Flood Risk Reduction Feasibility Study for Delta Legacy Community of East Walnut Grove, CA

Funded by California Department of Water Resources Small Communities Flood Risk Reduction Program

Submitted to:
Sacramento County Department of Water Resources

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Visit the East Walnut Grove Story Map for more details: [East Walnut Grove Story Map - Sacramento County Small Communities Flood Risk Reduction Program](). [1]

[1] https://sacramentocounty.maps.arcgis.com/apps/MapJournal/index.html?appid=3e6a7a1f41184e4f8d1445fc9d90b69e

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Acronyms and Abbreviations

2014 RFMP	2014 Lower Sacramento River/Delta North Regional Flood Management Plan
AFOTF	Agricultural Floodplain Ordinance Task Force
APE	area of potential effect
AWSE	Assessment Water Surface Elevation (used for DWR NULE levee performance curves)
BFE	Base Flood Elevation
BWFS	Basin-Wide Feasibility Study
BW-12	Biggert-Waters Flood Insurance Reform Act of 2012
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
COE	Corps of Engineers
Conservancy	Delta Conservancy
county	Sacramento County
District	Reclamation District
DLIS	Delta Levees Investment Strategy
DPC	Delta Protection Commission
DSC	Delta Stewardship Council
DWR	California Department of Water Resources
EAD	Expected Annual Damage
EIR	Environmental Impact Report
EOP	Emergency Operations Plan
ESP	Emergency Safety Plan
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map

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FIS	Flood Insurance Study
FODSS	Flood Operation Decision Support System (developed by Sacramento County OES and Ca DWR)
fps	feet per second
FSRP	Flood System Repair Project (developed by DWR)
ft.	feet
GAR	Geotechnical Assessment Report (developed by DWR)
GHAD	Geologic Hazard Abatement District
H&H	hydrologic and hydraulic
HFIAA	Homeowner Flood Insurance Affordability Act
HMP	Hazard Mitigation Plan
HOA	Homeowners Association
Legal Delta	legally defined Sacramento-San Joaquin Delta
LHMP	Local Hazard Mitigation Plan
LM	levee mile
LMA	Local Maintaining Agency
LURMP	Land Use and Resource Management Plan (by Delta Protection Commission -DPC for Primary Zone of Delta)
M	million
MA	Structural-Based Management Action
NAVD 88	North American Vertical Datum 1988
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program (developed by FEMA)
NRHP	National Register of Historic Places
NULE	Non-Urban Levee Evaluation (developed by Ca DWR)
OA	Operational Area
OES	Office of Emergency Services
O&M	operation and maintenance
OMRR&R	operation, maintenance, repair, rehabilitation, and replacement
RD	Reclamation District
RFMP	Regional Flood Management Plan (component of CVFPP)

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RMA	routine maintenance agreement
ROW	right-of-way
RR&R	repair, rehabilitation, and replacement
RSP	rock slope protection
SAFCA	Sacramento Area Flood Control Agency
SB	Senate Bill
SCFRRP	Small Communities Flood Risk Reduction Program
SEMS	Standardized Emergency Management System
SFHA	Special Flood Hazard Area
SPA	Special Planning Area
SPFC	State Plan of Flood Control
SRA	Shaded Riverine Aquatic (habitat)
SRFCP	Sacramento River Flood Control Project
SSJDNHA	Sacramento-San Joaquin Delta National Heritage Area
SWIF	System-wide Improvement Framework (administered by USACE; routed through CVFPB
SWP	State Water Project
U.S.	United States
USBR	United State Bureau of Reclamation
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WSAFCA	West Sacramento Flood Control Agency
WSEL	water surface elevation

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Executive Summary

In 2017, Sacramento County received grants from the California Department of Water Resources (DWR) Small Communities Flood Risk Reduction Program to conduct feasibility studies to reduce flood risks to five Delta Legacy Communities in the north Delta, including: Hood, Courtland, Locke, Ryde and Walnut Grove (West and East) located on both sides of the Sacramento River. For Walnut Grove East, located on the east side of the Sacramento River, the scope of this study includes the following:

- Identifying a potential suite of structural and non-structural flood risk reduction elements
- Developing management actions based on the potential flood risk reduction elements
- Developing and preparing implementation costs for each of the management actions
- Identifying a preferred suite of management actions and other non-structural measures based on stakeholder and community input and,
- Developing an implementation plan which includes an implementation schedule and finance plan

The study considers potential solutions to reduce flood risks while sustaining agriculture and the regional economy, improving riverine habitat viability, addressing regional levee maintenance governance, and improving the resiliency and reliability of conveying fresh water through the Delta with an improved leveed system in the Sacramento River Corridor.

East Walnut Grove is located on the east or left bank of the Sacramento River approximately 25 miles south of Sacramento, just south of the Delta Cross Channel (DCC), approximately 1.0 mile south and downstream of the community of Locke. Levees which protect the tract of land known as East Walnut Grove are primarily maintained by Reclamation District (RD or District) 554; and the levees protecting the industrial, southern portion of East Walnut Grove are located on the tract of land known as Tyler Island are maintained by RD 563. There are a total of nearly 3.45 miles of levees within RD 554 that offer protection to East Walnut Grove including: 0.9 mile along the combined left (east) bank levees of the Sacramento River (0.6 mile) and Georgiana Slough (0.3 mile) at their common confluence; 1.2 miles along the right (west) bank of Snodgrass Slough; 0.8 mile along the south or right bank of the DCC; and 0.54 miles of dry cross levee south of East Walnut Grove, abutting RD 563 and the industrial north portion of Tyler Island. The industrial portion of East Walnut Grove, all located within the northern portion of Tyler Island, are protected by a combined 22.5 miles of levees along Georgiana and Snodgrass Sloughs as well as the North Fork of the Mokelumne River. However, the project study area within RD 563 – Tyler Island is largely limited to the nearly 0.50-mile segment along the Snodgrass Slough right bank levee downstream and southeast of RD 554; a short 950-ft.-long segment of levee along the right (west) bank levee of the North Fork Mokelumne River, and 0.7 mile of the left or east bank levee of Georgiana Slough immediately downstream of RD 554. In

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total, the collective East Walnut Grove study area includes the review and evaluation of nearly 4.8 miles of levees, of which 1.6 miles are considered State Plan of Flood Control (SPFC), and 3.2 miles are considered non-SPFC levees.

The majority of the levees surrounding the East Walnut Grove study area were initially constructed prior to 1906 by local interests and were generally built using materials dredged from the adjacent Sacramento River and the nearby adjoining Snodgrass Slough to the east, and Georgiana Slough to the west. Over time, various improvements have been made to the levees in the study area located along the left banks of the Sacramento River and Georgiana and they are now considered part of the State and federally authorized Sacramento River Flood Control Project (SRFCP) and are now part of the levees. The levees on the east side of RDs 554 and 563, as well as those on the north side of RD 554, have also been improved over time, but are not considered part of the federal- and State-authorized SRFCP nor a portion of the SPFC levee system.

Sacramento County and its consultants developed this feasibility study in coordination with a planning committee comprised of residents living within the community of East Walnut Grove, including landowners and business owners that live within the community and within RDs 554 and 563, and representatives from both RDs. Several public stakeholder meetings were held to identify existing concerns and solicit feedback on the feasibility study process.

Structural-based Management Actions

A suite of 12 potential structural-based management actions were formulated based on stakeholder discussions and the available geotechnical data, including geotechnical data collected in 2016 by RD 554. These structural-based management actions included: repairing and strengthening-in-place various portions of and/or the entirety of the RD 554 perimeter levee system; and for the industrial area of East Walnut Grove within RD 563 on Tyler Island, developing a flood fight berm along the west side of Walnut Grove-Thornton Road, and potentially improving portions of the RD 563 levee system inclusive of a previous cross levee concept alignment west to southwest of Walnut Grove-Thornton Road; and securing 100-year Federal Emergency Management Agency (FEMA) accreditation for the community of East Walnut Grove.

Three of the structural-based management actions consist of repairing and strengthening-in-place the 0.80 mile-long right bank levee of the USBR Delta Cross Canal (DCC) and 1.7 miles along the right bank of Georgiana Slough downstream of the DCC (both considered non-SPFC levees). The collective 2.5 miles of levee improvements directly adjoining the DCC will provide the multi-benefit on improving the resiliency and reliability of conveying SWP and CVP water through the North Delta. The DCC and the freshwater conveyance corridors immediately upstream and downstream of the DCC are considered critical components of the SWP and CVP infrastructure to convey fresh water supplies through the Delta while minimizing salt water intrusion within the Delta and within the water exported south of the Delta.

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The 12 structural-based management actions can be paired with a suite of non-structural management actions, including the potential implementation of a community-based private flood insurance program developed specifically for the noted community and/or additional Delta Legacy Communities via either a Homeowners Association (HOA), Sacramento County, or other means such as a Geologic Hazard Abatement District (GHAD). The key non-structural action items for consideration are summarized below within this Executive Summary and Section 7.3 of this Feasibility Study Report.

The management actions were evaluated largely qualitatively (including input from a quantitative EAD analysis) against the study's planning objectives of reducing risk to life; reducing risk to property damage; reducing probability of levee failure; limitation of high insurance premiums; improved flood preparedness and response; enhancing resiliency and reliability of through-Delta water conveyance and identifying multi-objective opportunities. Each of the management actions were also evaluated qualitatively relative to agricultural sustainability, local support, and cost.

With this trade-off analysis and a final stakeholder meeting held in December 2020, and follow-up presentations to the Delta Legacy Communities Board of Directors and regional Rotary Club meetings held November 2020 through June 2021, a recommended suite of structural-based management actions was further identified as follows:

- **Management Action 1**: Repair and Strengthen-in-Place Sacramento River and Georgiana Slough SPFC Left Bank Levees in RD 554 (Non-Urban Levee Evaluation [NULE] Segment 128) – estimated cost of $9.0 million (M)
- **Management Action 2**: Repair and Strengthen-in-Place Snodgrass Slough Right Bank Non-SPFC Levee (NULE Segment 1051) in RD 554 – estimated cost of $11.5M
- **Management Action 3**: Repair and Strengthen-in-Place Right Bank of the DCC in RD 554 (portions of NULE Segment 1052) – estimated cost of $6.3M
- **Management Action 4**: Repair and Strengthen-in-Place RD 554 Non-SPFC Dry Cross Levee Adjoining RD 563 along Old Walnut Grove-Thornton Road in RD 554
- **Management Action 5**: Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554, directly south of the Delta Cross Channel
- **Management Action 6b**: All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut Grove-Thornton Road in RD 563 – estimated cost of $5.3M

The cost for the recommended suite of Management Actions (MAs) 1 through 5 and 6b are currently estimated at $34.4M in 2020 dollars for full implementation. MA 5 and MA 6b are two stand-alone management actions that result in large, sizeable net reductions in Expected Annual Damages (EADs) to the East Walnut Grove study area. With the implementation of MA 5 which collectively includes repairing, strengthening-in-place and securing 100-year FEMA certification for the entire RD 554 portion of the East Walnut Grove the total net reduction of EAD is

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estimated at $3.5M under existing conditions, and considerably higher at $16.9M under future conditions with climate change adjustments. For Management Action 6b within the RD 563 portion of the study area that includes both a flood-fight road and an improved flood evacuation route for the North Delta communities along the Walnut Grove Thornton the total net reduction of EAD is estimated at $3.7M under existing conditions, and as high as $11.6M under future conditions with climate change adjustments.

Table ES-1: Estimated Costs, Net Reduction in EAD Values, and Flood Risk Reduction Payback Period for Suite of Management Actions Under Existing Conditions

Management Action	Estimated Cost	Total Net Reduction in EAD to the West Walnut Grove Study Area under Existing Conditions[1]	Flood Risk Reduction Payback Period in Years (excluding interest)[2]
Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554 **(MA 5, inclusive of MA 1-4)** (4)	$29,100,000	$3,500,000	8.4 years
All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut-Grove Thornton Road in RD 563 **(MA 6B)** (3)	$5,300,000	$3,700,000	1.4 years
Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area with Cross Levee System **(MA 11, inclusive of MA 7-10)** (4)	$38,900,000	$3,800,000	10.1 years

[1] Net Reduction in EAD values are substantially greater under future conditions with climate change adjustments
[2] Flood risk reduction payback period in years is substantially shorter under future conditions with climate change adjustments

Note that while MAs 1 through 3 as stand-alone measures would not represent substantial, incremental reductions in EAD for the study area, the said levee improvements adjoining the community within RD 554 would substantially reduce the potential for life loss if a levee breach were to occur anywhere immediately adjacent to the community within RD 554. These same measures also provide the multi-benefit of improving the reliability and resiliency of conveying SWP and CVP water through the fresh water corridor of Delta, as noted above.

Non-Structural Measures

In addition to the key structural-based management actions highlighted above, several non-structural measures were evaluated for their potential to reduce residual flood risk. These non-structural measures can be implemented independent of, or in combination with, the structural-based improvements. This study recommends the following preferred non-structural measures for implementation, some of which are already in the early stages of implementation:

- Voluntary structural elevation of residential and commercial structures
- Wet or dry floodproofing residential, commercial, and agricultural structures

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- Improved emergency response for the East Walnut Grove study area and adjoining RDs in the Lower-Sacramento – North Delta Regional Flood Management Plan region
- Implementation of a community-based flood-risk insurance program specific to the community of East Walnut Grove in lieu of or in tandem with the current FEMA National Flood Insurance Program (NFIP). The nearby city of Isleton has taken the initial steps in implementing a similar insurance program and there may be some local economies of scale for East Walnut Grove and other nearby Delta Legacy Communities in the North Delta to pool their resources together and possibly be a pilot test case for establishing a regionally based insurance program for rural communities in the Delta and greater Central Valley. In addition to reducing flood insurance rates the program can also be tailored to buy-down risks by establishing and setting aside local cost-share funds to improve and implement flood risk reduction management actions outlined above and non-structural measures outlined herein.
- Updating the Sacramento County Local Hazard Mitigation Plan and formalizing potential relief cut locations within RDs 554 or 563
- Continued and improved public education and awareness
- Support continued actions to improve and maintain high NFIP Community Rating System (CRS) score for Sacramento County/East Walnut Grove
- Continued State support for refinements and Amendments to the NFIP via Agricultural Floodplain Ordinance Task Force and H.R. 3167
- Improved governance between RDs 554 and 563, other regional RDs in the north Delta, and a potential HOA or GHAD for reducing flood risks within the project study areas of RDs 554 and 563
- Flood channel conveyance improvements in North and South Forks of Mokelumne River and potential flood easements on Staten Island

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1. Introduction

The California Department of Water Resources (DWR) Small Communities Flood Risk Reduction Program (SCFRRP, project) and the Regional Flood Management Plans (RFMPs) were created following adoption of the 2012 Central Valley Flood Protection Plan (CVFPP) by the Central Valley Flood Protection Board (CVFPB). Both the RFMPs and SCFRRP were created by the CVFPB and DWR and are intended to be locally developed flood risk programs authored by regional flood control agencies, Local Maintaining Agencies (LMAs), local Reclamation Districts (RDs), local land-use planning entities such as counties and cities, and the residents of the communities protected by State Plan of Flood Control (SPFC) levees. The RFMP program consists of six regional plans within the extent of the CVFPP, three within the Sacramento River Basin and three within the San Joaquin River Basin. The Lower Sacramento River/North Delta RFMP completed in July of 2014 (herein referred to as the 2014 RFMP) encompasses the greater Sacramento Area, the Yolo and Sacramento Bypass systems, and the north Sacramento-San Joaquin Delta (Delta) Legacy Communities along the Lower Sacramento River system between Sacramento and Rio Vista. Small communities, as defined in the CVFPP, are communities protected by SPFC levees with populations between 200 and 10,000, but exceptions were made to include Delta Legacy communities with populations of less than 200, such as Locke and Ryde.

The SCFRRP is very similar to the DWR 5-year plans developed for and by the levee districts throughout the Delta where the LMAs or RDs are tasked with identifying where their greatest risks are to flooding and each of the LMAs or RDs prioritize repairs and improvements to their levee systems to minimize flood risks. The key difference between the two programs is the SCFRRP focuses more on the densely populated portions of land tracts protected by SPFC levees; whereas the Delta 5-year plans focus more on the perimeter levee systems protecting the tracts/islands within the Delta independent of whether the levees are SPFC or non-SPFC levee systems.

1.1 Intent of Senate Bill 5 for Small Communities

The Central Valley periodically experiences devastating floods. One of the most recent large events in 1997 led to passage of the Central Valley Flood Protection Act of 2008, also known as Senate Bill (SB) 5. SB 5 requires DWR to prepare a strategic systemwide flood protection plan for SPFC[1] facilities in the Sacramento-San Joaquin Valley. The 2012 CVFPP was the first iteration of this plan, and SB 5 mandates that it be updated on a 5-year interval.

[1] In summary, the SPFC includes the State and federal flood control works, lands, programs, plans, conditions, and mode of maintenance and operations of the Sacramento River Flood Control Project described in Section 8350 of the California Water Code, and of flood control projects in the Sacramento River and San Joaquin River watersheds for which the State (DWR or Central Valley Flood Protection Board) has provided assurances of nonfederal cooperation to the United States.

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Regarding small communities, SB 5 requires cities, counties and State and local flood management agencies to collaborate to provide cost-effective strategies for reducing flood risk. The bill also called for development of funding mechanisms to finance flood protection responsibilities at the local level. To this end, the 2012 CVFPP included many broad goals for improved flood management for areas protected by SPFC facilities, including small communities and portions of the Sacramento-San Joaquin Delta (Delta).

The SCFRRP focuses specifically on reducing flood risks for small communities protected by SPFC facilities, inclusive of areas designated as Delta Legacy Communities. Small communities are defined as communities protected by SPFC facilities with a population of less than 10,000 residents. Delta Legacy Communities are a subset of small communities, located within the legally defined (Legal) Delta, which have cultural, historic, or ambiance value that give the Delta a distinctive sense of place (Delta Protection Commission [DPC], 2012) (Figure 1-1).

Under the SCFRRP, Sacramento County, as the local land-use planning entity, was awarded a DWR grant in 2017 on behalf of the community of East Walnut Grove, to prepare a feasibility study to identify and prioritize flood risk reduction management actions. For the purposes of this report, the community of East Walnut Grove refers to the densely populated town of East Walnut Grove within RD 554 and the industrial area of East Walnut Grove within RD 563 adjacent to Walnut Grove-Thornton Road. In addition to East Walnut Grove there are seven additional Delta Legacy Communities that received grant funds to prioritize flood risk reduction measures in the Sacramento River corridor of the North Delta. Those Legacy communities include Courtland, Hood, Locke, West Walnut Grove/Ryde on Grand Island, Isleton, Clarksburg and Rio Vista.

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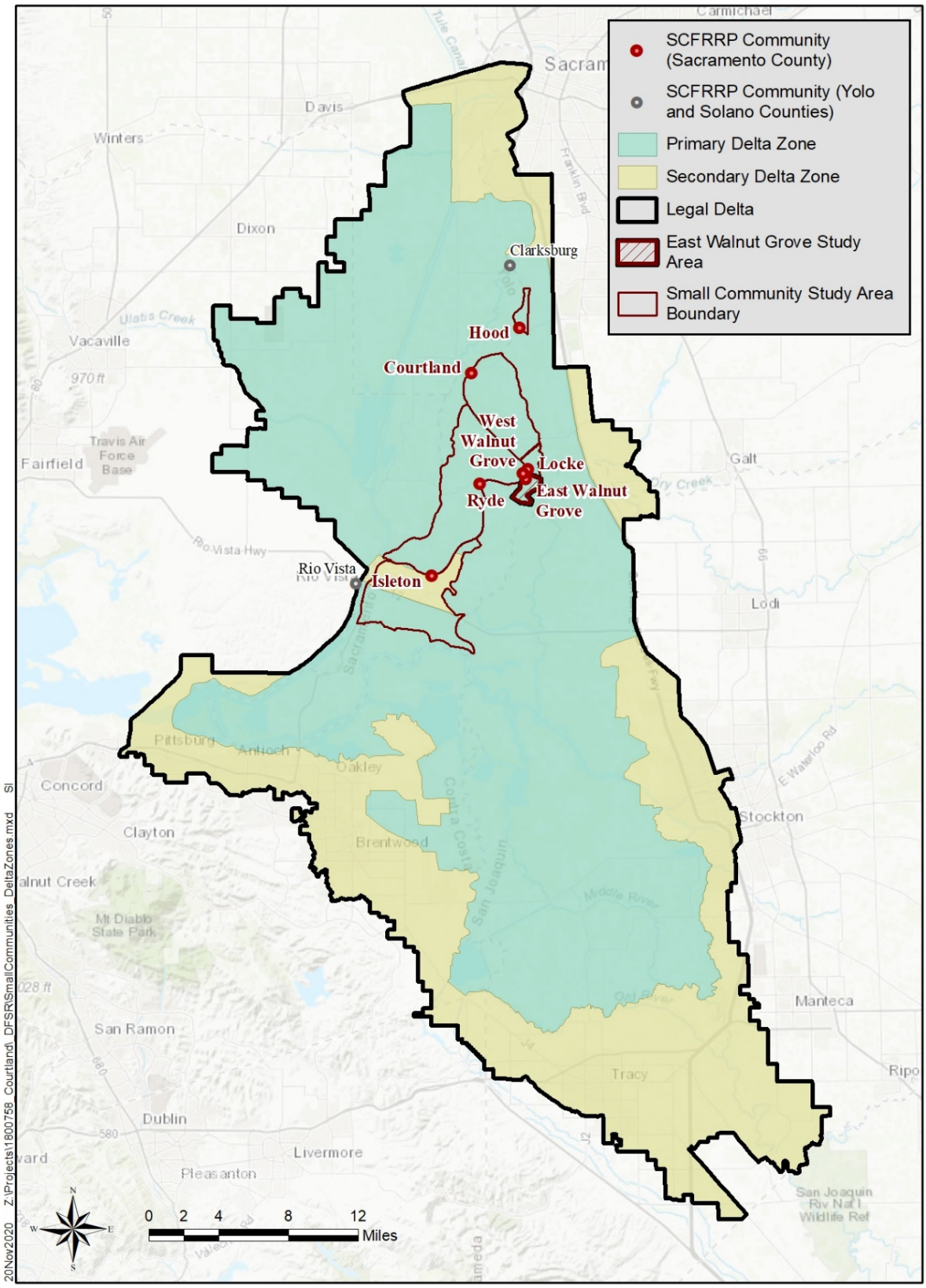

Figure 1-1. Delta Legacy Communities Participating in the Small Communities Flood Risk Reduction Program

1.2 Goals and Scope of the Study

As described in the 2012 and subsequent 2017 CVFPP Update, the goal of the State as well as the Delta Legacy Communities is to improve SPFC levees and applicable adjoining non-SPFC levees protecting small communities to achieve 100-year (1% annual chance) flood protection, as defined by the Federal Emergency Management Agency (FEMA). Consistent with this goal, the goal of this feasibility study is to develop, evaluate, and prioritize structural and non-structural flood risk reduction measures for the East Walnut Grove study area, which would also strengthen and modernize SPFC levees within the study area which comprise a portion of the Delta's freshwater corridor, and to ultimately achieve 100-year flood protection and meet FEMA 100-year certification criteria.

