricultural lands could also diminish the agricultural character of the region, the maintenance of which is an important priority for the

region, as reflected in both the Sacramento Area Council of Governments Blueprint adopted in December 2004 and the Next Economy Prosperity Plan adopted in March 2013.

To address these issues, the development of an Agricultural Sustainability Fund is being proposed as a central component of FloodProtect's efforts to support agricultural sustainability in the face of potential changes to the existing landscape of the Yolo Bypass and Cache Slough Complex. The Agricultural Sustainability Fund is intended to compensate for the anticipated loss in agricultural production associated with flood risk reduction efforts within these areas by providing the necessary funding to leverage existing and future agricultural sustainability efforts. By enhancing the remaining agricultural lands both within and outside of the Yolo Bypass and Cache Slough Complex areas, the Agricultural Sustainability Fund would result in an offsetting increase in the agricultural productivity on the remaining lands, resulting in a net overall benefit to the agricultural economy, consistent with the policy direction provided in the 2009 Delta Reform Act.

The Agricultural Sustainability Fund would be used to support the continued work of local growers to produce high-quality agricultural products and bring those products to local, regional, and national markets. The fund would be expended on agricultural sustainability efforts consistent with the existing agricultural policies included in the general plans, economic development plans, and climate action plans for the counties within the region, and through the efforts of the County Agricultural Commissioners, the Yolo/Solano Farmbudsman, the County Farm Bureaus, the Resource Conservation Districts, and other stakeholders working in local communities to promote agricultural sustainability.

A detailed program would be developed which identifies the programs that would be eligible for funding and the process for allocating funds. Fees would be deposited into an agricultural sustainability fund to be managed by the host County to support the agricultural economies on which they depend. Programs eligible for funding would typically fall into the following categories: resource assistance to growers and local maintaining agencies, permitting assistance, road improvements, rural levee and water infrastructure improvements, agricultural infrastructure improvements, agricultural productivity research, farm-to-school programs, marketing and public outreach, opportunities for local government collaboration with growers, and opportunities to enhance the environmental services associated with agriculture.

Yolo County is developing a detailed study that identifies their vision for how an agricultural sustainability fund program could be developed and implemented, including the types of activities that would be eligible for funding and funding sources. Once completed, the Yolo County Agricultural Sustainability Fund study can be used by stakeholders in the region to further refine the development of an Agricultural Sustainability Fund that could be implemented consistent with the substantial land use changes being initiated by the State and federal governments within the Yolo Bypass and Cache Slough Complex.

Yolo Bypass Drainage and Water Infrastructure Improvements

Yolo County recently completed the Yolo Bypass Drainage and Water Infrastructure Improvement Study, which identifies drainage and water infrastructure improvements in the Yolo Bypass that benefit agricultural operations and wetlands management. Yolo County conducted the study to identify the potential impacts on agriculture and wetlands of proposals by the California Natural Resources Agency and the U.S. Department of the Interior to increase the frequency and duration of inundation in the Yolo Bypass for seasonal fish habitat. While the identified improvements are not anticipated to fully address the potential agricultural and wetland impacts of State and federal initiatives in the Bypass, they will help reduce drainage times, improve water delivery, and otherwise increase the likelihood the Yolo Bypass will continue to support multiple important land uses in the future.

The study team obtained information regarding improvements to drainage and water supply infrastructure from over 15 interviews with landowners, farmers, water managers, wetland managers and others with extensive knowledge and experience with Yolo Bypass and drainage water supply systems. The Yolo Basin Foundation organized a stakeholder meeting in April 2013 to review maps of drainage systems throughout the Bypass and evaluate potential projects. Additionally, the team collected limited field data to verify water operations. The Yolo Basin Foundation organized a second stakeholder meeting in October 2013 to review draft project descriptions, recommended studies, and priorities. The study team used feedback from participants, research on the relative potential benefits, permitting requirements, and approximate cost estimates to assess initial priorities, as well as other factors for the recommended projects. The study was completed and publicly released in April 2014.

The drainage and infrastructure improvement projects identified in the study provide unique opportunities to improve drainage and water supply conditions in the Yolo Bypass for agricultural and wetland operations. The projects are separated into location-specific improvements (Projects 1 through 9) and Bypass-wide improvements (Projects 10 through 12). Additionally, four studies were identified for future analysis. The following is a list of projects and studies.