Structural Flood Risk Reduction Measures

- Repair/strengthen in-place existing levee system(s)
- Strengthen existing levee(s)/embankments with cut-off walls, seepage berms, stability berms, etc.
- Repair existing erosion sites on levee systems
- Address and correct known encroachments/deficiencies in levee systems that pose threat to levee integrity
- New setback levee in place of existing levee system segments

The flood risk reduction measures to be developed include multi-benefit objectives for East Walnut Grove and its agricultural, recreation, and socioeconomic attributes, where possible, as well as statewide water conveyance benefits along the Sacramento River and other north Delta freshwater corridors consisting of the Delta Cross Channel (DCC), Snodgrass Slough, and Georgiana Slough. Improvements to the levee systems (SPFC and non-SPFC levee system) protecting the East Walnut Grove study area can collectively enhance the resiliency and reliability of through-Delta water conveyance.

Non-Structural Flood Risk Reduction Measures

- New ring levee system(s) and/or new cross levee to isolate smaller areas (communities) from a larger perimeter levee system that may be more susceptible to levee failures
- New all-weather access roads or flood fight berms to address and potentially fend-off rising flood water that may occur in other portions of a large RD compared to a small fractional area (community) protected by a larger perimeter levee system
- Voluntary elevation of structures, ideally for potential flood depths greater than 3 to 5 feet
- Wet floodproofing of structures, ideally for flood depths less than 5 feet, and some agricultural structures for flood depths greater than 5 feet
- Securing FEMA accreditation by executing a number of combined structural and non-structural measures pursuant to 44 CFR §65.10
- Improved Emergency Response; Local Hazard Mitigation Plans, Flood Emergency Safety Plans, and potential relief cuts
- Alternatives to FEMA's National Flood Insurance Program – community- and flood-risk based insurance programs with or without formation of a Geologic Hazard Abatement District
- Public awareness and education of local and regional flood risks
- Improved governance between neighboring LMAs/RDs and communities
- Regional/local flood easements and flood flow/channel conveyance enhancements
- Acquisitions and relocations of structures and residents

While 100-year flood protection is the goal of the State and the Delta Legacy Communities, there are concerns that improvement of the flood control system could encourage development, thereby potentially increasing flood risk. However, within the Primary Zone of the Delta (as shown in Figure 1-1) there are significant restrictions within the adopted 2013 Delta Plan adopted by the Delta Stewardship Council (DSC) that do not permit development to occur by displacing agricultural land uses.

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As a result, improvements identified in this study are not expected to induce development and/or result in increased flood risk within the East Walnut Grove study area.

1.3 State's Interest in the Delta

The State of California has broad interests in integrated water management within the Delta which must be considered within the context of this feasibility study, including:

- *Water Supply Reliability* – The State supports the availability and conveyance of surface water (when available based on hydrologic conditions), timely delivery, and adequate water quality for urban and agricultural water users. Water, from north of Delta sources, is delivered through the Delta by DWR, via the State Water Project (SWP), the State Water Contractors and the United States (U.S.) Bureau of Reclamation, via the Central Valley Project (CVP).
    - SWP and CVP supplies conveyed south of Delta serve approximately 3M acres of agricultural lands and a population of 25M.
    - The entire volume of water conveyed by the SWP and CVP in the north Delta currently passes directly by East Walnut Grove via the 1.6 miles of SPFC-leveed channels of the Sacramento River and Georgiana Slough adjacent to East Walnut Grove, and the 2.5 miles of non-SPFC leveed channels of the adjoining DCC and Snodgrass Slough immediately adjacent to and downstream of the DCC.

Sustainable Delta – the State supports investments that contribute to Delta sustainability and resiliency in the face of sea level rise and climate change, which will likely result in higher and longer duration flood stages.

- *Delta Ecosystem Protection, Enhancement, and Restoration* – The State supports integrating flood and water management with ecosystem restoration actions that may include riparian, tidal marsh, freshwater marsh, and floodplain habitats.
- *Preserving the Unique Characteristics of the Delta* – Delta Legacy Communities have a distinct natural, agricultural, and cultural heritage with the State recognizing the importance of preserving and enhancing the unique characteristics of these Delta Legacy communities. Through numerous initiatives, the State has prioritized support for the preservation and revitalization of these communities as well as the Delta agricultural economy and culture, fishing, boating, waterfowl and upland game bird hunting, wildlife viewing, and recreation. In addition to the State's recognition of significant cultural values, the entire Legal Delta has received the distinction as California's one and only National Heritage Area, designated by Congress in March 2019.
- *Providing Appropriate Levels of Flood Protection* – The State, through DWR, has a long history of cost-sharing with federal and local agencies on projects that provide benefits to the local, State and national economic interests. Although operation and

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maintenance (O&M) is coordinated through LMAs in the Delta, for most areas, the State ultimately has O&M responsibility for SPFC facilities, including SPFC channel maintenance, and also an interest in providing technical and financial assistance for levee maintenance and rehabilitation of non-SPFC facilities within the Delta.

The State's investment in integrated water management must contribute to a sustainable Delta. Therefore, this feasibility study defines which actions could potentially contribute the most to Delta sustainability and how levee investment metrics are defined, tracked, and measured.

1.4 East Walnut Grove's Need for Improved Flood Protection

East Walnut Grove is one of eight Delta Legacy Communities located along the Lower Sacramento River Corridor in the North Delta participating in the SCFRRP (Figure 1-2). Note that Walnut Grove exists as a single community on both sides of the Sacramento River, but for this flood risk reduction study, the east and west sides of Walnut Grove are discussed and evaluated separately, since they have different levels of flood risk and are located within different RDs. The levees surrounding the community of East Walnut Grove along the left (east) bank of the Sacramento River and Snodgrass Slough were constructed prior to 1906 by local interests and were generally built using materials dredged from the adjacent Sacramento River and nearby, adjoining sloughs. Various improvements have been made to the SPFC levees along the Sacramento River over the years, including levee reconstruction and bank protection work at multiple locations. In 2006, FEMA reached out to Sacramento County and the levee maintenance districts including RD 554 to learn if adequate documentation supported certification of the levees. In 2012, FEMA updated the flood insurance rate maps (FIRMs) and the Walnut Grove Tract, inclusive of the town of East Walnut Grove, was mapped as a Special Flood Hazard Area (SFHA) Zone AE.

The levees protecting the community of East Walnut Grove fall short of meeting current, modern levee design standards to provide a 100-year level of flood protection (pursuant to FEMA accreditation standards in the Code of Federal Regulations, Chapter 1, Subchapter B, Part 65, Section 65.10 [44 CFR §65.10]).

Also, in 2012, the Biggert-Waters Flood Insurance Reform Act (BW-12) was passed putting into motion substantial annual increases to flood insurance costs until premiums are rated based on the elevation certificate. The unfortunate oversite in this is that the premiums don't recognize that there is a levee system that has stood the test of time. Instead, premiums are rated as if there were no levees present. Consequently, whether or not one believes the flood hazard to be of concern, the cost of flood insurance administered by FEMA under the current National Flood Insurance Program (NFIP) has certainly become a large and continuously growing concern.

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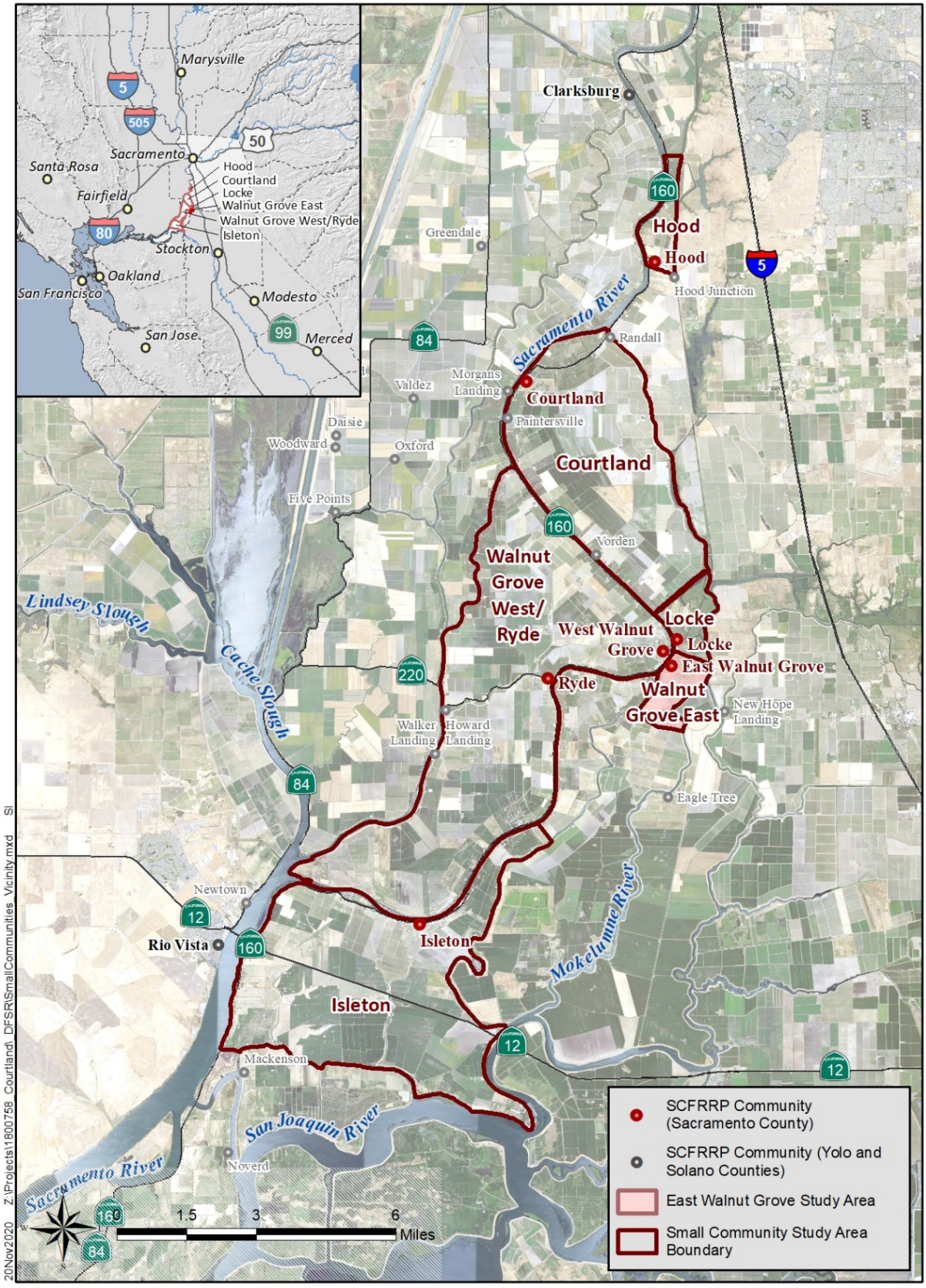

Figure 1-2. Delta Legacy Communities Participating in the SCFRRP.

1.5 Study Area and Location

The study area for this SCFRRP effort includes the community of East Walnut Grove and the larger, adjoining agricultural areas shared between RDs 554 and 563 (Figure 1-3). The portion of RD 554 (450 acres south of the Delta Cross Canal) encompasses the tract of land known as Walnut Grove (East), and RD 563 includes the adjacent Tyler Island that includes the Walnut Grove industrial park area along Walnut Grove – Thornton Road. The RD 563 portion of the study area totals 290 acres. The community of East Walnut Grove is co-located between portions of the two RDs.

The densely populated community of East Walnut Grove sits at an elevation of 8 to 13 feet (North American Vertical Datum 1988 [NAVD 88]) along the east (left bank) of the Sacramento River and Georgiana Slough, south of Locke and the DCC. Elevations and flood depths provided herein are referenced to NAVD 88. RD 554 is the LMA responsible for levee maintenance in this area and maintains nearly 3.5 miles of levee (0.9 mile of SPFC levees along the left or east banks of the Sacramento River and Georgiana Slough, 2.0 miles of non-SPFC levees along the DCC and Snodgrass Slough, and a 0.54-mile "dry cross levee" which separates RD 554 from Tyler Island/RD 563 to the south[2]). This levee system protects approximately 450 acres in RD 554 south of the DCC, including the community of East Walnut Grove and adjoining agricultural lands planted in both permanent and seasonal crops. The industrial portion of East Walnut Grove is located along the Walnut Grove-Thornton Road corridor within RD 563 on Tyler Island. The project study area on Tyler Island within RD 563 is limited to only the northern 290-acre portion of Tyler Island. The RD 563 levees within the project study area include and are limited to 0.50 miles of a non-SPFC levee reach along the right or west bank of Snodgrass Slough, a short 950 ft. reach of non-SPFC levee along the right or west bank of the Mokelumne River, and 0.70 miles of a SPFC levee reach along the left or east bank of Georgiana Slough.

A levee breach of any SPFC levee on the left bank of either the Sacramento River or Georgiana Slough or of any non-SPFCS levee along the DCC or Snodgrass Slough within RD 554 would very likely result in quickly inundating all of East Walnut Grove within RD 554, including portions of the industrial area of East Walnut Grove within RD 563.

[2] In addition to other flood management facilities, the SPFC includes "Project levees," which were constructed by the U.S. Army Corps of Engineers as part of federal-State flood control projects and were turned over to the State for operations and maintenance ("assurances"). The State has generally passed on the responsibility for routine maintenance of Project levees to LMAs, *(inclusive of RDs 554 and 563)*. The SPFC relies on many other non-SPFC features, such as non-State or federal reservoirs to regulate flows and reduce loading on the system, and private levees in the Central Valley or non-project (local) levees in the Delta, for which the State has not provided assurances.

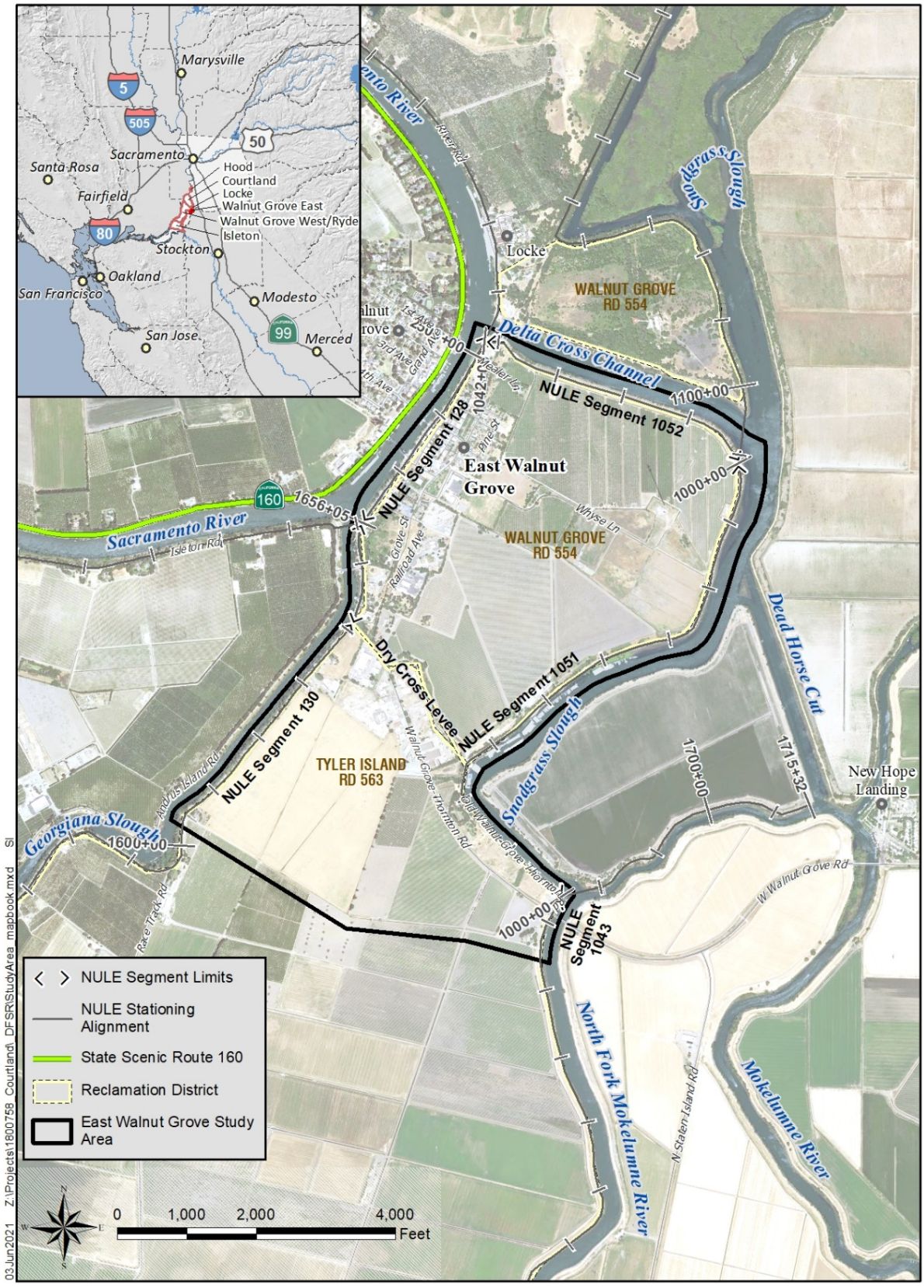

Figure 1-3. East Walnut Grove Study Area

1.6 Public Outreach and Engagement

This feasibility study has been prepared in close coordination with the community of East Walnut Grove and agencies with a shared interest in a safe, sustainable, and vibrant Delta. Sacramento County has been engaged with local planning groups for each Delta Legacy Community in Sacramento County to share the story of each community, help the public understand flood risks, and share possible flood risk reduction planning documents and solutions for the future.

Visit the East Walnut Grove Story Map for more details: East Walnut Grove Story Map - Sacramento County Small Communities Flood Risk Reduction Program.[3]

1.6.1 Stakeholder Identification and Outreach

The residents and business owners of East Walnut Grove have been invited and encouraged to participate in the planning effort. This feasibility study has been prepared in close coordination with representative participating stakeholders with interest and knowledge in providing enhanced flood protection for East Walnut Grove. Stakeholders include representatives of RD 554 and RD 563; landowners and NFIP policy holders within RDs 554 and 563 and Sacramento County; the Sacramento County Department of Water Resources, inclusive of the County's floodplain administrator; and State and federal agencies (including FEMA), and non-governmental agencies with interests at the nexus of ecosystem restoration and flood risk solutions within and beyond the Delta. Community residents and landowners within East Walnut Grove have been encouraged to stay engaged in this process through implementation of both structural-based MAs and non-structural measures.

1.6.2 Communications and Engagement

The goal of this feasibility study is to have the flood risk reduction solutions be developed, promoted, and prioritized by the community of East Walnut Grove, inclusive of areas beyond the community of East Walnut Grove and within RDs 554 and 563. The feasibility study began by developing a planning committee initially comprised of people that live within the community and within the two noted RDs. The committee is comprised of the following members: Jeff Tranum, Daniel Wilson, Gil Labrie, Les Lyman, Justin Van Loben Sels, Steve Mello, and Chris Neudeck.

Meeting fatigue has occurred in the Delta due to the multitude of planning processes that have been performed particularly in the last decade. Thus, the planning committee acted as representatives that could help guide the study through development prior to being released to the entire community and residents/business owners within both RDs. The study process began

[3] https://sacramentocounty.maps.arcgis.com/apps/MapJournal/index.html?appid=3e6a7a1f41184e4f8d1445fc9d90b69e

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with the development of an interactive Story Map on Sacramento County's Storm Ready website http://sacdelta.stormready.org/ (published in September 2018) that could describe the community, its importance to the region, its current flood risk, and recommended solutions to reduce that risk.

An initial meeting with the planning committee as well as trustees from RDs 554 and 563 was held in June 2018. The purpose of this meeting was to identify existing concerns, brainstorm opportunities, and develop an array of potential solutions. This meeting acted as a guide to direct the study. The concerns identified included; (1) instability issues on the Snodgrass Slough levee; (2) geometry deficiencies on the DCC levee; (3) remaining steps needed to obtain FEMA 100-year certification for the portion of East walnut Grove in RD 554 south of the DCC; (4) reduce flood risk in adjacent RD 563 – Tyler Island,; (5) improved flood evacuation timing; and (6) investigate and evaluate the impact of a potential relief cut within RD 563, and possibly within RD 554.

The opportunities include improving flood fight coordination between RD 554 and RD 563 as well as a multi-benefit opportunity of the levee system repairs/improvements to improve resiliency of through-Delta water conveyance, and protecting habitat areas owned by the California Department of Fish and Wildlife (CDFW) from deep flooding.

Structural management actions and non-structural measures were discussed. The group's highest priority structural management action was to fix the weakest links within the levee system. The group also expressed the desire to obtain FEMA 100-year certification and evaluate costs associated with doing so within RD 554. RD 554 has been working on this process and had a $2.4 million (M) cost-share agreement with the U.S. Army Corps of Engineers (USACE) that has since expired. The group expressed desire to use the feasibility study as a means to negotiate a similar agreement. Click here to learn more about achieving a 100-year level of flood protection pursuant to the current FEMA accreditation standards.[4]

A close review of the FEMA regulations, in particular 44 CFR §65.10 (b) *Design criteria* (4) *Embankment and foundation stability,* indicates certain through seepage and underseepage criteria and factors of safety must be adhered to meet full certification criteria. In the North Delta, where there are significant sandy soil materials underlying the levee systems initially built over 150 years ago and periodically upgraded decades ago, the levees still fall well short of meeting current, modern engineering and FEMA accreditation standards. To meet such standards, most all of the levees in the North Delta, inclusive of the SPFC and non-SPFC levees protecting the community of East Walnut Grove, may need to be retrofitted with either seepage cutoff walls and/or a combination of seepage/stability berms which are very costly and can cost in excess of $15M per mile.

[4] https://www.fema.gov/sites/default/files/documents/fema_levee-guidance.pdf

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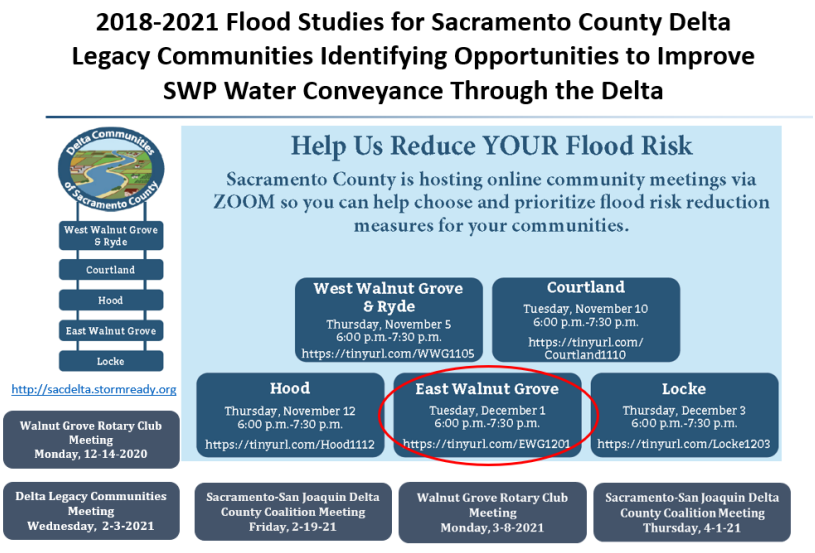
Non-structural measures discussed included improvement of the emergency operations plan and coordination with RD 563 on relief cut options. The group also wanted to evaluate ways to reduce NFIP flood insurance premiums. A common non-structural measure is to raise houses so that the lowest inhabitable floor space is safely above the flood hazard elevation on a firm, flood resistant foundation.

The study team attended a RD 554 board meeting in September 2019 to obtain existing data and input on existing and needed geotechnical information. To obtain accurate estimates of Expected Annual Damages (EAD), which are used to evaluate and prioritize flood risk reduction management actions, the team discussed the need to obtain more accurate crop data and to increase the base flood elevation from 9 ft. to 11 ft. The team also discussed the need for additional geotechnical explorations and data on the cross levee between RDs 554 and 563.

The study team met with representatives from RDs 563 and RD 554 to coordinate flood response and evaluate solutions to prevent flooding from occurring within RD 563. The attendees provided history of repairs on the system and discussed flood potential from the Cosumnes-Mokelumne system. Relief cuts options were evaluated, and the group noted that there is a need to create a plan and agreement between the two RDs beforehand, preferably well in advance of attempting to implement a relief cut during flood emergency conditions. The need for increased flood protection for the industrial area within RD 563 was noted. This area may need a ring levee or additional muscle wall for protection from a flood originating within RD 563, as most recently occurred in 1986. The biggest flood concerns are near the downstream oxbow at Oxbow Marina and around where the levee recently slipped during high-water conditions in 2017. There was also a desire to improve carrying capacity in the downstream channels, particularly the South Fork of the Mokelumne.



The LMAs felt that additional data regarding the existing levee system would help in this planning effort.

The study team had a meeting with the planning committee members in February 2020 to review geotechnical data and obtain feedback on proposed alternatives. The planning committee expressed that the preferred structural solution is to obtain FEMA certification, but this will require addressing seepage and some erosion near Sheldon gas. They also mapped a route for an all-weather access road/flood fight berm behind the industrial area on RD 563. A potential relief cut on RD 563,

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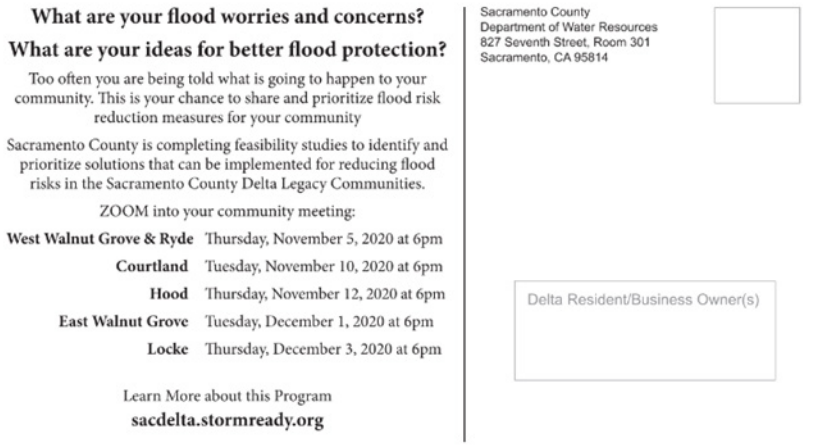
which could result in a 6-ft. reduction in flood depths at the upper end of the basin, was also discussed.

The planning committee as well as the public was provided a draft feasibility study report in November 2020 for their review which was followed by a virtual meeting in December 2020 to discuss the report and receive additional input. During the December 2020 meeting, stakeholders expressed support for enhancing the resiliency and reliability of through-Delta water conveyance by repairing and strengthening the SPFC levees within the study area. Some stakeholders did not express favorable support for a flood fight berm in RD 563, while others expressed concern over the cost of securing FEMA accreditation for RD 554.



What are your flood worries and concerns?

What are your ideas for better flood protection?

Too often you are being told what is going to happen to your community. This is your chance to share and prioritize flood risk reduction measures for your community

Sacramento County is completing feasibility studies to identify and prioritize solutions that can be implemented for reducing flood risks in the Sacramento County Delta Legacy Communities.

ZOOM into your community meeting:

West Walnut Grove & Ryde	Thursday, November 5, 2020 at 6pm
Courtland	Tuesday, November 10, 2020 at 6pm
Hood	Thursday, November 12, 2020 at 6pm
East Walnut Grove	Tuesday, December 1, 2020 at 6pm
Locke	Thursday, December 3, 2020 at 6pm

Learn More about this Program

sacdelta.stormready.org

Sacramento County
Department of Water Resources
827 Seventh Street, Room 301
Sacramento, CA 95814

Delta Resident/Business Owner(s)

This input was incorporated into the final report submitted to the Sacramento County Board of Supervisors for consideration of adoption by December of 2021. Additional stakeholder input regarding the preference, prioritization, and implementation of management actions and accompanying non-structural measures summarized in Sections 7 and 8 was also sought between the development of the draft and final Feasibility Study Report.

A summary of outreach meetings held for the East Walnut Grove study area is provided in Table 1-1.

Table 1-1. Outreach Community Meetings for the East Walnut Grove Study Area.

Date	Event/Location	Address	Host Organization	Attendance
6/12/2018	Kiononia Hall	14120 Grand Ave, Walnut Grove	SCFRRP Study Team	5
9/24/2019	Walnut Grove Fire Station	14160 Grove St., Walnut Grove	Reclamation District 554	9
1/30/2020	RD 563 District Office	13941 River Rd., Walnut Grove	Reclamation District 563	7
2/26/2020	Kiononia Hall	14120 Grand Ave, Walnut Grove	SCFRRP Study Team	12

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Date	Event/Location	Address	Host Organization	Attendance
12/01/2020	Virtual Zoom Meeting	--	SCFRRP Study Team	13

1.6.3 Coordination with Key Agencies within the Delta

This feasibility study has been prepared in coordination with the Delta stakeholders. They include representatives of RD 554 and RD 563; landowners and FEMA NFIP policy holders within RD 554 and RD 563; the Delta Legacy Communities Task Force; Sacramento County; State and federal agencies, and non-governmental agencies with environmental interests that are knowledgeable about the flood risks and potential solutions within the Delta.

Although many agencies are involved in the Delta, three regional agencies are heavily involved in land use policy and sustainability in this region, and thus have a special interest in SPFC improvements, as detailed below.

1.6.3.1 Delta Protection Commission

The DPC is focused on conservation of agricultural land and supporting economically sustainable agricultural operations in the Delta. The DPC maintains and implements the Land Use and Resource Management Plan (LURMP) for the Primary Zone of the Delta. City/County General Plans and future projects that affect land use in the five Delta counties must be consistent with the LURMP and are subject to review by the DPC.

DSC Delta Plan Coequal Goals

1) Providing a more reliable water supply for California and
2) 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." (CA Water Code §85054)

1.6.3.2 Delta Stewardship Council

The DSC was created to achieve the State mandated coequal goals for the Delta. The DSC also drafted, updates and administers the Delta Plan, a long-term management plan with recommendations to further the coequal goals, in a manner that protects and enhances the unique cultural, recreational, natural resources, and agricultural values of the Delta as an evolving place. All proposed projects within the Delta must be consistent with the Delta Plan, which precludes displacement of agricultural land uses with non-agricultural land uses; and subsequent structural solutions, such as improving/modifying the existing levee systems identified in this study for the community of East Walnut Grove, which may be subject to a consistency determination by the DSC.

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1.6.3.3 Delta Conservancy

The Delta Conservancy (Conservancy) is the primary State agency focused on the implementation of ecosystem restoration in the Delta and supports efforts that advance environmental protection and the economic well-being of Delta residents. The Conservancy collaborates and cooperates with local communities and other parties to preserve, protect, and restore the natural resources, economy, and agriculture of the Delta and Suisun Marsh. The Conservancy also collaborates on Delta branding and marketing, the Delta Carbon Program, invasive species control, and the CDFW Delta Conservation Framework. The Conservancy's Delta Public Lands Strategy includes integrated conservation for publicly funded lands in the Delta.

1.7 Related Plans, Programs and Studies

Many plans influence flood management in the Delta, as summarized below. In particular, this study aggregates and uses evaluations from the CVFPP and DWR's Non-Urban Levee Evaluations (NULE) Program and Flood System Repair Project (FSRP) to inform the development and prioritization of flood risk reduction measures for the East Walnut Grove study area.

1.7.1 Central Valley Flood Protection Plan

The CVFPP, mentioned previously, proposed improvements to SPFC levees, and where applicable, Delta (non-SPFC) levees, ecosystem enhancements, and flood risk reduction measures for small communities. The CVFPP identifies structural and non-structural options to protect small communities from the 100-year flood, and is the basis for selecting flood risk reduction elements and management actions considered in this feasibility study, including (DWR, 2012a):

1. Reconstructing or repairing perimeter levees in-place or making improvements to existing SPFC perimeter levees, and non-SPFC levees that could impact and/or enhance the performance of SPFC levees.
2. Protecting small communities "in-place" using ring levees, training levees, or floodwalls when improvements do not exceed a certain predetermined cost threshold.
3. Implementing non-structural improvements, such as developing flood fight berms, raising and elevating structures, floodproofing, willing seller purchases, and/or relocating structures, when the in-place improvements described above are not feasible.

1.7.2 Sacramento River Basin-Wide Feasibility Study

The Sacramento River Basin-Wide Feasibility Study (BWFS) was prepared subsequent to the 2012 CVFPP and focused on a multi-benefit approach to expansion of the flood bypasses. Solutions proposed in the BWFS germane to the East Walnut Grove study area include addressing system capacity constraints to allow for improved conveyance through widening the

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Yolo and Sacramento Bypasses and Fremont and Sacramento Weirs. These expansions and modifications are underway and are expected to provide a reduction in flood stage of 1 to 2 feet along segments of the Sacrament River, adjacent to Delta Legacy Communities, as depicted in Figure 1-4. The noted expansions and modifications to the upstream Sacramento and American rivers/bypasses will help neutralize some of the basin-wide impacts of climate change in the Lower Sacramento River as most all excess flows will be diverted into the bypass systems with metered or controlled flows being routed downstream of the American River in the Lower Sacramento River in the North Delta. However, it should be noted that the Sacramento River BWFS did not fully address climate change impacts from the adjoining, largely unregulated basins of Morrison Creek, Snodgrass Slough, the Cosumnes and Mokelumne rivers and Dry Creek that impact high flow stages in the Mokelumne River and Snodgrass Slough abutting the East Walnut Grove study area. Climate change could result in higher flood flows and stages within the Morrison Creek, Cosumnes and Mokelumne River watersheds that can collectively or individually impact downstream flood stages in the Mokelumne River that may increase the risk of flooding to the community of East Walnut Grove.

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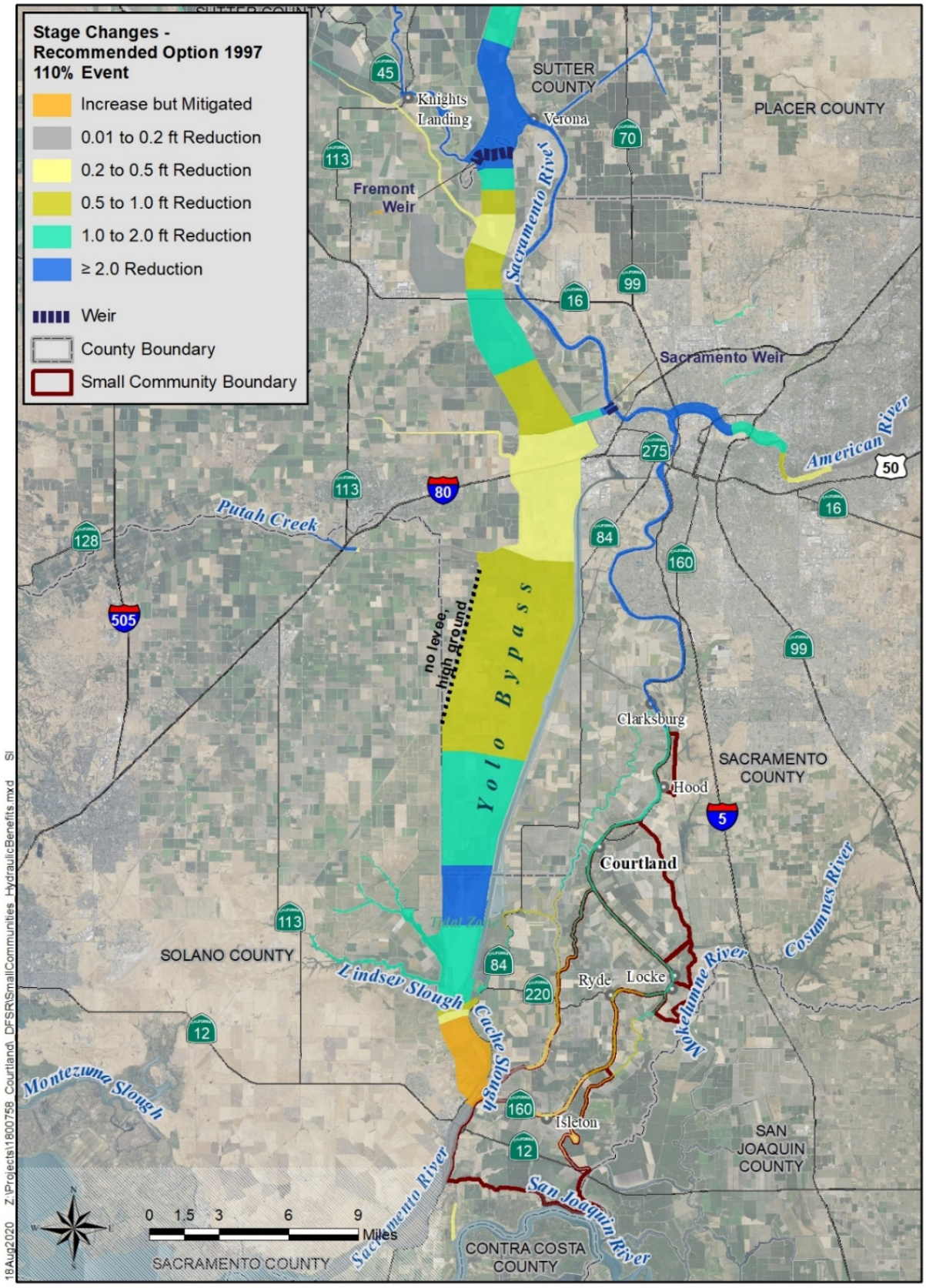

Figure 1-4. Flood Stage Reductions as a Result of the BWFS Expansions and Modifications.

1.7.3 Lower Sacramento River/Delta North Regional Flood Management Plan

The 2014 Lower Sacramento River/Delta North Regional Flood Management Plan (2014 RFMP) was developed by FloodProtect, a regional working group, as the regional follow-on to DWR's 2012 CVFPP. The 2014 RFMP was funded by DWR but drafted by local agencies and identified pre-feasibility level regional flood management solutions (FloodProtect, 2014). The 2014 RFMP also recommended further flood risk reduction feasibility studies for many small communities and Delta Legacy Communities, including East Walnut Grove.

1.7.4 Delta Levees Investment Strategy

The Delta Levees Investment Strategy (DLIS) was prepared by the DSC as a follow-on to the Delta Plan to identify funding priorities for State investments in Delta levees. Funding priorities were developed using a risk-based analysis, which quantified risks to people, property and infrastructure, water supply reliability, ecosystems, and the Delta as a place, by developing estimates of flooding probability due to seismic and hydrologic events.

The DSC's goal was to develop a list of very-high priority and high priority islands and tracts by quantifying risks using several metrics such as expected annual fatalities and EAD. Seventeen islands were identified as very-high priority and 36 islands and tracts were identified as high priority (DSC, 2017). The RD 554 portion of the East Walnut Grove study area has been initially placed in the "Other Priority" category, based on many variables, and thus was not highly prioritized for State investment under the initial DLIS prioritization process (Figure 1-5). However, the RD 563 portion of the East Walnut Grove study area on the northern, upstream end of Tyler Island was identified as an area of high priority for Delta levee investments (Figure 1-6).

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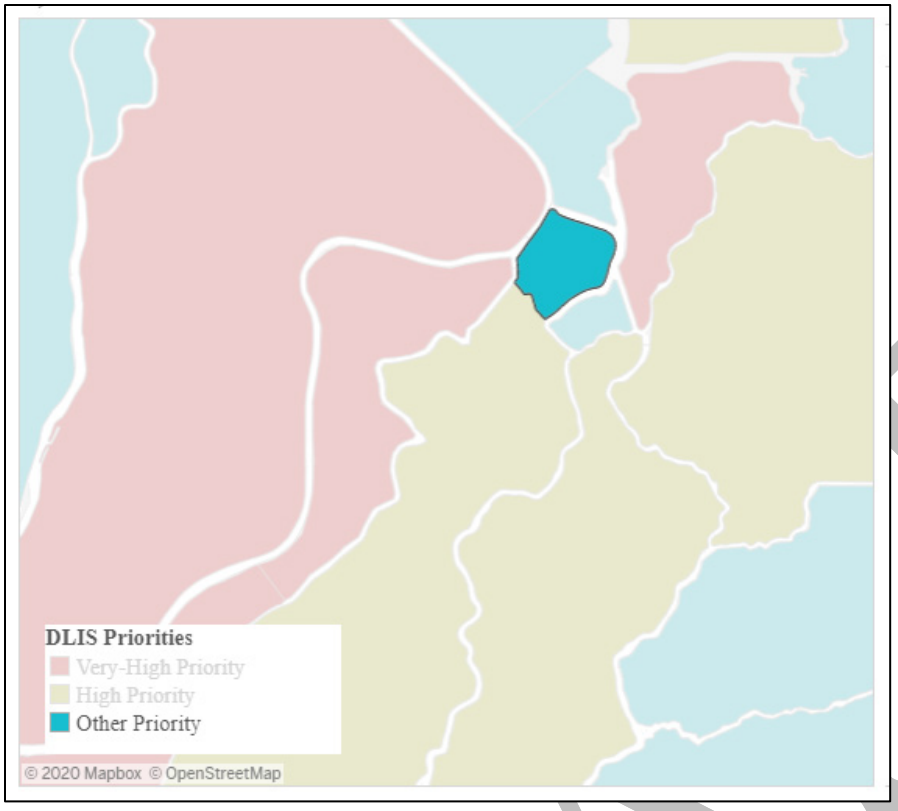

Figure 1-5. DLIS Analysis – Overall Prioritization of RD 554 (Rand Corporation, 2020)

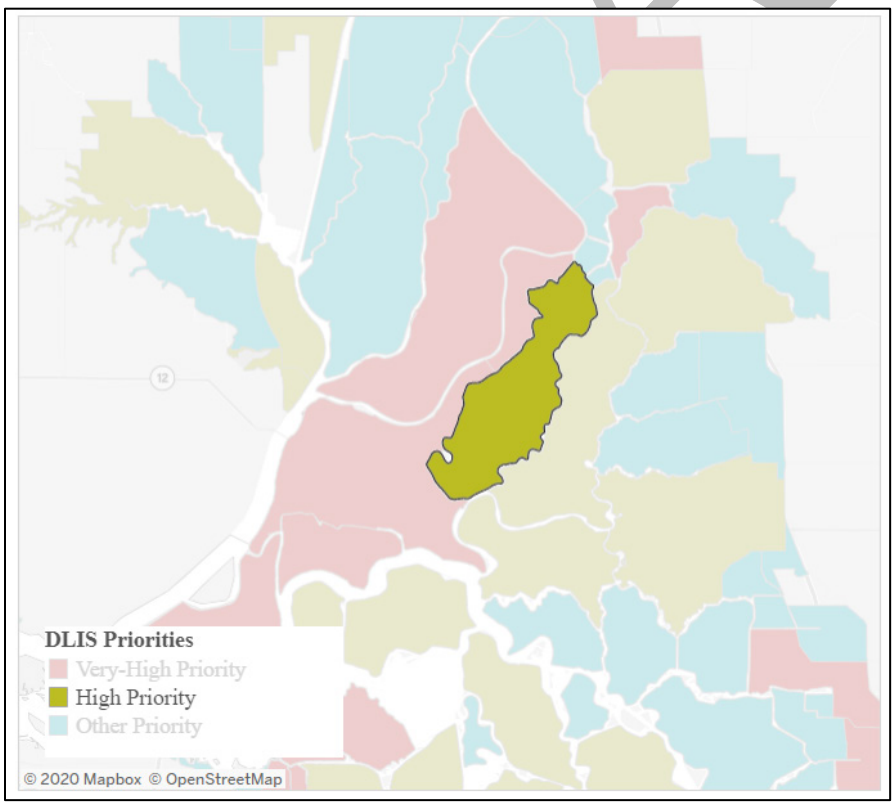

Figure 1-6. DLIS Analysis – Overall Prioritization of RD 563 (Rand Corporation, 2020)

It should be noted that the DSC is in the current process of updating their DLIS, based upon more current data and updated methodologies. A representation of the initial DLIS analysis (annual probability of flooding due to a hydrologic event) is shown in Figure 1-7 for RD 554. The RD 554 portion of the East Walnut Grove study area was initially estimated to have an annual probability of 1.5 percent to flooding as a result of a hydrologic event according to DLIS. Similarly, RD 563 downstream of RD 554 was initially estimated to have an annual probability of 2.8 percent to flooding (Figure 1-8). These annual probabilities of flooding are largely based upon levee geometry, namely freeboard levels relative to overtopping, combined with information provided in the Delta Risk Management Strategy, and not the current geotechnical characteristics of the RD 554 and RD 563 levee systems.