Proposed projects:

- Project 1: Wallace Weir Improvements
- Project 2: Tule Canal Agricultural Crossing/Water Control Structure Improvements
- Project 3: Lisbon Weir Improvements
- Project 4: Conaway Main Supply Canal Augmentation
- Project 5: Davis Wetlands Water Supply Improvements
- Project 6: South Davis Drain Input Reconfiguration

- Project 7: Yolo Bypass Wildlife Area Dual Function Canal Reconfiguration
- Project 8: Yolo Bypass Wildlife Area Public and Operation and Maintenance Road Improvements
- Project 9: Stormwater and Summer Tailwater Re-Use and Supply
- Project 10: Local Agricultural Crossing Improvements
- Project 11: Creation of Coordinated Maintenance and Improvement Reimbursement Program or Agency
- Project 12: Westside Tributaries Monitoring

Proposed Studies:

- Study 1: Bypass Sedimentation Rate Changes due to Managed Flooding
- Study 2: Vegetation Management with Increased Frequency and Duration of Flooding
- Study 3: Plan to Manage Beaver Canal Damage and Obstructions
- Study 4: Management Entity Model

The implementation of these projects would be anticipated to occur in advance of the proposed State and federal efforts to create seasonal floodplain habitat for salmonids, within the Yolo Bypass and to expand the Bypass to achieve flood risk reduction. Funding for these projects could come from a wide variety of sources but would be expected to include State and federal funding associated with these seasonal floodplain habitat and flood risk reduction efforts.

Cultural Resources Protection

The implementation of flood control projects can disturb sensitive cultural places, when they are unidentified, including: prehistoric, archaeological, cultural, spiritual, and ceremonial places that are not located on tribal reservations or Rancherias. Federal and State laws have been adopted to protect these sensitive resources and establish a procedure for tribal consultation. At the federal level, Section 106 of the National Historic Preservation Act (Section 106) requires Federal agencies to take into consideration the potential effects of proposed undertakings on cultural resources listed on or determined potentially eligible for inclusion in the National Register of Historic Places (NRHP), and to allow the Advisory Council on Historic Preservation (ACHP) the opportunity to comment on the proposed undertaking. The regulations implementing Section 106 are promulgated by the Secretary of the Interior, as codified in Code of Federal Regulations (CFR) Title 36, Part 800 (36 CFR Part 800). Determining the NRHP eligibility of a site or district is guided by the specific legal context of the site's significance as set out in 36 CFR Part 60.4.

At the State level, tribal consultation is required in the planning process, which occurs at both the general plan and the project level. At the general plan level, California Senate Bill (SB) 18 states that prior to a local (city or county) government's adoption of any general plan or specific plan, or amendment to general and specific plans, or a designation of open space land proposed on or after March 1, 2005, the local government shall initiate consultation with California Native American tribes for the purpose of preserving or mitigating impacts to Cultural Places. Although the flood control projects identified in this document are, for the most part, not anticipated to require general plan amendments, the general approach of conducting early consultation with Native American tribes related to flood control improvements is a key tenant of the RASP. Early tribal notification and consultation is critical to creating a collaborative partnership between Native American Tribes and project proponents that ensures cultural resource protection is integrated into project planning.

The Native American Historic Resource Protection Act is codified in Public Resources Code (PRC) sections 5097.993 and 5097.994. The Act makes it unlawful to destroy Native American historic, cultural, or sacred sites. As described in the Act, a Cultural Place is defined as:

- Native American sanctified cemetery, place of worship, religious or ceremonial site, or sacred shrine Public Resources Code [PRC] Section 5097.9), or;

- Native American historic, cultural, or sacred site, that is listed or may be eligible for listing in the California Register of Historic Resources pursuant to Section 5024.1, including any historic or prehistoric ruins, any burial ground, or any archaeological or historic site (PRC Section 5097.993).

The intent of SB 18 is to establish *meaningful* consultation between tribal governments and local governments ("government-to-government") at the earliest possible point in the planning process so that cultural places can be identified and preserved and to determine necessary levels of confidentiality regarding Cultural Place locations and uses. According to the Government Code (GC) Section 65352.4, "consultation" is defined as:

The meaningful and timely process of seeking, discussing, and considering carefully the views of others, in a manner that is cognizant of all parties' cultural values and, where feasible, seeking agreement. Consultation between government agencies and Native American Tribes shall be conducted in a way that is mutually respectful of each party's sovereignty. Consultation shall also recognize the tribes' potential needs for confidentiality with respect to places that have traditional tribal cultural significance.

At the project level, the California Environmental Quality Act (CEQA) identifies the process for protecting sensitive cultural resources as well as historic resources. Under CEQA, historical resources and "unique archaeological resources" are recognized as a part of the environment (Public Resources Code Sections 21001(b), 21083.2, 21084(e), 21084.1). In 1992, the Public Resources Code was amended as it affects historical resources. The amendments included

creation of the California Register of Historical Resources (Public Resources Code Sections 5020.4, 5024.1 and 5024.6).

The California Register is an authoritative listing and guide for state and local agencies and private groups and citizens in identifying historical resources. This listing and guide indicates which resources should be protected from substantial and adverse change. The California Register includes historical resources that are listed automatically by virtue of their appearance on or eligibility for certain other lists of important resources.