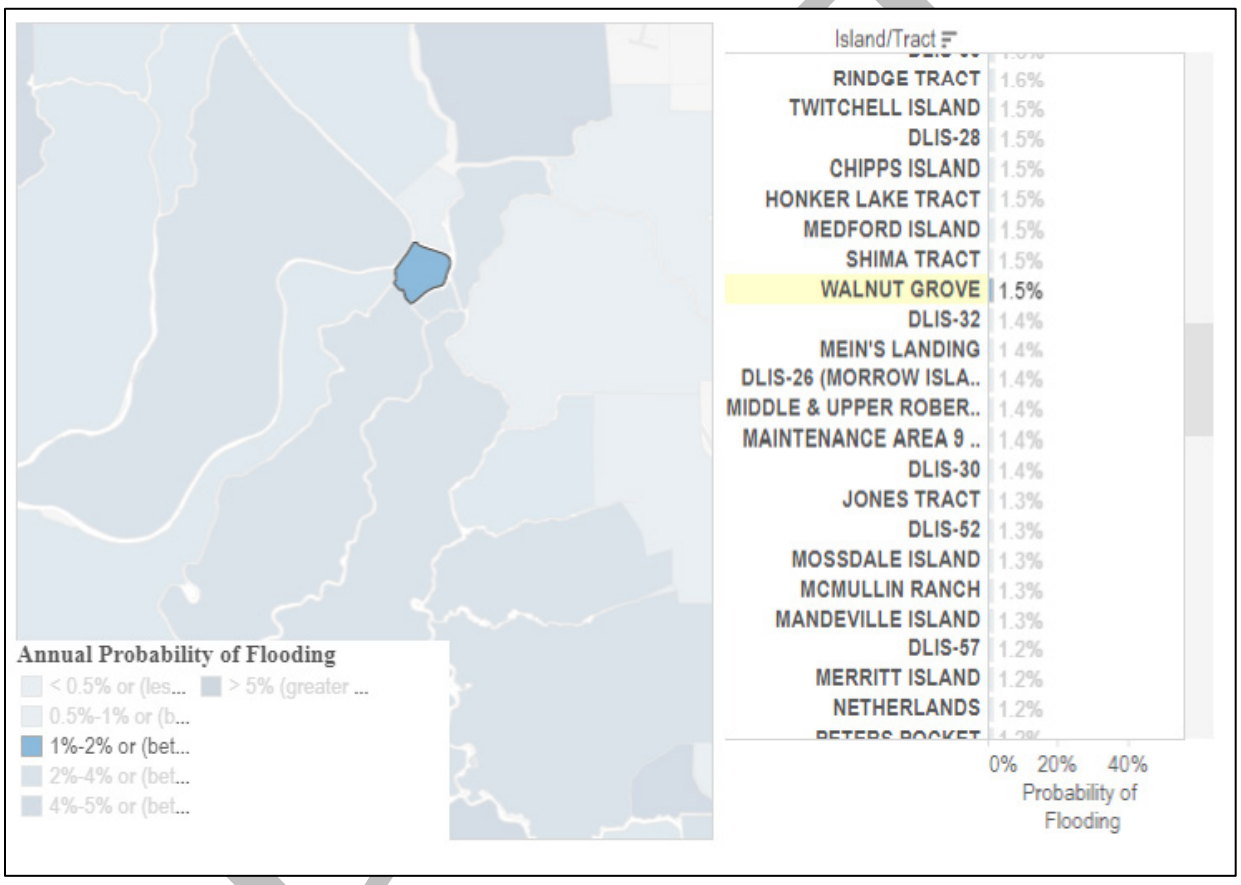

Figure 1-7. DLIS Analysis - Hydrologic Event for RD 554 (Rand Corporation, 2020)

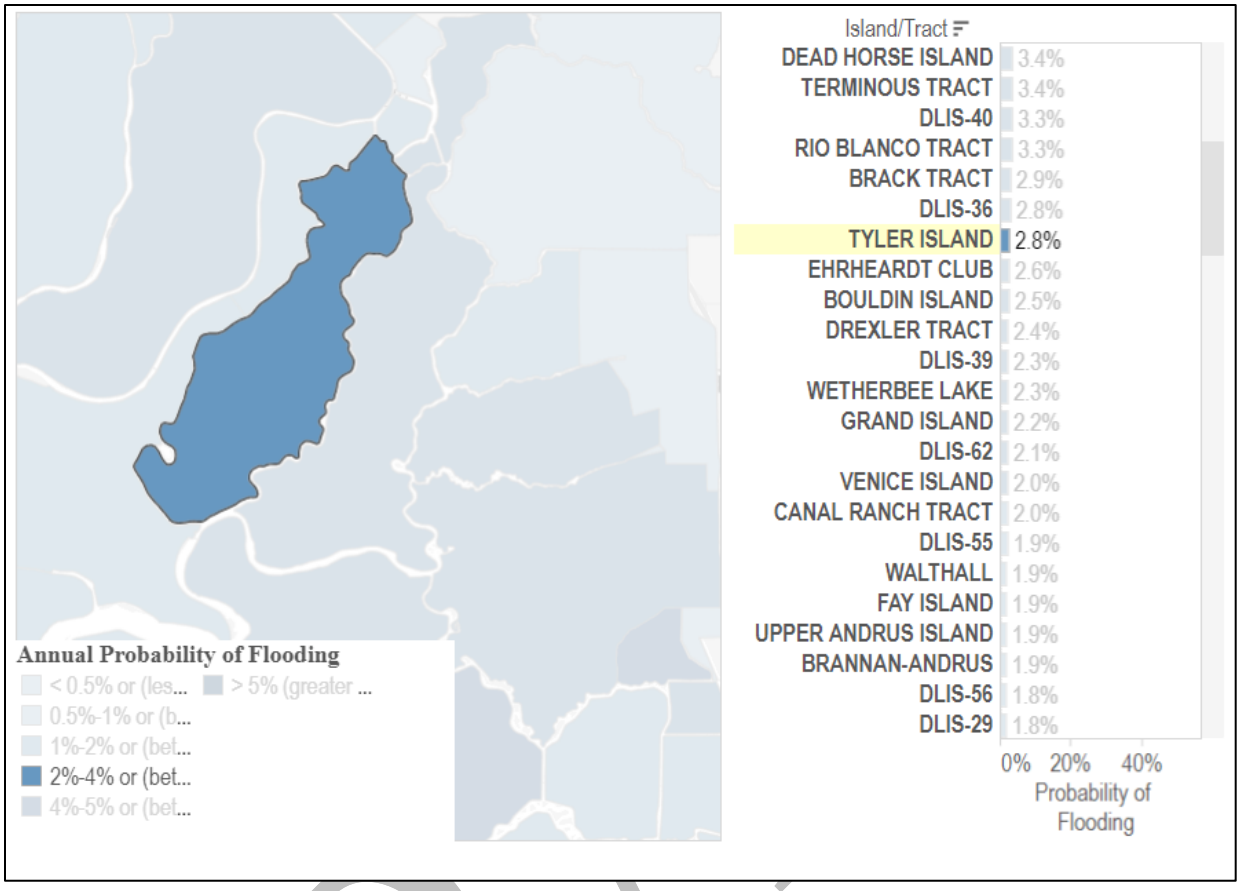

Figure 1-8. DLIS Analysis - Hydrologic Event for RD 563 (Rand Corporation, 2020)

The rulemaking process to adopt regulations implementing the DLIS is ongoing. However, the interactive DLIS Decision Support Tool representing the current prioritization and analysis framework is publicly accessible online here.[5]

1.7.5 Flood System Repair Project

The FSRP is funded by $150M of Proposition 1E funding and aims to assist LMAs in reducing flood risk on a cost-sharing basis. Through the FSRP, LMAs are provided technical and financial support to repair documented critical or serious problems with flood protection. The master database from the FSRP identifies levees with past performance problems for seepage, slope instability, erosion, and other problems (FloodProtect, 2014). DWR has not identified any current, outstanding FSRP repair sites within either the RD 554 or the RD 563 portions of the East Walnut Grove study area; however, FSRP sites have been identified in the lower reaches of Tyler Island in RD 563 beyond the immediate study area. Thus, an all-weather access road/flood fight berms and a cross levee have been explored to reduce flood risks to the RD 563 portion of the East Walnut Grove study area containing industrial development.

[5] https://www.rand.org/pubs/tools/TL266/tool.html

1.7.6 Non-Urban Levee Evaluations

DWR's NULE program evaluated non-urban levees against geotechnical criteria likely to impact levee performance, including stability, through seepage, underseepage, and erosion. In general, the program was administered using a phased approach in communities with less than 10,000 residents and included Phase 1 preliminary geotechnical evaluations using historical data for all NULE levees, and Phase 2 geotechnical field investigations to further evaluate those levees protecting more than 1,000 persons. NULE levee segments were assigned ratings based on potential failure mode and placed in an overall hazard category for which recommendations and cost estimates were prepared. Data from the NULE program are currently used in conjunction with LMA inspection reports and data from the FSRP to characterize SPFC and non-SPFC levees and to inform future State, regional, and local flood planning and financing efforts.

The results of Phase 1 NULE studies for the study area are detailed in Appendix A-1 and in Section 2.1.1, Topography and Levees. However, the East Walnut Grove study area did not meet the population threshold for NULE Phase 2 studies and therefore DWR geotechnical investigations were not conducted as part of that study. Therefore, site-specific geotechnical conditions were warranted and developed via mud rotary borings, cone penetration test soundings and accompanying soil sample lab tests were conducted by RD 554 in 2016 (*see* Appendix A-2 for additional information).

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2. Existing Conditions

2.1 Existing Conditions

2.1.1 Topography and Levees

Ground elevation for the East Walnut Grove study area is highest immediately adjacent to the levees (4-12 ft., NAVD 88) and slopes toward the center of the study area (less than 0-4 ft., NAVD 88) (Figure 2-1). Top of levee elevations vary from approximately 13 to 27 feet within the study area, with highest levee elevations located on the northwesterly upstream portion of the basin. The community of East Walnut Grove sits at an elevation of 4 to 12 feet NAVD 88 along the east bank of the Sacramento River and upstream easterly bank of Georgiana Slough in comparison to the larger study area that generally sits at an elevation of 0 to 4 feet NAVD 88.

The study area consists of nearly 4.83 miles of levees (Figure 2-1). Of these, approximately 3.45 miles are located within RD 554. The 3.45 miles of levees within RD 554 include:

- 0.9 mile of SPFC levees along the left (east) bank of the Sacramento River and its confluence with Georgiana Slough (NULE Segment 128)
- Nearly 2.55 miles of non-SPFC levees:
    - 0.8 mile along the south or right bank of the DCC (NULE Segment 1052)
    - 1.2 miles along the right (west) bank of Snodgrass Slough (NULE Segment 1051)
    - 0.54 mile of dry cross levee south of East Walnut Grove, abutting RD 563 and the industrial north portion of Tyler Island

The remaining 1.38 miles of levees located within RD 563 consist of:

- 0.7 mile of SPFC levees along the left (east) bank of Georgiana Slough (NULE Segment 130)
- 950 ft. of non-SPFC levee along the right (west) bank of the Mokelumne River (NULE Segment 1043)
- Nearly 0.50 mile of levee along the right (west) bank of Snodgrass Slough (NULE Segment 1051)

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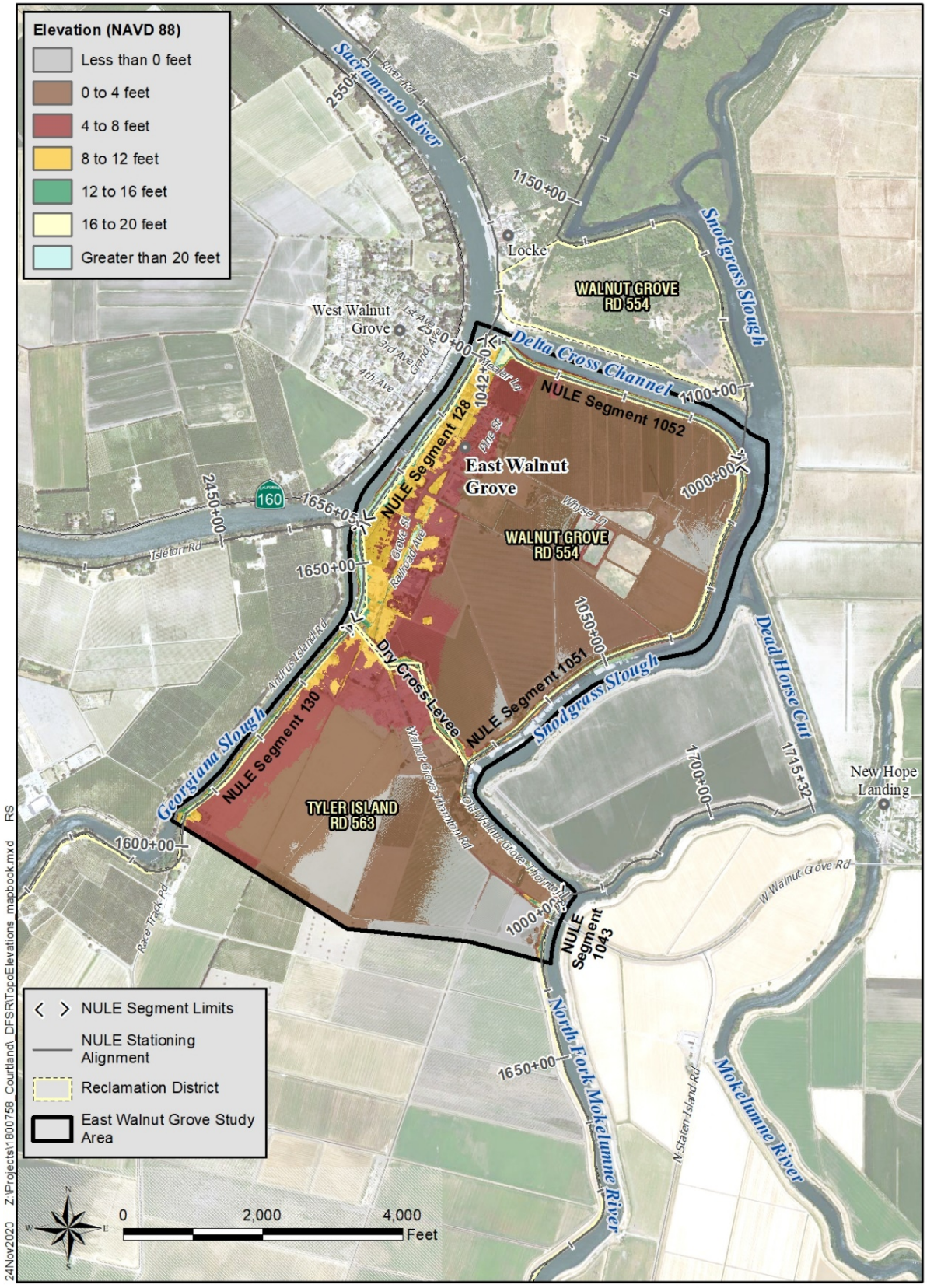

Figure 2-1. East Walnut Grove Study Area Ground Elevations and Levees.

As part of the 2017 update to the CVFPP, flood risk was assessed by defining impact areas with associated index points within the San Joaquin and Sacramento River Basins. Within this context, defined flood risks were quantified at discrete index points with impact area-specific levee performance curves. The levee performance curves were developed to be representative of a levee reach protecting the impact area, typically the worst case. The East Walnut Grove study area was aggregated into two impact areas: SAC 52 (Walnut Grove, RD 554) and SAC 53 (entirety of Tyler Island, RD 563) (as shown previously in Figure 1-3).

Levee performance curves were collectively updated by DWR and Sacramento County for each of the project levee segments in the study area during the course of this study as a result of geotechnical explorations performed in 2016. The new levee performance curves are included in Appendix E. For the purposes of this study, the existing SAC 53 impact area was divided into two new impact areas: SAC 53 – Urban, which is representative of the urban portion of East Walnut Grove that is located in the most northerly portion of RD 563 that adjoins RD 554, and SAC 53 – N1, which represents the remainder of RD 563 – Tyler Island (Figure 2-2). SAC 53 – N1 is outside the bounds of the East Walnut Grove study area and is not used within the context of this feasibility study.

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Figure 2-2: East Walnut Grove Study Area Impact Areas

Levee miles associated with each impact area are summarized in Table 2-1 below.

Table 2-1. Levee Miles for SAC 52 and SAC 53 (URS, 2011a)

	Levee Miles		
CVFPP Impact Area	**SPFC Levee**	**Non-SPFC Levee**	**Total**
SAC 52 (Walnut Grove, RD 554)	0.90	2.55	3.45
Portion of SAC 53 (Tyler Island)	0.70	0.68	1.38
Study Area Total	**1.60**	**3.23**	**4.83**

The DWR NULE program reviewed and summarized NULE Segment geometry based on Light Detection and Ranging (LiDAR) topography collected for DWR's Central Valley Floodplain Evaluation and Delineation between October 2008 and February 2009. Documented geometry information for the levees in the study area is summarized in Table 2-2.

Table 2-2. Summary of Levee Geometry: RD 554 (URS, 2011a)

Levee Segment Location	NULE Segment	Reach Length within RD 554 (miles)	Approximate Levee Height	Approximate Crown Width	Approximate Landside Slopes	Approximate Waterside Slopes
Left Bank Sacramento River and Georgiana Slough- RD 554 (SPFC levee)	128	0.9	10-15 ft. above the landside toe	30-60 ft.	1.7H:1V to 2.8H:1V	2.2H:1V to 3H:1V
Right Bank DCC RD 554 (Non-SPFC levee)	1052	0.8	15-21 ft. above the landside toe	15-20 ft.	1.7H:1V to 2H:1V	2.8H:1V to 3.5H:1V
Right Bank Snodgrass Slough RD 554 (Non-SPFC levee)	1051	1.2	14-21 ft. above the landside toe	20-35 ft.	1.5H:1V to 2H:1V	1.5H:1V to 3H:1V
Dry cross levee - RD 554 (Non-SPFC levee)	N/A	0.55	5-12 ft. above the waterside toe	16 ft.	3H:1V (RD 554)	2H:1V (RD 563)
Total		**2.45**				

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Table 2-3 Summary of Levee Geometry: RD 563 (URS, 2011a)

Levee Segment Location	NULE Segment	Reach Length within RD 563 (miles)	Approximate Levee Height	Approximate Crown Width	Approximate Landside Slopes	Approximate Waterside Slopes
Left Bank Georgiana Slough - RD 563 (SPFC levee)	130	0.7	9-25 ft. above the landside toe	15-40 ft.	1.9H:1V To 4H:1V	2.1H:1V To 5.5H:1V
Right Bank Snodgrass Slough RD 554 (Non-SPFC levee)	1051	0.50	14-21 ft. above the landside toe	20- 35 ft.	1.5H:1V to 2H:1V	1.5H:1V to 3H:1V
Right Bank North Fork Mokelumne River - RD 563 (Non-SPFC levee)	1043	0.18	12-25 ft. above the landside toe	15-35 ft.	2H:1V to 3.1H:1V	1.1H:1V to 3.2H:1V
	Total	**1.38**				

2.1.2 Geomorphology

Geomorphology (bed and bank erosion and sediment deposition) mapping developed for the DWR NULE program indicates three main deposits underlie the RDs 554 and 563 levees within the project study area: Recent Overbank Deposits (Rob), Holocene age Overbank Deposits (Hob), and Holocene age basin deposits (Hn) (Figure 2-3).

The western portion of RD 554 south of the DCC, including NULE Segment 128 along the left bank of the Sacramento River and approximately 1,100 feet of the western portion of NULE Segment 1052 along the DCC, is underlain by Rob (interbedded silt, sand, and clay layers which vary laterally in extent and character). The center of RD 554 south of the DCC, including approximately 500 feet of the DCC levee (NULE Segment 1052), is underlain by Hob (silt, clay, and lesser sand). The east portion of RD 554, including approximately 2,100 feet of the eastern portion of NULE Segment 1052 and much of NULE Segment 1051 along the right bank of Snodgrass Slough, is underlain by Hn (fine sand, silt, and clay). The northeast corner of the study area has Recent Overflow Channel Deposits (Rofc, sand, silt, and clay) underlying approximately 500 feet of NULE Segment 1052 along the DCC. The RD 554 dry cross levee is largely underlain by Recent Slough Deposits (Rsl; silt, clay, and sand).

All these deposits, except the Rofc, nearly converge in the lower portion of NULE Segment 1051 along the right bank of Snodgrass Slough. Rob underlies the southern 2,800 feet of NULE

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Segment 1051 except for about 100 feet from approximately station 151+15 to 152+15, which is underlain by Rsl. Just north of the Rob, approximately 400 feet of the levee is underlain by Hob.

Several of the exploratory borings indicate that lenses of organic clay and/or peat may exist below, waterside and landside of the DCC, Snodgrass Slough and Georgiana Slough levees.

See Appendix A-1 and Appendix A-2 for additional information on existing geotechnical conditions within the study area.

Levees within the study area which are built on sandy soil materials are of particular note since these levees can be particularly impacted by through seepage and underseepage, which can result in levee failure if left unchecked. In these areas where the levees are more susceptible to seepage and underseepage, remediations to address these vulnerabilities are generally more costly, requiring deeper vertical cutoff walls or wider combination seepage/stability berms. Retrofitting these levees, which is required to secure FEMA accreditation, can often cost upwards of $15M or more per mile. Click here to read FEMA's guidance for levee certification that lists a number of additional criteria that must be met in addition to the underlying seepage problems that are prevalent throughout the North Delta and other leveed areas within the Sacramento and San Joaquin River Basins.[6]

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[6] https://www.fema.gov/sites/default/files/documents/fema_levee-guidance.pdf

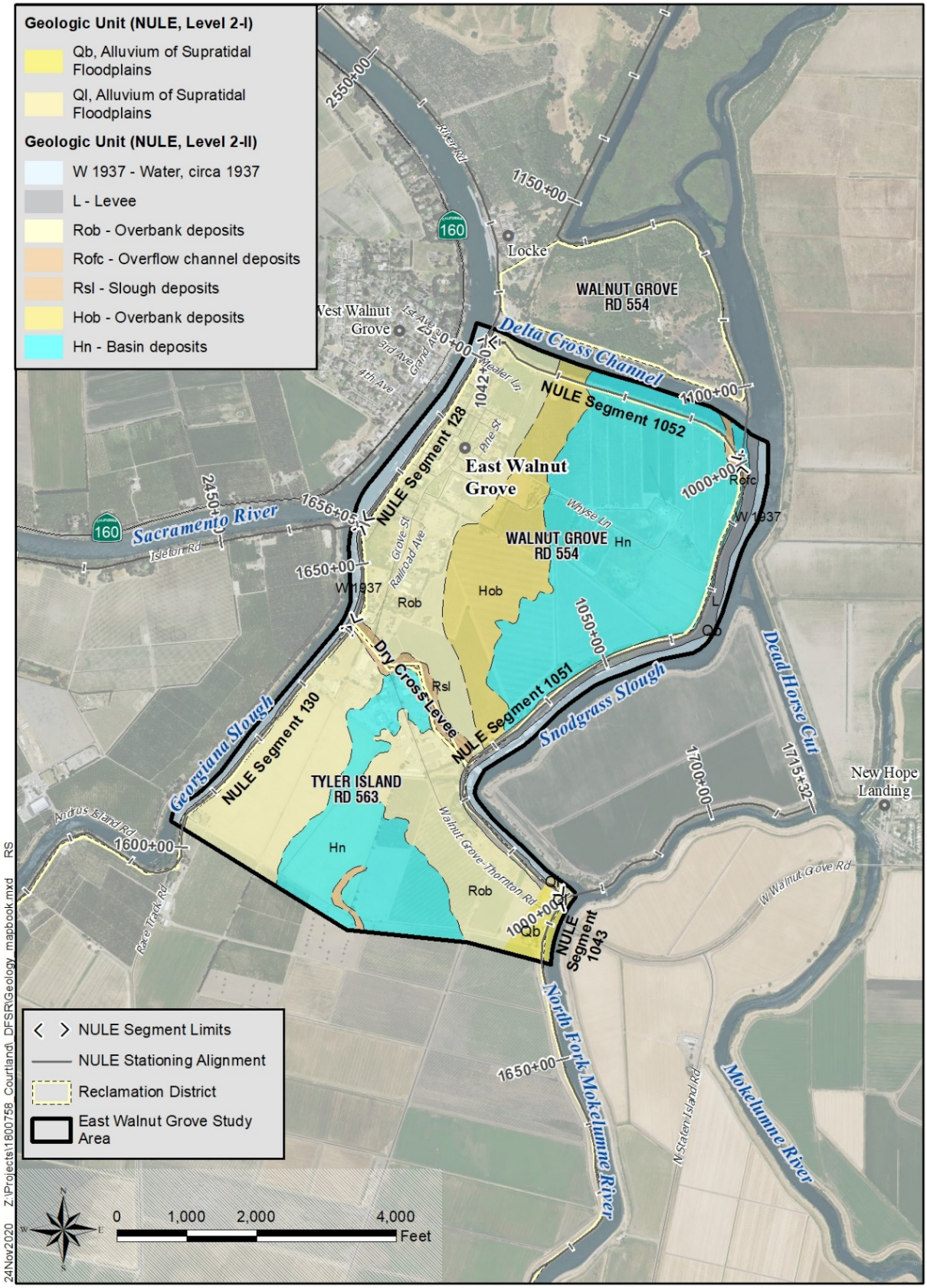

Figure 2-3. Geomorphology within the East Walnut Grove Study Area.

2.1.3 Population, Communities, and Land Use

Managing Rural Floodplains to Avoid Increased Flood Risk

As stated in the Delta Plan, "to reduce the risk to lives, property, and State interests in the Delta, additional standards are needed to address new residential development… the policies in [the Delta Plan] are designed to reduce risk while *preserving the Delta's unique character and agricultural way of life.* **These policies should be construed as those required to provide the minimum level of flood protection, and should not be viewed as encouraging development in flood-prone Delta areas.** Consistent with existing law, urban development in the Primary Zone should remain prohibited."

According to the 2017 CVFPP Update and based on 2010 census data, the total population of the SAC 52 impact area (Walnut Grove), inclusive of the community of East Walnut Grove and the adjoining larger agricultural area within RD 554 to its east and south of the DCC, is 493. Population in the SAC 53 impact area, inclusive of RD 563 Tyler Island, is 89; however, this population is assumed to be outside the immediate East Walnut Grove study area (DWR, 2017d). Exclusive income information for East Walnut Grove is not available; however, according to an annual American Community Survey conducted in 2016 and 2018, the median household income for the Walnut Grove designated place (inclusive of East Walnut Grove and Locke) declined from $53,634 to $47,400 (United States Census Bureau, 2010). East Walnut Grove is not currently considered a disadvantaged community by the State of California.

Sacramento County has designated East Walnut Grove as a Special Planning Area (SPA). The community is subject to the county's SPA ordinance which drives land use planning and development. Allowed land uses in East Walnut Grove and approved locations per the ordinance are shown in Figure 2-4.

East Walnut Grove is within the Primary Zone of the Legal Delta which means that local and county general plans and land use decisions must also be consistent with the Delta Plan; however, limited development within East Walnut Grove along with several other communities in the Delta (Hood, Ryde, Courtland) is permitted within 23 California Code of Regulations (CCR) Section 5010 (*Locate New Urban Development Wisely)* and exempt from 23 CCR Section 5013 (*Require Flood Protection for Residential Development in Rural Areas)* of the Delta Plan (Figure 2-5). Section 5010 of the Delta Plan requires new residential, commercial and industrial development be limited to those areas designated by city or county general plans, while Section 5013 prescribes floodproofing requirements for new residential development. While land use must still be consistent with the county's SPA ordinance, the exemption from Section 5013 allows for development within the immediate community to be unconstrained by Delta-specific floodproofing requirements. Together with the county's SPA ordinance, these land use requirements help prevent uninhibited growth which can sometimes result from improvements to the flood control system in other portions of the Central Valley outside of the Primary Zone of the Delta

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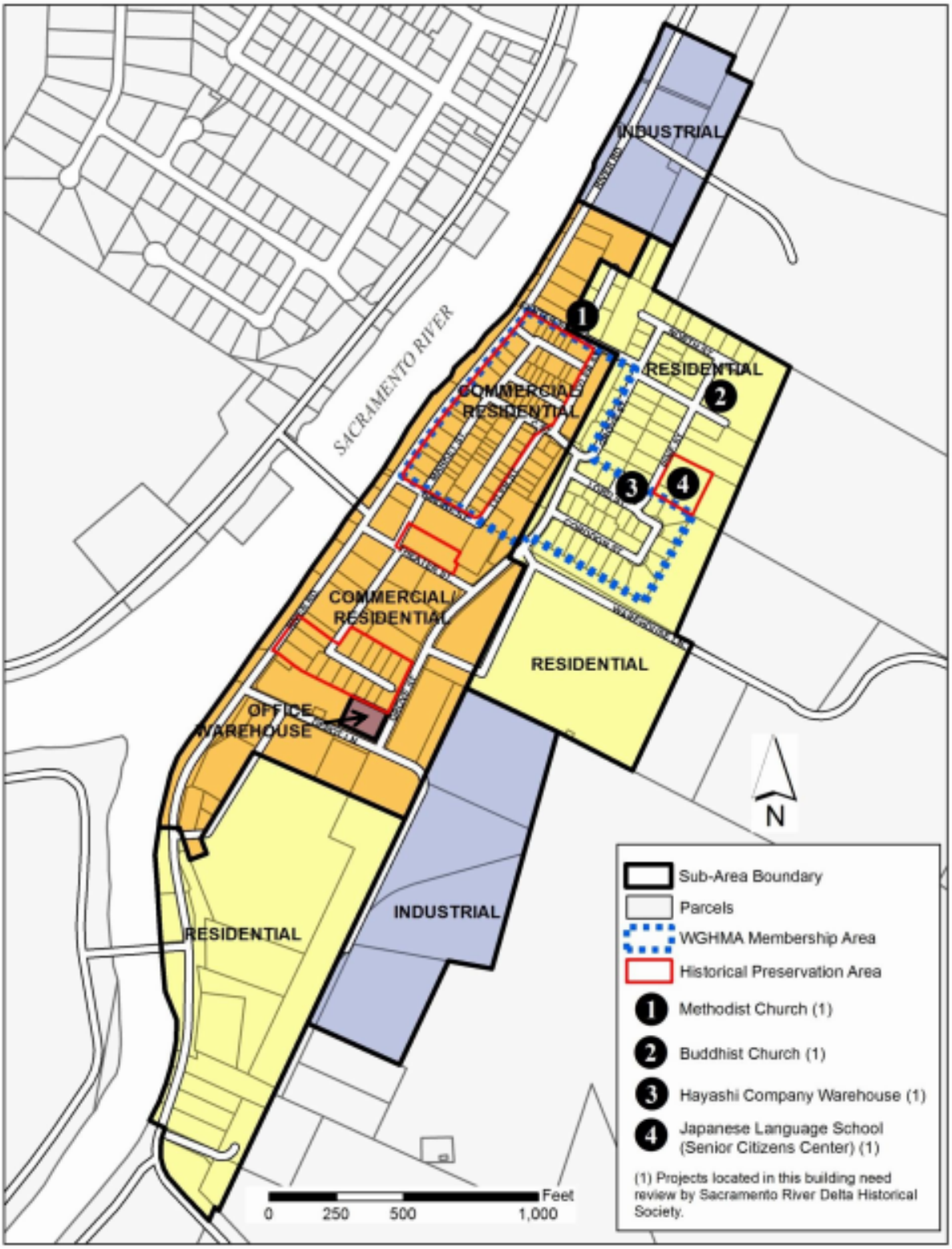

Figure 2-4. East Walnut Grove Special Planning Area (County of Sacramento, 2017a) within RD 554 South of the Delta Cross Channel

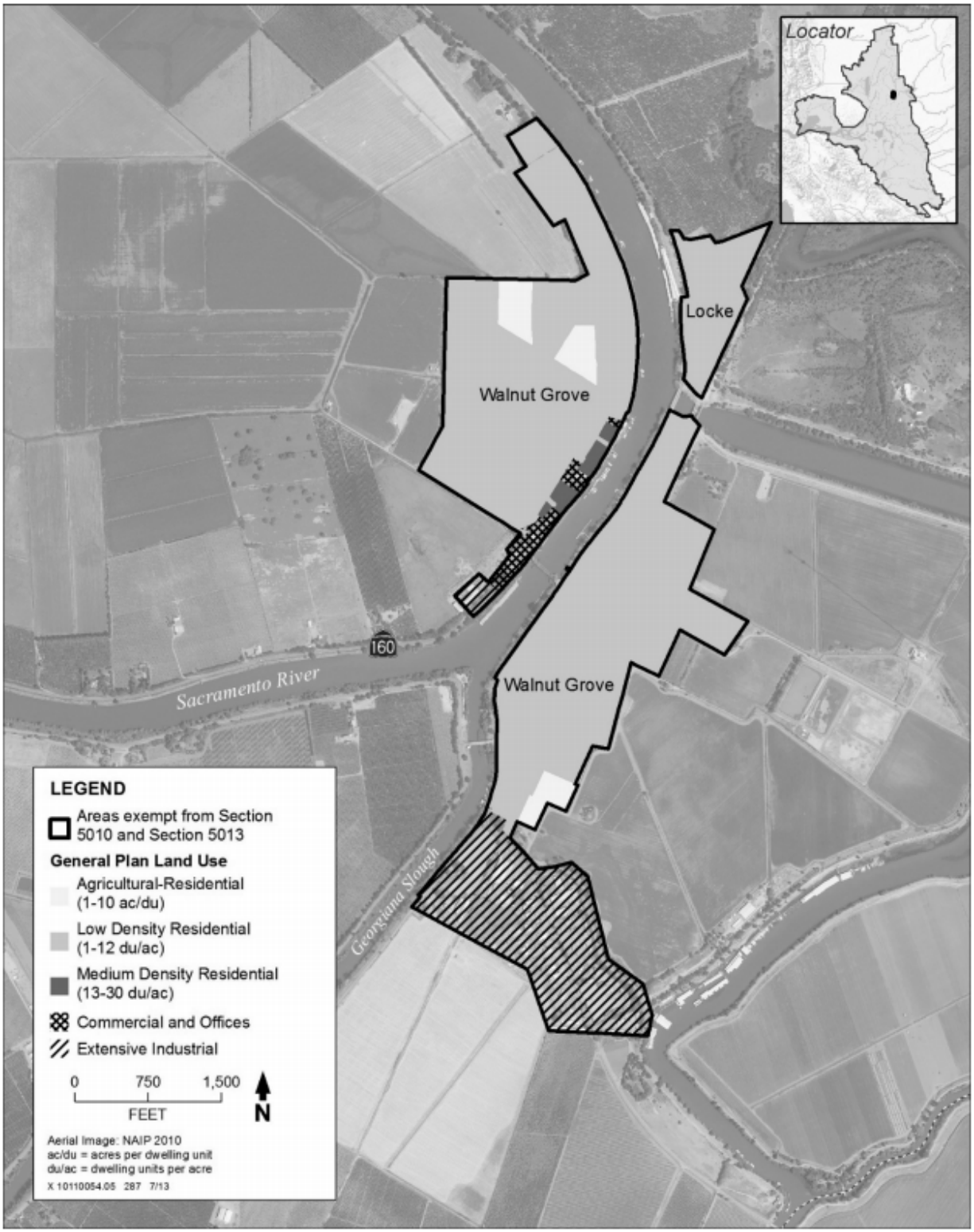

Figure 2-5. East Walnut Grove Land Use under the Delta Plan (DSC, 2013)

2.1.4 Hydrology and Hydraulics

The RD 554 portion of East Walnut Grove study area is bounded by the Sacramento River, the upper 0.3-mile reach of Georgiana Slough, DCC and Snodgrass Slough waterways; and the RD 563 portion is bounded by the waterways of Snodgrass Slough, a small segment of the North Fork of the Mokelumne River, as well as the upper reaches of Georgiana Slough. These collective waterways are influenced by tidal conditions from the San Francisco Bay. The Sacramento River watershed is approximately 27,500 square miles and drains north to south. Flows in the Sacramento River are regulated by four major upstream reservoirs, namely Shasta, Oroville, New Bullards Bar, and Folsom. The upstream Yolo Bypass and Sacramento Bypass channels are currently designed and operated to divert as much as 75 percent of the total flood flows from the Lower Sacramento River. Systemwide improvements are planned and identified in the 2017 CVFPP Update to enlarge the Sacramento and Yolo Bypass and Weirs upstream of the Delta which will divert or shunt greater amounts of flood flows (greater than 75%) away from the Lower Sacramento River and Georgiana Slough immediately adjacent to the community of East Walnut Grove. Figure 1-4 indicates a stage reduction of approximately 1 to 2 feet at East Walnut Grove due to the planned enlargements of the upstream bypasses and weirs.

Estimated existing 100-year peak flows and future 100-year peak flows adjusted for climate change and sea level rise which account for future systemwide improvements, along with predetermined USACE 1957 design flow and profile, are summarized in Table 2-4. Additional information on how these peak flows were estimated can be found in Appendix I-1 and I-2. The existing 100-year peak flow in the Sacramento River from the DCC to Georgiana Slough is approximately 65,100 cubic feet per second (cfs). In Georgiana Slough between the junction with the Sacramento River and the boundary of RD 563, the existing 100-year peak flow is 19,900 cfs. For the Sacramento River, the future 100-year peak flow is approximately 10 percent lower than the existing 100-year peak flow, with the future 100-year peak flow marginally increased for Georgiana Slough.

Table 2-4. Sacramento River and Georgiana Slough Existing and Future 100-Year Peak Flows and USACE 1957 Design Flows

Reach	Existing 100-Year Peak Flow (cfs)	Future 100-Year Peak Flow (cfs)	USACE 1957 Design Flows
Sacramento River: Delta Cross Channel (DCC) to Georgiana Slough adjoining RD 554	66,300	59,200	56,500
Georgiana Slough: just downstream of Sacramento River near RD 554/RD 563 Boundary	19,900	20,100	20,600

It should also be noted that, at some locations, the 100-year water surface profile "With Future Conditions" (inclusive of the upstream system-wide bypass/weir improvements, climate change adjustments and downstream sea level rise adjustments) is 1 to 2 feet higher than the USACE 1957 profile grade that is used as a guide for the operations and maintenance of the RD 554

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perimeter levee system along the Sacramento River and adjoining upstream portion of Georgiana Slough (*see* Figure 2-6 below). For more details on the water surface elevations, current and future, that are anticipated for the Sacramento River and Georgiana Slough surrounding RD 554, *see* Appendix I-1 and I-2.

Appendix I-I is a comprehensive assessment of the hydrology and hydraulics (H&H) of the Lower Sacramento River system combined with the H&H of the North Delta eastern streams inclusive of Snodgrass Slough, Morrison Creek, the Mokelumne River, and the unregulated Cosumnes River.

Appendix I-2 is a brief review of the potential operational impacts of the Delta Cross Channel and how the seasonal operations of the DCC gates (normally and historical closed during high flood stage conditions) may have been evaluated and assumed by FEMA to be normally open during high flood stages in the Sacramento River. Appendix I-2 suggests that the maximum flood stages established by FEMA for Snodgrass Slough are set artificially too high, and should be revisited. Likewise, upon close review of Appendix I-1, the water stages in the Sacramento River, particularly downstream of the DCC could be set artificially too low in the Sacramento River and at the head of Georgianna Slough. It appears as if the FEMA model assumes substantial flows are conveyed though the DCC gates that are normally and historically closed during high river stages. The H&H flows and profiles provided in Appendix I-1 for various recurrence intervals, including 10-, 25-, 50-, and 100-yr recurrence intervals (with and without climate adjustments) take onto consideration that the DCC gates are normally closed.

It should be noted that the H&H models and information presented in supporting Appendices I-1 and I-2 were not deployed in connection with conducting the EAD analyses that were performed by HDR (Appendix E – August 2021) in connection with this Feasibility Study. The EAD analyses for the East Walnut Grove SCFRRP study efforts were conducted consistent with the same hydrologic and hydraulic models deployed for the most recent CVFPP planning efforts. The EAD evaluations for current hydraulic conditions were performed consistent with the concurrent efforts for the 2022 CVFPP updates; whereas EAD future conditions with adjustments for climate change, inclusive of sea level adjustments, were conducted consistent with the adjustments developed for the previous 2017 CVFPP planning efforts.