Any building, site, structure, object or historic district meeting one or more of the following criteria may be eligible for listing in the California Register:

- It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States;
- It is associated with the lives of persons important to local, California, or national history;
- It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master or possesses high artistic values; or
- It has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.

Eligibility for the California Register also depends on the integrity, or the survival of characteristics of the resource that existed during its period of significance.

CEQA Guidelines Section 15126.4(b)(3) states, "Public agencies should, whenever feasible, seek to avoid damaging effects on any historical resource of an archaeological nature." The Guidelines further state that preservation in place is the preferred manner of mitigating impacts, and that preservation ". . . may be accomplished by, but is not limited to, the following:

- Planning construction to avoid archaeological sites;
- Incorporation of sites within parks, greenspace, or other open space;
- Covering the archaeological sites with a layer of chemically stable soil before building tennis courts, parking lots, or similar facilities on the site;
- Deeding the site into a permanent conservation easement."

To comply with Section 15126.4(b)(3), these and other non-invasive alternatives need to be seriously contemplated prior to considering excavation and data recovery. The CEQA Guidelines state, "when data recovery through excavation is the only feasible mitigation, a data recovery plan, which makes provision for adequately recovering the scientifically consequential information from and about the historical resource, shall be prepared and adopted prior to any excavation being undertaken" [CEQA Guidelines, Title 14, Section 15126.4(b)(3)(C)].

As noted above, CEQA is also concerned with effects of a project on "unique archaeological resources." If an archaeological site meets the definition of a unique archaeological resource (Public Resources Code Section 21083.2), then the site must be treated in accordance with the special provisions for such resources, which include time and cost limitations for implementing mitigation.

If it can be demonstrated that a project will cause damage to a unique archaeological resource, the lead agency may require reasonable efforts to be made to permit any or all of these resources to be preserved in place or left in an undisturbed state. Examples of that treatment are described in the code. To the extent that unique archaeological resources are not preserved in place or left in an undisturbed state, mitigation measures shall be required as provided in the code.

Finally, California law also protects Native American burials, skeletal remains and associated grave goods regardless of their antiquity, and provides for the sensitive treatment and disposition of those remains (California Health and Safety Code Section 7050.5, California Public Resources Code Sections 5097.94 *et seq.*). The disposition of human remains and burial-associated artifacts would typically require the preparation of a treatment plan that includes Tribal monitors and re-burial as close to the origin site as possible. Implementation of the flood control projects identified in this plan will be required to comply with the above CEQA regulations regarding the protection and mitigation of cultural resources.

5.6 Yolo Bypass/Cache Slough Integrated Water Management Plan

During the course of developing this RFMP, several key partner agencies recognized a unique opportunity to develop an ambitious multi-objective plan in the heart of the Sacramento River Flood Control Project. This plan, the Yolo Bypass / Cache Slough Integrated Water Management Plan (IWMP), seeks to provide system-wide flood benefits through modifications to the Yolo Bypass while simultaneously implementing significant habitat conservation, water supply, and agricultural sustainability improvements.

The vision of this IWMP is to reduce the economic, environmental, and social costs of individually implementing competing project objectives in a small geographic area like the Yolo Bypass / Cache Slough complex. This vision can be accomplished through the achievement of the following five goals established for flood management in the region:

- Implement system-wide flood improvements – Identify viable and locally supportable modifications to flood management infrastructure in and around the Yolo and Sacramento Bypasses.

- Improve agricultural sustainability – Undertake efforts to improve rural levee systems, implement feasible rural floodplain management requirements, and establish dedicated funding for rural agricultural economic development.

- Conserve / create high value habitat – Improve aquatic and other habitat values in a manner that preserves flood management function and minimizes impacts on farming and other existing land uses.

- Consider water supply facilities in project development – Coordinate flood management and ecosystem restoration project development with existing local diversion facilities and planned improvements to water supply facilities for consistency and efficiency.

- Establish a more sustainable approach to O&M – Identify long-term plan for operating and maintaining flood control and related facilities associated with the bypasses to include possible changes to governance, financing, and environmental compliance.

The Yolo Bypass / Cache Slough complex is currently the target of numerous single objective large scale projects intended to modify the existing landscape from primarily a flood conveyance corridor to satisfy a broader range of objectives. The extent of transformation in this small geographic area needed to satisfy an independently implemented patchwork of single objective projects is neither supportable due to local economic impacts nor viable due to uncertain landowner support. However, there is growing consensus around the concept that these, often competing, singular objectives can be accommodated through a more inclusive and less parochial approach to project scoping and development. This IWMP is founded on the concept that all parties interested in the Yolo Bypass / Cache Slough complex can achieve their goals and "get better together" by seeking truly integrated solutions that concede project formulation around a single objective to multi-objective formulation where the alternatives are evaluated based on a broader range of equally treated objectives.