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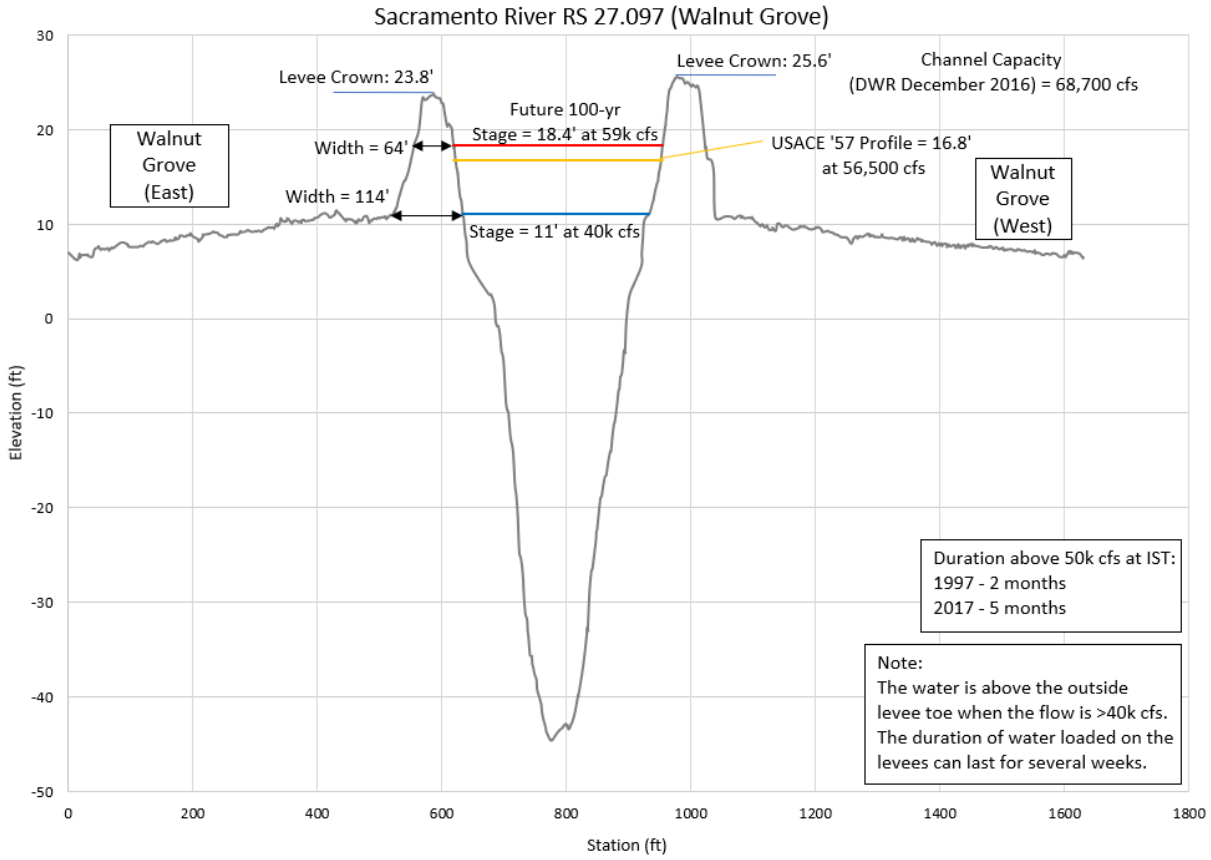

Figure 2-6. Cross Section at Sacramento River Station 27.097 at East Walnut Grove Viewing Downstream

2.1.5 Water Resources and Water Conveyance

Delta waterways are important to North Delta communities and the State's water supply system. East Walnut Grove lies along the Sacramento River immediately south of and adjoining the DCC. Snodgrass Slough borders East Walnut Grove to the east. These waterways provide vital agricultural water supply to local farmers and also convey water to areas throughout the State of California south of the Delta.

2.1.6 Existing Infrastructure

The community of East Walnut Grove is served by the Sacramento Regional County Sanitation District, whose regional wastewater treatment plant is located on the north side of Elk Grove.

Critical infrastructure within the study area is shown in Figure 2-7. Critical infrastructure includes county maintained paved roads, local bridges, a fire station, a police station, gaging stations, water wells, oil/gas wells and underground storage tanks. The Walnut Grove-Thornton Road is located within the RD 563 portion of the project study area and serves as an evacuation route to Interstate 5 (located to the east) for several north Delta legacy Communities.

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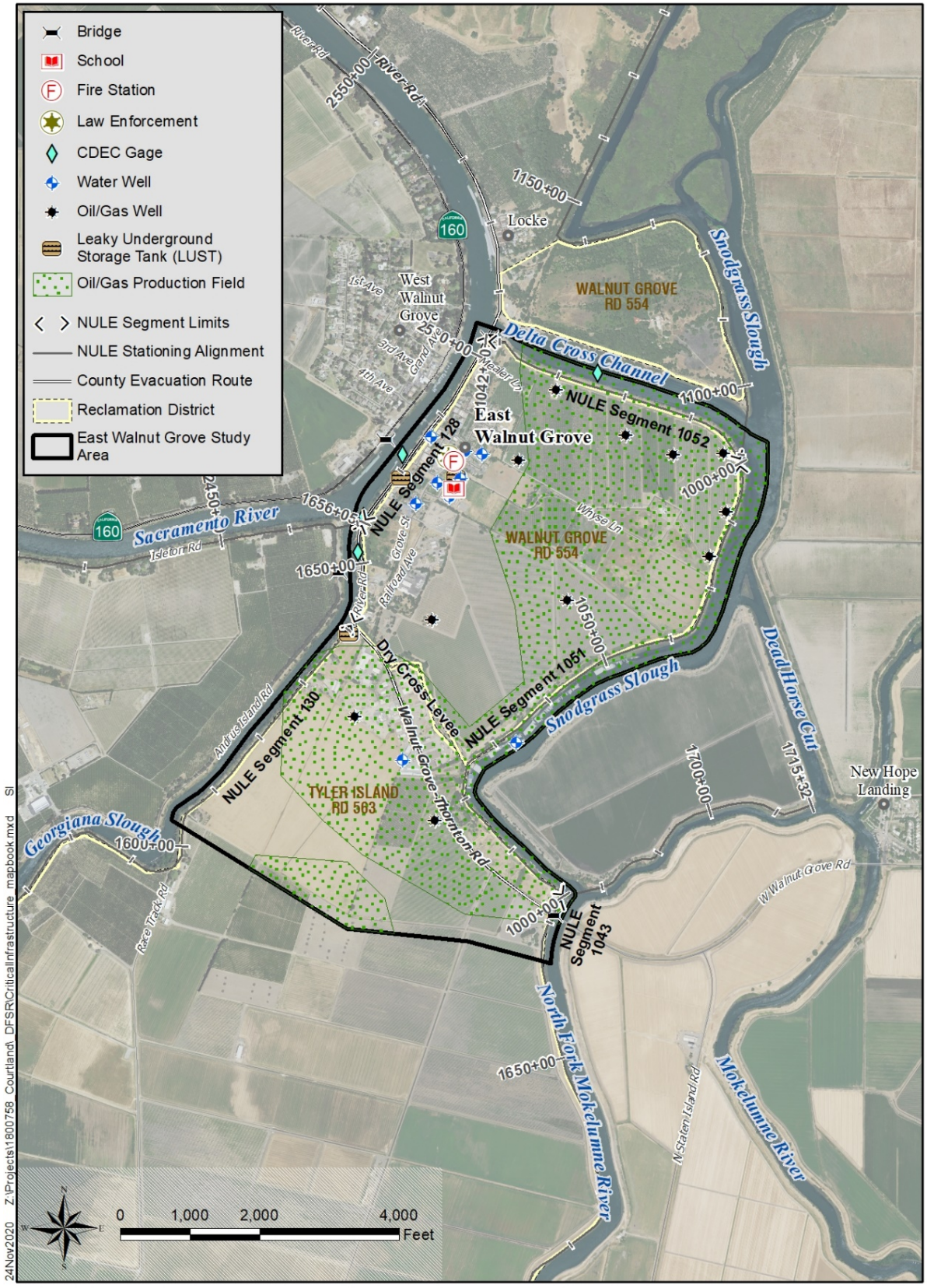

Figure 2-7. Critical Infrastructure within the Study Area of East Walnut Grove

Infrastructure is a critical input in evaluating flood damage, which informs flood risk. The 2017 CVFPP Update inventoried structures, vehicles, highways, and streets within the East Walnut Grove study area to evaluate the annualized EAD for the East Walnut Grove study area, which were updated during the course of this study as part of the 2022 CVFPP Update. These inventories are largely provided within the discussion of flood risk to the study area in Section 3.1.1.4.

2.1.7 Biological Resources

According to the U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory database, riverine, freshwater forest/shrub wetland, freshwater pond, and palustrine farmed features are found in the study area. The Sacramento River is located adjacent to the northwestern boundary of the study area and flows into Georgiana Slough, a wide waterway along the southwest boundary. Snodgrass Slough, situated on the entire eastern boundary of the study area, intersects the DCC bordering the northern portion of the study area. Irrigation ditches throughout the interior of the study area, among parcels of agricultural land, provides drainage to the property owners, but the water is removed at a pumping plant before entering waterways.

The majority of the East Walnut Grove study area is designated as prime farmland (Figure 2-8). Farmland of local importance is located adjacent to the densely populated community of East Walnut Grove within select portions of the larger RD 554 basin.

When conducting work on the waterside slopes, particularly below the ordinary high water lines in any waterways in the North Delta, and particularly within the Lower Sacramento River and adjoining sloughs, work is normally limited to the short three month construction period of August 1 through October 31 due to the presence of special-status and endangered fish species and supporting habitat.

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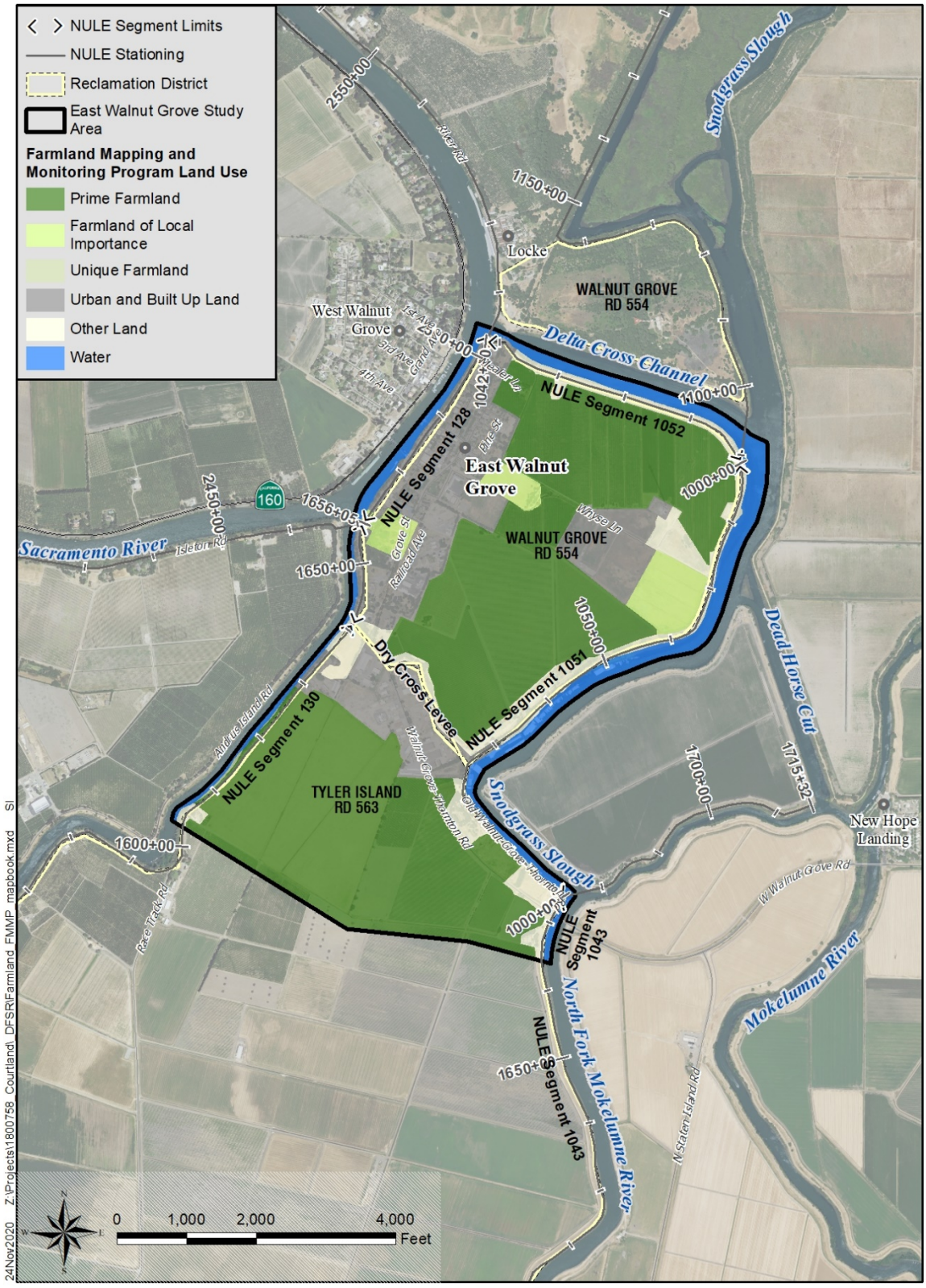

Figure 2-8. Farmland Designations within the Study Area of East Walnut Grove

Vegetation classifications include a crosswalk between Central Valley Riparian Mapping Project (CVRMP) and the U.S. National Vegetation Classification Standard, whereby habitat is defined by CVRMP. There are nine vegetation communities within the study area (Figure 2-9). The majority of the study area is comprised of vineyards and seasonal crops. Some land is cropland and pasture including seasonal corn, alfalfa, and other miscellaneous row crops. Other vegetation types within the study area include riparian forest, riparian scrub, marsh, and seasonal wetland.

Fourteen special-status plant species and 34 special-status wildlife species are documented or have potential to occur in the study area. The study area also supports suitable habitat for five special-status fish species. Designated USFWS and National Marine Fisheries Service critical habitat and Essential Fish Habitat also occur within the Sacramento River and border the study area.

See Appendix B for additional information on biological resources within the study area.

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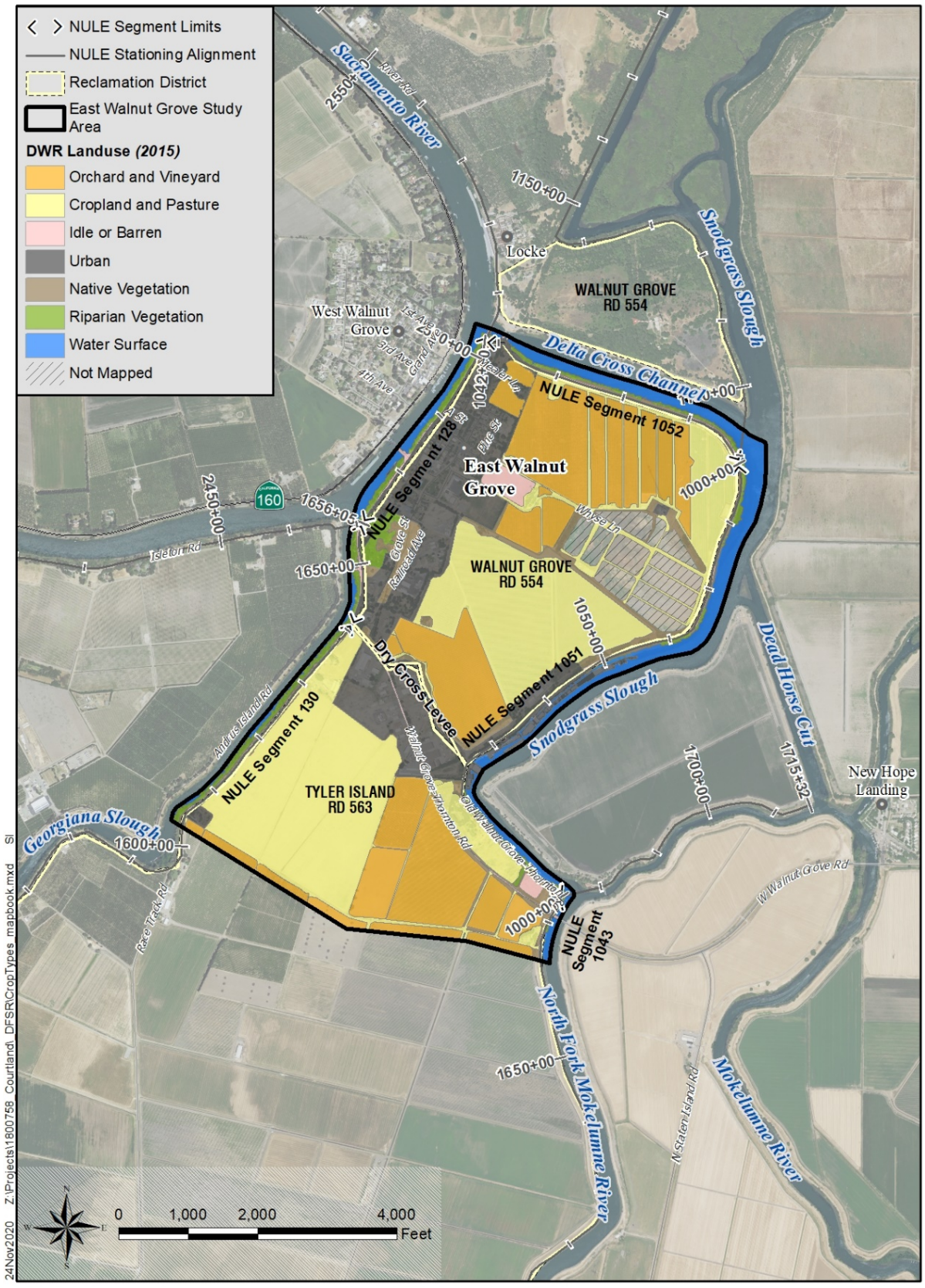

Figure 2-9. Crop Types within the Study Area of East Walnut Grove

2.1.8 Cultural Resources

According to a records search conducted at the North Central Information Center, a total of 17 cultural resources are within the study area. Three of these resources including the Walnut Grove Commercial/Residential Historic District, the Walnut Grove Chinese-American Historic District, and the Walnut Grove Japanese American Historic District are districts (resources comprised of several individual contributing elements) and have been found to be eligible for listing in the National Register of Historic Properties (NRHP) (Figure 2-10). One resource is a historical archaeological site and the remaining 13 are built environment resources dating to the historic era. Four of the remaining built environment resources have been determined eligible for listing in the NRHP and the California Register of Historical Resources (CRHR) and one appears eligible based on written descriptions. Another resource has been determined ineligible for listing in the NRHP and CRHR. None of the remaining listed resources have formally been evaluated for their eligibility to be listed in the NRHP or CRHR. The built environment resources are located throughout the project area but are concentrated in the town of East Walnut Grove; some of the resources do not have specific addresses (such as the railroad). Information provided by the county of Sacramento indicates that there are no additional cultural resources within the study area.

The entire study area is itself also a part of the Sacramento-San Joaquin Delta National Heritage Area (SSJDNHA). Established on March 12, 2019, the SSJDNHA, the first National Heritage Area established in California, supports historic preservation, natural resource conservations, recreation, heritage tourism, and educational projects within and beyond the Primary Zone of the Delta, but otherwise has no effect on water rights, property rights, or hunting and fishing rights within the designated area.

See Appendix C for additional information on cultural resources within the study area.

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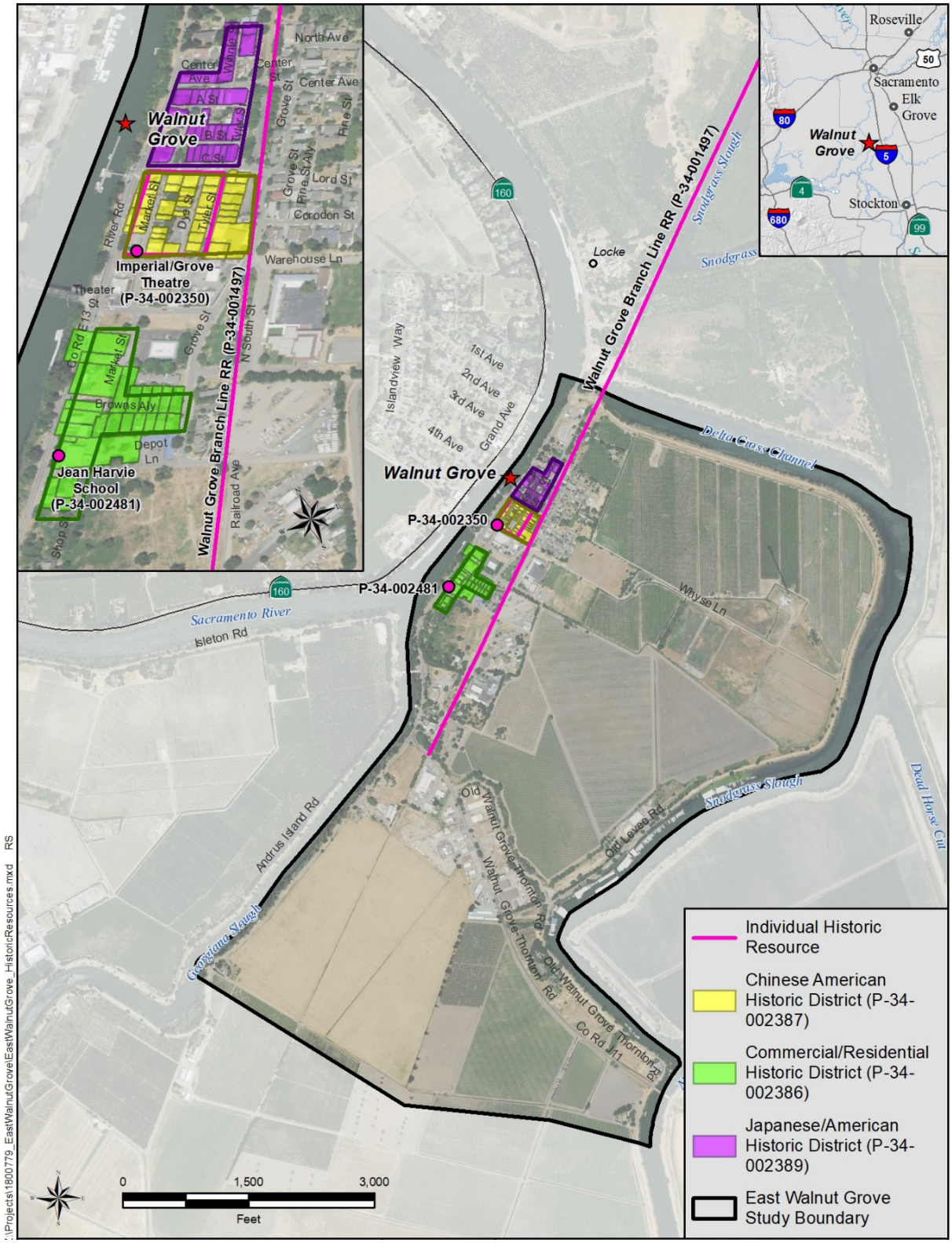

Figure 2-10. Historic Resources within the Study Area of East Walnut Grove.

3. Problems, Opportunities and Constraints

3.1 Problems

In order for East Walnut Grove to safely thrive into the future as the wonderful place that it is, the issue of flood risk must be addressed. There are nearly 5 miles of levee surrounding the East Walnut Grove study area and a breach anywhere would cause widespread flooding putting East Walnut Grove at risk of significant flood damage, including the damage / loss of homes and potential loss of lives.

Other issues for the study area include escalating NFIP insurance premium rates, vulnerability of levees protecting through-Delta water conveyance, compliance with current FEMA accreditation standards, agricultural sustainability, threatened ecosystems, and threats from climate change and sea level rise.

3.1.1 Flood Risk

In the 2012 CVFPP, flood threats to small communities were characterized using attributes related to flood frequency, potential flood depth, and proximity to the nearest river. These characterizations were then used to prioritize the small communities into four categories (DWR, 2012b):

- **Group A (High Hazard)**: Communities subject to high flooding frequency (greater than 1% per year) and also subject to deep flooding conditions (potential flood depths exceeding 3 ft. on average).

- **Group B (Moderate to High Hazard)**: Communities subject to high flooding frequency (greater than 1% per year), subject to sheet flooding conditions (potential flood depths of less than 3 ft. on average), and less than two miles from a major flooding source.

- **Group C (Low to Moderate Hazard)**: Communities subject to high flooding frequency (greater than 1% per year), subject to sheet flooding conditions (potential flood depths of less than 3 ft. on average), and more than two miles from a major flooding source.

- **Group D (Low Hazard)**: Communities that are not subject to high flooding frequency (less than 1% per year).

Of those small communities protected by SPFC levees throughout the entire Central Valley, a total of eight were prioritized as **High Hazard**, including the communities of East Walnut Grove, West Walnut Grove, Ryde, Courtland, Hood, and Locke. Consequently, flood risk to these communities, inclusive of the community of East Walnut Grove, is the highest relative to flood threats in the larger Central Valley, warranting improved flood protection in these areas.

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Within the context of this feasibility study, flood risk is the largest problem facing the East Walnut Grove study area. In the event of a levee failure, particularly on the levee immediately fronting the community, East Walnut Grove and the larger study area could see both life loss and significant property damage.

Flood risk is used as a basis to develop and prioritize flood risk reduction management actions for the purposes of this feasibility study. Flood risk is defined as:

Flood Risk = Probability of a Levee Failure x Consequences of a Levee Failure

Probability of levee failure within the East Walnut Grove study area has been historically evaluated by the DSC in the DLIS, and by DWR in the FSRP, 2017 CVFPP Update and through the NULE program. These estimates are provided in Section 3.1.1.2.

Within the context of this study, consequences of levee failure are defined in terms of life loss and property damage. Life loss and property damage as a result of flooding within the East Walnut Grove study area has been recently evaluated by DWR as part of the 2012 CVFPP and 2017 CVFPP Update and are being re-evaluated as part of the 2022 CVFPP Update. Current life loss estimates for the East Walnut Grove study area are provided in Section 3.1.1.3, and an inventory of property at risk of flooding is provided in Section 3.1.1.4.

The number of lives lost and the extent of property damage as a result of a levee failure also depend on several factors, including depth of flooding, inundation time, and floodwater velocity. Expected flood depths and inundation time within the study area have been estimated as part of the preparation of the Delta Flood Emergency Safety Plan (ESP) for RD 554, and are summarized in Sections 3.1.1.5 and 3.1.1.6.

3.1.1.1 History

There has never been a levee failure or flood event in RD 554 since the inception of Walnut Grove. In 1986, lower Tyler Island (RD 563) flooded and threatened to impact developed area of East Walnut Grove in RD 554. At that time, a successful flood fight effort to keep RD 554 from flooding was undertaken which included the development of the RD 554 dry cross levee to ensure that the urban area of RD 554 did not get flooded. The emergency construction of the dry cross levee paved the way for the more permanent configuration that exists today along the common border of RDs 554 and 563.

3.1.1.2 Probability of Levee Failure

As previously discussed, probability of levee failure within the study area has been historically evaluated by DWR as part of the FSRP, the NULE program, and the 2017 CVFPP Update, and by the DSC as part of the DLIS. The collective CVFPP and FSRP analyses aggregated the level of flood protection by impact area. The levels of flood protection offered by the current levee system(s) as detailed in the 2017 CVFPP Update were updated with new geotechnical information during the course of this study. Levee performance curves were collectively updated

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by DWR and Sacramento County for each of the project levee segments in the study area, and are provided in Appendix E. With updates to these levee performance curves, the SAC 52 impact area (Walnut Grove, RD 554) is conservatively estimated to have a 10-year level of flood protection at the USACE 1957 Assessment Water Surface Elevation (AWSE). The SAC 53 – Urban impact area, which represents the most northerly industrial portion of RD 563, is conservatively estimated to have a 4-year level of flood protection at the USACE 1957 AWSE.

DLIS analyses estimated the level of flood protection for RD 554 – Walnut Grove, and RD 563 – Tyler Island. The DLIS estimated that RD 554 – Walnut Grove has an estimated 29-year level of flood protection, while RD 563 – Tyler Island is estimated to have a 21-year level of flood protection. Based upon empirical data and history provided above, the latter estimate of a 21- to 29-year level of flood protection is more applicable, particularly when comparing to the current, modern standard of obtaining a 100-year level of flood protection in accordance with FEMA's accreditation standards, pursuant to 44 CFR §65.10.

DWR's initial NULE Geotechnical Assessment Report (GAR) qualitatively evaluated probability of failure for the East Walnut Grove study area (Table 3-1). For each NULE segment, four potential failure mechanisms (underseepage, slope stability, through seepage, and erosion) were evaluated and the segment was categorized based on its overall vulnerability (low, moderate, high) to the various failure mechanisms. Segments were categorized as low, moderate, or high, based on the likelihood of either levee failure or the need to flood fight to prevent levee failure at the USACE 1957 design water surface elevation (WSEL). These analyses found the SPFC levees within the study area (NULE Segment 128) along the Sacramento River within RD 554 – Walnut Grove to have a *low* likelihood of either levee failure or the need to flood fight to prevent levee failure at the USACE 1957 design WSEL or AWSE. The SPFC levees within the study area (NULE Segment 130) along the Sacramento River within RD 563 – Tyler Island were found to have a *high* likelihood of either levee failure or the need to flood fight to prevent levee failure at the USACE 1957 design WSEL or AWSE. The non-SPFC levees along the right bank of the DCC upstream of East Walnut Grove (NULE Segment 1052) were found to have a *moderate* likelihood of either levee failure or the need to flood fight to prevent levee failure at an elevation 3 feet below the levee crown based on potential vulnerability to underseepage and erosion. Existing information on the non-SPFC levees along the right bank of Snodgrass Slough (NULE Segment 1051) was insufficient to assign a hazard level. The non-SPFC levees along the right bank of the Mokelumne River in RD 563 were found to have a *high* likelihood either levee failure or the need to flood fight to prevent levee failure at an elevation 3 feet below the levee crown. These same values were updated by DWR and Sacramento County during this feasibility study. One area of key concern is an existing erosion site along the Sacramento River levee just downstream of the Delta Cross Channel; and there is notable concern of levee slope stability along the right bank levee of Snodgrass Slough just west of or opposite the Slough's confluence with Deadhorse Cut. More details on the areas of highest concern within the RD 554 portion of the study area are provided in Appendices A, E-1, and E-2.

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Table 3-1. Summary of NULE GAR Assessment Results for the East Walnut Grove Study Area (URS, 2011a)

Levee Segment Location	NULE Segment	Overall Segment Characterization	Results by Individual Failure Mechanism			
			Under-seepage	Slope Stability	Through Seepage	Erosion
Left Bank Sacramento River and Upstream Portion of Georgiana Slough (RD 554 - SPFC levee)	128	Low	Low	Low	Low	Low
Left Bank Georgiana Slough (RD 563 - SPFC levee)	130	High	High	Moderate	Moderate	High
Right Bank Mokelumne River (RD 563 - Non-SPFC levee)	1043	High	High	High	Lacking Sufficient Data	Lacking Sufficient Data
Right Bank Snodgrass Slough (RDs 554 & 563 -Non-SPFC levee)	1051	Lacking Sufficient Data (Low-High)	Lacking Sufficient Data (Low-High)	Lacking Sufficient Data (Low-High)	Low Lacking Sufficient Data (Low-High)	Low
Right Bank Delta Cross Channel (RD 554 - Non-SPFC levee)	1052	Moderate	Moderate	Lacking Sufficient Data (Low-Moderate)	Low	Moderate

3.1.1.3 Life Loss

The 2017 CVFPP Update estimated potential life loss on an annualized basis for the subject impact areas SAC 52 (East Walnut Grove) and SAC 53_URB (Tyler Island) . Life loss on an annualized basis was analyzed in the 2017 CVFPP Update for a series of scenarios over a 60-year period of 2007 to 2067. The baseline scenario included an approximation of system performance prior to 2007, before implementation of system improvements in the Sacramento Basin. Four other scenarios were also analyzed which considered, to varying degrees, the impact of implementation of DWR flood control projects, non-structural systemwide actions including enhancement of flood preparedness and warning notifications, larger-scale actions such as widening the Sacramento weir and Yolo Bypass system(s), climate change, sea-level rise and

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population and land use changes. For all five scenarios, no life loss was estimated for either impact area, including for the 2007 baseline case (DWR, 2017d).

Life loss on an annualized basis was also estimated as part of the DLIS. From this analysis, expected annual fatalities for both RD 554 – Walnut Grove and RD 563 – Tyler Island were estimated to be zero (DSC, 2017).

A breach on the levee fronting or adjacent to the community of East Walnut Grove could result in floodwater depths in the community up to 10 feet and floodwater velocities in excess of 5 feet per second (fps). Floodwater depths and velocities in this scenario would result in little to no warning time for evacuation, which poses imminent flood threats to the community of East Walnut Grove and would very likely result in life loss.

Instantaneous flooding with combined high flood depths and velocities into homes is a messy, dangerous situation likely resulting in loss of lives and costly cleanup expenses.

3.1.1.4 Property Damage

Structure counts, agricultural acreage, vehicle counts, and total miles of highways and streets, along with their associated values, were quantified as part of the 2017 CVFPP Update. These inventories and their associated values were updated as part of the 2022 CVFPP Update efforts during the course of this study, and inventories were also tabulated for the new impact area, SAC 53 – Urban, which includes only the most northerly industrial portion of RD 563 which adjoins RD 554. (*See* Figure 2-2 for delineation of the East Walnut Grove impact areas SAC 52 and SAC 53_URB.) Within the East Walnut Grove study area, the value of structures, vehicles, highways and streets, and agricultural crops total over $141.5M in 2020 dollars:

- Total estimated depreciated replacement value of the 249 structures in the East Walnut Grove study area: $132.4M
- Total estimated vehicle value: $7.0M
- Total estimated value of highways and streets: $1.2M
- Total estimated value of agricultural crops: $899,000

Structures at risk of flooding are summarized in Table 3-2. The RD 554 portion of the East Walnut Grove study area contains approximately 222 structures, with the majority of these located within the densely populated community of East Walnut Grove. A total of 27 structures are contained within the most northerly portion of RD 563 which adjoins RD 554 (SAC 53 – Urban). As part of the 2022 update to the CVFPP, depreciated replacement values for these structures and contents were defined for the two impact areas within the East Walnut Grove study area. As shown in Table 3-3, the total depreciated replacement value for the East Walnut Grove study area in 2020 dollars is just over $132.4M, with the majority of this value located within the RD 554 portion of East Walnut Grove study area.

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Table 3-2. Structures within the East Walnut Grove Study Area (HDR, 2021).

CVFPP Impact Area	Total Structures Count				
	Residential	Commercial	Industrial	Public	Total
SAC 52 (RD 554) south of Delta Cross Channel	141	45	21	15	222
SAC 53 – Urban (Industrial Portion of RD 563)	5	0	22	0	27
Total East Walnut Grove Study Area	**146**	**45**	**43**	**15**	**249**

Table 3-3. 2022 CVFPP Depreciated Replacement Value for SAC 52 (RD 554) and SAC 53 - Urban (HDR, 2021).

CVFPP Impact Area	Depreciated Replacement Value				
	Residential	Commercial	Industrial	Public	Total
SAC 52 (RD 554) south of Delta Cross Channel	$43,859,000	$18,209,000	$21,195,000	$17,542,000	$100,805,000
SAC 53 – Urban (Industrial Portion of RD 563)	$1,868,000	$0	$29,759,000	$0	$31,627,000
Total East Walnut Grove Study Area	**$45,727**,000	**$18,209**,000	**$50,954**,000	**$17,542**,000	**$132,432**,000
Average Depreciated Value of Structures	$362,000	$508,000	$1,407	$777.000	$783,000

Note: Costs are reported in Quarter 1, 2020 dollars

The total amount of vehicles, total miles of highways and streets, and a summary of agricultural acreage, along with their estimated worth for the SAC 52 (RD 554) and SAC 53 – Urban impact areas, are summarized in Table 3-4, Table 3-5, and Table 3-6 below. In summary, the total vehicle value within the study area is nearly $7.0M in 2020 dollars, with vehicles located in RD 554 valued at $6.75M.

Table 3-4. Vehicle Count and Value for SAC 52 (RD 554) and SAC 53 - Urban (HDR, 2021).

CVFPP Impact Area	Total Vehicle Count	Total Vehicle Value
SAC 52 (RD 554) south of the Delta Cross Channel	750	$6,750,000
SAC 53 – Urban (Industrial Portion of RD 563)	24	$216,000
Total East Walnut Grove Study Area	**774**	**$6,966,000**

Note: Costs are reported in Quarter 1, 2020 dollars

There are no highways within the East Walnut Grove study area, however county roads and streets totaling 6.9 miles in cumulative length are valued at over $1.2M in 2020 dollars. Crops within the study area are valued at $899,000 in 2020 dollars.

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Table 3-5. Total Miles of Highways and Streets and Value for SAC 52 (RD 554) and SAC 53 - Urban (HDR, 2021).

CVFPP Impact Area (area in acres)	Highways Miles	Total Highways Value	Streets Miles	Total Streets Value	Total Value of Highways and Streets
SAC 52 (RD 554) south of the Delta Cross Channel	0	$0	5.1	$916,000	$916,000
SAC 53 – Urban (Industrial Portion of RD 563)	0	$0	1.8	$319,000	$319,000
Total East Walnut Grove Study Area	**0**	**$0**	**6.9**	**$1,235,000**	**$1,235,000**

Note: Costs are reported in Quarter 1, 2020 dollars

Table 3-6. Crop Acreage and Total Value for SAC 52 (RD 554) and SAC 53 - Urban (HDR, 2021).

CVFPP Impact Area	Agricultural Acreage (acres)									Total Value
	Citrus	Deciduous	Field	Grain	Pasture	Rice	Truck	Vineyard	Total	
SAC 52 (RD 554) south of Delta Cross Channel	0	92	0	106	0	0	15	35	248	$891,000
SAC 53 – Urban (Industrial Portion of RD 563)	0	0	4	0	0	0	5	0	9	$8,000
Total East Walnut Grove Study Area	**0**	**92**	**4**	**106**	**0**	**0**	**20**	**35**	**257**	**$899,000**

Note: Costs are reported in Quarter 1, 2020 dollars

Baseline (or without project) EAD estimates for the two impact areas associated within the East Walnut Grove study area have been also developed as part of the 2022 CVFPP Update efforts (Table 3-7). As previously discussed, EAD is a common metric used to estimate risk within the Delta and other components of the Sacramento River Flood Control Project (SRFCP). EAD is calculated on an annualized basis and represents the annual average expected damages through the consideration of potential flooding conditions. Baseline EAD estimates incorporate updated levee performance curves and are provided for existing conditions and future conditions. Baseline EAD values under existing conditions include the existing conditions of the flood management system(s) in the Central Valley and includes projects that have been authorized and have funding, or that have started construction or implementation as determined for the 2022 CVFPP Update. Baseline EAD values under future conditions have the same features as the existing conditions, with the addition of the effects of inland climate change projections and sea level rise adjustments that were applied for the 2017 CVFPP update. As shown below in Table 3-7, the total baseline EAD for the East Walnut Grove study area under existing conditions is estimated at nearly $7.5M in 2020 dollars. With the effects of climate change and sea level rise, baseline EAD for the East Walnut Grove study area under future conditions is estimated at over $35M in 2020 dollars. It should be noted that the EAD analyses utilized the hydrologic and hydraulic (H&H) models developed specifically for the CVFPP 2017-2022 updates by DWR's

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consultant team, and not the H&H models prepared by the GEI Consultant Team in Appendix I-1.

Table 3-7. 2022 CVFPP EAD Values for SAC 52 (RD 554) and SAC 53 - Urban (HDR, 2021)

CVFPP Impact Area	EAD[7], Existing Conditions	EAD[8], Future Conditions with Climate Change Adjustments
SAC 52 (RD 554)	$3,546	$17,088
SAC 53 – Urban (Industrial Portion of RD 563)	$3,949	$18,405
Total East Walnut Grove Study Area	**$7,495**	**$35,493**

3.1.1.5 Flood Depths and Velocities

Inundation mapping was conducted in May 2017 for RD 554 as part of Sacramento County's Flood ESP for the RDs collectively located in the North Delta and in Sacramento County. For the East Walnut Grove study area, a hypothetical levee breach located along the community of East Walnut Grove (along NULE Segment 128) was modeled to estimate potential flood depths and inundation times within the study area.

In the community of East Walnut Grove, flood depths are predicted to reach upwards of 10 feet and flow velocities potentially in excess of 10 fps. Maximum flood depths within the study area as a result of a levee breach at this location are estimated to reach upwards of 15 feet in the southeast portion of RD 554 (Figure 3-1). As shown in Figure 3-1, denoted by the arrows extending from the hypothetical breach, these flood depths are representative of a levee breach anywhere along Sacramento River NULE Segment 128 in RD 554. Figure 3-1 depicts worse case flood depths that could occur in RD 554 with a levee breach along the Sacramento River in the project study area at, upstream, or downstream of the community of East Walnut Grove. Flood depths could actually be reduced by a few feet or more as indicated in Figure 3-1 down to the Base Flood Elevation (BFE) of 9.0 feet NAVD 88 indicated if a downstream relief cut could be implemented in the RD 554 dry cross levee into RD 563 (*see* 5.2.6 for more information).

[7] EAD as defined by the 2022 Without-Project Scenario from the 2022 CVFPP Update.
[8] EAD as defined by the Future Without-Project Scenario from the 2017 CVFPP.

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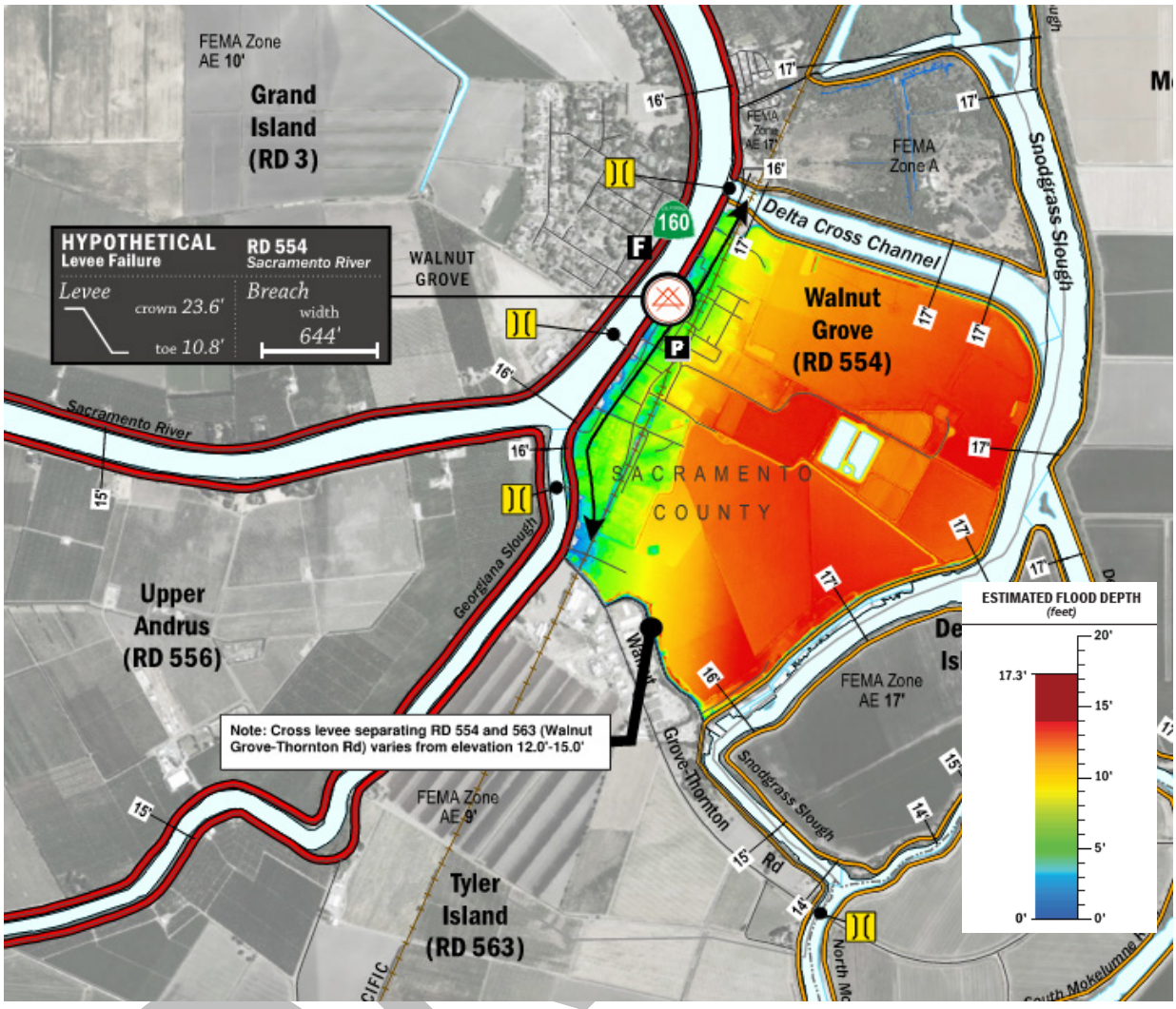

Figure 3-1. Study Area Maximum Flood Depths (Dynamic Planning + Science, 2017).