In order to achieve the goals stated above, the current IWMP concept is developed around eleven (11) plan elements as follows:

1. Small community protection (Yolo and Knights Landing)
2. Reconfiguration of the Elkhorn Basin for additional flood capacity and habitat
3. City of Woodland flood protection incorporating Westside rail relocation
4. Sacramento bypass and weir widening
5. Lower Bypass / Cache Slough reconfiguration for additional flood capacity and habitat
6. Increased flood protection and mitigation of any hydraulic impacts for Rio Vista
7. North Bay Aqueduct Alternate Intake Project implementation
8. Yolo Bypass / Cache Slough Corridor Management Plan development
9. FEMA NFIP regulatory relief for rural areas (Clarksburg)
10. Yolo Bypass / Cache Slough O&M Authority and Funding
11. Agriculture Sustainability Fund establishment

The IWMP overlaps with the RFMP in that a number of these plan elements are recommended in the RFMP as individual single objective projects. However, the combination of these projects with the other plan elements results in a high priority, multi-objective plan for the Yolo Bypass / Cache Slough complex with strong regional support. While some of these plan elements are very unique in scope, they are necessary to explore, in order to take advantage of this rare opportunity to align State and local interests in the often-contentious area of system-wide improvement projects. Further, these elements could help accelerate implementation of the State System-wide Investment Approach (SSIA) as described in the Central Valley Flood Protection Plan (CVFPP), strengthen local agency support for the Sacramento River Basin Wide Feasibility Study, and better align the State and region to take advantage of other funding streams planned for expenditure in the Yolo Bypass / Cache Slough complex in the near future. One such example is implementation of the Biological Opinion for operation of the State Water Project and the Central Valley Project, commonly referred to as the BiOp project.

Additional funding is required to advance the IWMP beyond its current concept and to evaluate its technical feasibility and political viability. A project delivery team (PDT) has been established to develop a scope, schedule, and budget for development of the IWMP. This PDT is comprised of the following agencies:

- State of California – Department of Water Resources
- Solano County
- Yolo County
- Sacramento Area Flood Control Agency
- West Sacramento Area Flood Control Agency
- Solano County Water Agency
- Reclamation District 2068

The short term goal of the PDT is to reach agreement on the scope, schedule, and budget for the IWMP and secure funding to initiate its development by the end of calendar year 2014. Some elements of the IWMP may be implemented earlier by leveraging other available funds and/or grant programs. The long term goal of the PDT is to have the IWMP integrated into the Sacramento River Basin Wide Feasibility Study in 2016 and adopted for implementation in the 2017 update of the CVFPP.

5.7 Next Steps

It was always envisioned that the RFMP would be a living and on-going process. To the extent that DWR will provide funding for regional planning through adoption of the 2017 update to the CVFPP, FloodProtect will provide support as additional funds become available.

FloodProtect will submit the completed RFMP, including the list of proposed regional improvements, to DWR as a condition of the funding agreement, and FloodProtect will continue to support the region in implementing the recommendations in the RFMP which will include these actions:

- Coordinate with DWR on the Sacramento River Basinwide Feasibility Study including planning assumptions, hydrologic and hydraulic modeling analyses, ecosystem restoration opportunities, benefits, peer review, and financing capabilities. FloodProtect will provide any available additional regional improvement information requested by DWR for its BWFS planning and technical analysis.

- Track future funding opportunities from DWR, such as the Urban Flood Risk Reduction and Small Communities Programs, to identify recommended regional improvements that may be eligible for direct or competitive funding.

- Conduct the necessary stakeholder outreach and coordination to develop organizational structure/governance, cost, policy/procedure, training requirements and synchronization to consolidate LMA, O&M and ER activities.

- Conduct advanced planning (to include: more detailed cost and schedule estimates, ID potential multi-benefit opportunities and permit requirements, and stakeholder coordination) of the four roughly defined alternatives for 100-yr level of protection for each of the region's other small communities (Hood, Courtland, Isleton, East & West Walnut Grove, and Locke) to support their qualification for future grant funding.

- Research potential funding opportunities for the development of pre-feasibility level analyses of the 15 identified potential conservation sites in the RFMP.

- Continue to develop the Yolo Bypass/Cache Slough IWMP including coordination with DWR, Yolo County, Solano County, Sacramento County, and all affected stakeholders. Additional planning and study is required to fully develop this plan.

- Continue coordination with other Sacramento River Basin RFMP planning teams to ensure that regional and system improvements are not in conflict and can be integrated with plans of adjacent planning regions to promote greater benefit.

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