3.1.1.6 Inundation Time

Using the same breach location discussed in the preceding section 3.1.1.3, the time to 1 foot of inundation in the East Walnut Grove study area was estimated as part of the inundation mapping performed for the RD 554 Delta Flood ESP. The majority of the study area within RD 554, as a result of a breach on the SPFC levee located along the left bank of the Sacramento River, is inundated to 1 foot in 0 to 3 hours, leaving very little or no time for evacuation.

For more information on flood risk and to view a hypothetical flood simulation of the East Walnut Grove study area, visit the East Walnut Grove Story Map developed by Sacramento County located here: East Walnut Grove Story Map - Sacramento County Small Communities Flood Risk Reduction Program.[9]

[9] https://sacramentocounty.maps.arcgis.com/apps/MapJournal/index.html?appid=3e6a7a1f41184e4f8d1445fc9d90b69e

3.1.2 Escalating NFIP Insurance Premium Rates

Flood risk can be determined using information from FEMA's Flood Insurance Study (FIS) in conjunction with FIRMs. FIRMs delineate SFHAs which are defined as areas that will be inundated by the 100-year flood event. These areas include lands and improvements behind levees that are not fully accredited by FEMA in accordance with 44 CFR §65.10. The current FIS for Sacramento County is dated August 16, 2012 (FEMA, 2012). The community of East Walnut Grove, as shown in Figure 3-2, is located within Zone X, which, as defined by FEMA, is an "area with a 0.2 percent (or 1 in 500) annual chance of flooding." Base flood elevations are not provided for Zone X areas since they are assumed to be higher than the base flood elevation. The southern portion of the study area located in RD 563 is located within Zone AE, which, as defined by FEMA, is "subject to inundation by the 1 percent annual chance flood event determined by detailed methods." According to Figure 3-2 excerpted from the FEMA FIRM the southern portion of the study area located within RD 563 – Tyler Island is subject to flooding in Zone AE to a BFE of 9.0 feet NAVD 88.

Delta legacy communities are subject to deep flooding behind a combination of federal/State authorized (SPFC) levees and non-SPFC, private levees. However, most all Delta legacy communities have **not** flooded in the last 100 years *(with the exception of RD 563-Tyler Island in 1986)* due to oversized levees with surplus freeboard and low to moderate risk of levee failure.

Figure 3-2. East Walnut Grove's 100-Year Floodplain Recognized by FEMA (FEMA, 2020).

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Flood insurance through the NFIP is mandatory for buildings with a federally backed mortgage located in a SFHA. Buildings located in Zone X are not identified by FEMA as being in a SFHA and mandatory flood insurance is not required. While the majority of the study area is located in Zone X, select buildings in the East Walnut Grove study area still retain NFIP insurance policies. NFIP policy premiums have been steadily on the rise since the passage of flood insurance reform laws including the BW-12 and the Homeowner Flood Insurance Affordability Act (HFIAA) of 2014. Under HFIAA, policyholders can expect to see gradual increases in annual premiums until they reach a rate that the NFIP deems to be actuarially based. Effective April 1, 2018, NFIP annual premiums increased by 8 percent from $866 per policy to $935 per policy, not including HFIAA surcharges or other fees (FEMA, 2017). In October 2019, FEMA announced that beginning on April 1, 2020, annual renewal premiums would increase by 11.3 percent (FEMA, 2019a). This rate restructuring has been postponed to October 2021 and March 2022 according to FEMA as of November 7, 2019 (FEMA, 2019b).

For those who do not already have a current NFIP policy, they will be rated by FEMA based on the elevation of the living quarters of their structure(s) relative to East Walnut Grove's BFE of 9.0 feet NAVD 88. Sacramento County currently enjoys up to 40 percent discount on flood insurance costs due to the county's high Community Rating System (CRS) score, which is one of the top five CRS scores in the entire nation. Still, the rates are rising rapidly. Many NFIP policies in East Walnut Grove are grandfathered in at low rates that increase each year until reaching the rate based on an elevation certificate. *For example: if the floor of a house is 4 feet below the FEMA BFE of 9.0 feet in East Walnut Grove, with a cost of $200,000 per dwelling structure and $40,000 for structure contents, the new (non-grandfathered) NFIP premium would be $6,804 per year plus fees (and this includes Sacramento County's favorable 40 percent discount with its high CRS score).*

As flood insurance rates increase the number of insured homes decrease. As a result, the East Walnut Grove community is increasingly and significantly under insured. While there are an estimated 249 structures in the combined East Walnut Grove study area (RD 554 south of the DCC and the urban portion of RD 563) valued with an estimated replacement value of $132.4M[10], there are only 26 NFIP polices (valued at $350,000 maximum per policy including structure contents, presently capped at $250,000 maximum for structrual damage and $100,000 for damage of structure contents) providing $9M[11] in coverage. This suggests the bulidings in East Walnut Grove are gossly underinsured for flood damage given high NFIP insurance rates.

To remove the entire project study area from the current FEMA BFE of 9.0 feet NAVD 88, the entire combined perimeter levee systems within the study area would require reparing and strengthening in-place to current, modern engineering standards, consistent with the

Levees protecting the Delta legacy communities fall well short of meeting current seepage and stability criteria pursuant to 44 CFR §65.10

[10] The FEMA Open Source data is aggregated by zip code. These estimates represent the values for SAC 52 from the draft 2017 CVFPP Update – Technical Analyses Summary Expanded Report, 2017, and has been escalated to July 2020 dollars.
[11] These estimates are sourced from the FEMA Open Source policy database.

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FEMA 100-year accreditation standards contained in 44 CFR §65.10. Click here to learn more about achieving a 100-year level of flood protection pursuant to the current FEMA accreditation standards.[12]

The current cost estimate of such levee repairs/improvements for strengthening in place to achieve FEMA accreditation for the community of East Walnut Grove/RD 554 as well as the entire study area, inclusive of the community of East Walnut Grove, is provided in Sections 6.2.5 and 6.2.12, respectively.

3.1.3 Vulnerability of Levees Protecting Through-Delta Water Conveyance

There are more than 1,100 combined miles of SPFC and non-SPFC levees in the Delta which convey water to 750,000 acres of farmland within the Delta for irrigation. Some, but not all, of these levees in concert with the adjoining river channels convey water toward the Clifton Forebay, which pumps the water south serving the needs of approximately 3M acres of agricultural lands and a population of 25M. Some of these same levees serve to protect the community of East Walnut Grove, which relies on this critical infrastructure to sustain the local agriculture economy, thus preserving the community's rich agricultural heritage. While the DWR NULE evaluations estimate a low likelihood of failure or the need to flood fight for the SPFC levee located along the left bank of the Sacramento River (NULE Segment 128), the non-SPFC levee located on the right bank of the DCC (NULE Segment 1052) is estimated to have a moderate likelihood of failure or the need to flood fight. This levee augments flow of the Sacramento River through the Delta to the collective SWP and CVP export pumps in the south Delta and is critical to maintain for saltwater intrusion and water quality purposes. Moreover, both SPFC and non-SPFC levees in the study area are vulnerable to climate change, which can intensify rain events and heighten flood risk, and the risk of a seismic event in the future which could cause the levees to fail. Additionally, as previously discussed, levees which are vulnerable to through seepage and underseepage can be particularly costly to remediate, making FEMA certification and 100-year flood protection infeasible to attain without significant cost-share from the State or others.

Maintenance and improvement of the current in-channel river conveyance system for the CVP and SWP water supply system(s) is a vastly better solution than a tunnel as presently proposed by the Delta Conveyance Authority (DCA). It costs less, is ecologically friendly, protects the "Delta as a Place," and it reduces flood risk to the Delta Legacy Towns, including the community of East Walnut Grove, located adjacent to the DCC. With or without the current proposal of the DCA's single purpose isolated conveyance facility, through-Delta conveyance will continue to rely on the freshwater corridor established both upstream and downstream of the DCC. Presently there are 37 miles of non-urban SPFC levees upstream and 25 miles downstream of the DCC that help convey water through the Delta (a total of 62 miles of SPFC levees which comprise significant portions of the Delta's freshwater corridor) (Figure 3-3). Improving 1.6

[12] https://www.fema.gov/sites/default/files/documents/fema_levee-guidance.pdf

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miles of SPFC levees within the RD 554/RD 563 study area boundary to current, modern standards consistent with FEMA's 100-year accreditation standards would constitute improving 4 percent of the non-urban SPFC levees between Freeport and the DCC and nearly 3 percent of the total non-urban SPFC levees in the Delta's freshwater conveyance corridor.

There is also significant value of repairing and strengthening-in-place the non-SPFC right bank levee of the DCC and the adjoining downstream right bank of Snodgrass Slough which are key non-SPFC levee segments that are an integral component of the fresh-water conveyance corridor within and immediately adjacent to the DCC.

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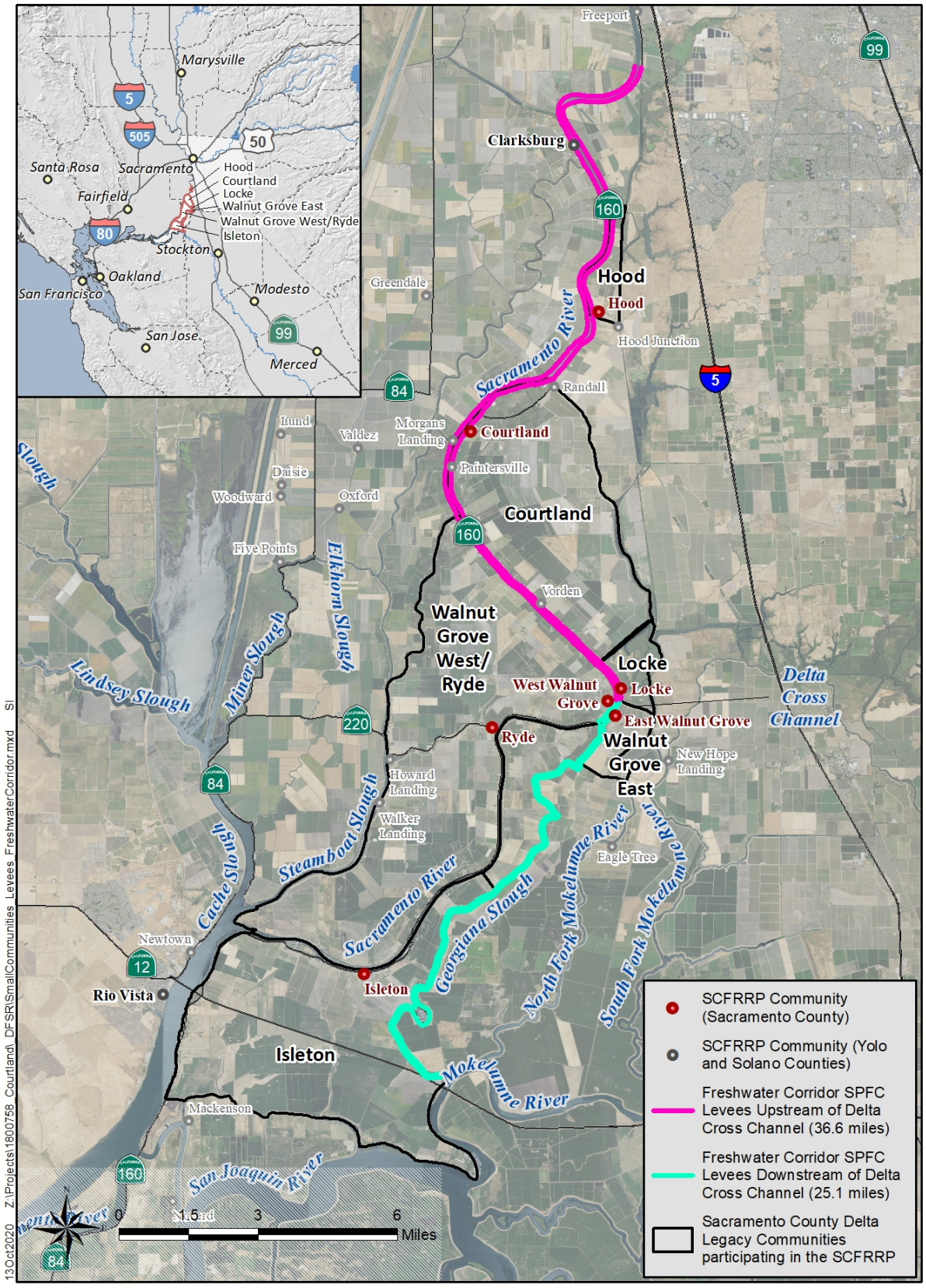

Figure 3-3. SPFC Levees which Comprise the Delta's Freshwater Corridor.

3.1.4 Agricultural Sustainability

Agricultural lands within the Delta and the immediate project study area are a key element of sustaining the economic health for the community of East Walnut Grove. In 2001, FEMA began updating FIRMs, and as a result, many small communities, including East Walnut Grove in 2012, were subsequently mapped into SFHAs. As a result, these communities are subject to regulations set forth by the NFIP, including land use requirements for elevating or flood-proofing new and substantially improved structures, and the requirement to purchase a flood insurance policy through the NFIP for each structure with a federally backed mortgage (mandatory insurance purchase requirement). These requirements do not provide the flexibility needed to sustain agriculture within the community and can make reinvestments that are needed in support of the agricultural economy infeasible or unattainable.

3.1.5 Threatened Ecosystems

Many of the historic tidal wetland areas of the Delta have been lost to development and placement of levees with a configuration that does not support tidal inundation of areas to sustain viable habitat. Vulnerability to flow and temperature changes associated with Delta water supply conveyance (and naturally occurring drought) and predation of migrating fish species from invasive species is also an issue in certain areas of the Delta.

3.1.6 Threats from Climate Change and Sea Level Rise

Climate change and sea level rise have the potential to increase peak flows and flood stages in the Lower Sacramento River and Mokelumne/Cosumnes River systems. As discussed in Appendix I-1, peak flows in the Sacramento River could increase by 4 percent for the 100-year flood and 2.3 percent for the 200-year flood as a result of climate change. Additionally, climate change combined with sea level rise could increase the 100-year flood stage in the Sacramento River near Georgiana Slough at East Walnut Grove by nearly 1.12 feet, with the 200-year flood stage along the same extent increased by 0.71 foot. Increased flows and flood stages can not only result in more frequent flooding, which can lead to levee failure through greater hydro-dynamic pressures (and potential overtopping), but can also result in greater stresses to the levee system as levees are loaded with water for longer durations of time and via other mechanisms resulting from increased flow/flood stages (e.g., erosion). Note, however, that within the East Walnut Grove study area, the effects of climate change and sea level rise are less pronounced along the mainstem of the Sacramento River, as a result of planned improvements in the upstream/adjacent bypass systems, than they are for the more isolated Snodgrass Slough.

It should be noted that the effects of climate change and sea level rise are partially neutralized along the Lower Sacramento River near the East Walnut Grove study area due to the planned system-wide improvements of widening both the Sacramento and Yolo Bypasses and their associated weirs. The said enhancements to the weir and bypass systems will shunt or divert greater amounts of water from entering the Lower Sacramento River downstream of the

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American River during high water stage conditions. The value of reducing flood stages in the Lower Sacramento River system by widening the Sacramento Weir and Yolo Bypass system(s) is briefly discussed above in 1.7.2 and shown in Figure 1-4.

Unfortunately, there are no bypass systems to accommodate increases in floodwater flows and stages in Snodgrass Slough that are heavily influenced by Morrison Creek and the larger downstream confluence flows and stages of the largely unregulated Cosumnes and Mokelumne rivers. Thus, for the community of East Walnut Grove there is a greater concern of climate change impacts to flood stages along Snodgrass Slough in relation to the Lower Sacramento River.

3.2 Opportunities

Opportunities to address the problems discussed above are summarized below.

3.2.1 Reduce Flood Risks

The levees protecting the East Walnut Grove study area do not meet FEMA accreditation and current engineering standards to achieve a 100-year level of flood protection. When a levee is accredited by FEMA, the levee system is certified to meet current engineering standards contained in 44 CFR §65.10. These standards include criteria for through- and underseepage, freeboard, stability, settlement, encroachments, interior drainage, and other operations and maintenance criteria. These standards and criteria help to reduce the overall probability of levee failure and to ensure that communities and areas located behind the accredited levee(s) are protected during high water events. Since flood risk is partially characterized by the probability of levee failure, improving levees up to FEMA standards can help to reduce flood risk, thereby reducing the potential for life loss and property damage. A discussion surrounding the potential for life loss within the East Walnut Grove study area is provided in the preceding Section 3.1.1.3. The potential for property damage within the East Walnut Grove study area was evaluated as part of this study using updated inventories of structures, vehicles, agricultural crops, highways, and streets from the forthcoming 2022 CVFPP Update. These inventories were used in a flood damage analysis to quantify EAD for the East Walnut Grove study area under existing and future conditions. These updated inventories are provided in Section 3.1.1.4, and results from the flood damage analysis are presented in Section 6.3.1.2 and further detailed in Appendix E.

Securing levee improvements to FEMA accreditation standards can also enhance the resiliency and reliability of the through-Delta water conveyance system and help to ensure that water is conveyed as needed to agricultural farmland within the Delta and through the Delta to the SWP and CVP export pumps in the south Delta. Once a levee is accredited, the designation is shown on FIRM maps and can result in areas being mapped out of SFHAs. This can subsequently result in lower NFIP insurance premium rates. FEMA accreditation could also substantially reduce premiums for a community, flood-risk based insurance program that may be applicable for the

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community of East Walnut Grove and possibly the adjoining larger project area of RDs 554 and 563 and other nearby Delta Legacy Communities.

3.2.2 Agricultural Sustainability

Efforts to improve agricultural sustainability within the Delta, inclusive of the community of East Walnut Grove are outlined in the DPC's LURMP. The LURMP identifies methods of supporting the long-term viability of agriculture within the Delta region while being responsive to enhancing natural habitats and ecosystem restoration efforts by:

- Supporting the continued capability for agricultural operations to diversify and remain flexible to meet changing market demands and crop production technology.
- Promoting the ability for agriculture operations to change the crops or commodities produced to whatever is most economically viable at the time.
- Supporting the use of new crop production technologies that keep Delta agricultural operations competitive and economically sustainable.

The DSC's Delta Plan also identifies policies and recommendations which seek to maintain Delta agriculture as a primary land use, food source, key economic sector, and as a way of life for the community of East Walnut Grove and for the Delta as a whole. The purpose of these policies and recommendations is to address the impacts to local agriculture from changing markets, water conveyance facilities, and changing water quality. A subset of these policies and recommendations include:

- Floodproofing the Delta, as far as feasible, mainly by improving existing levees.
- Restricting urban development, while supporting farming and recreation.
- Encouraging agritourism in and around legacy communities.
- Promoting value-added crop processing.

In addition to the above measures it is preferable to repair and strengthen-in-place levees systems with vertical cut-off walls over wider, seepage/stability berms on the land side of the levees that can displace valuable, high-productive agricultural lands.

3.2.2.1 Agricultural Floodplain Ordinance Task Force

The Agricultural Floodplain Ordinance Task Force (AFOTF) is comprised of officials from FEMA, DWR, the CVFPB, RDs, levee districts, flood control agencies, counties, engineers, farmers, and non-governmental organizations. After forming in 2015, the AFOTF's goal was to develop administrative options of FEMA's NFIP to address sustainability of modern agriculture in deep floodplains. Administrative options were considered as they could be potentially implemented without changing law or regulation.

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Administrative options to improve agricultural sustainability within the Sacramento Valley were summarized in a technical memorandum prepared in 2016. In total, the memorandum summarized nine recommendations which addressed how rules and practices could be modified to "…(1) reduce or remove elevation and floodproofing requirements for new and substantially improved agricultural structures, and (2) reduce the cost of NFIP insurance premiums for agricultural structures with a federally backed mortgage to a more appropriate portion of the financial risk in the NFIP" (AFOTF, 2016). Further details and recommendations developed by the AFOTF are highlighted as item No. 9 in supporting Appendix H - Identification of Non-Structural Measures for the communities of Hood, Courtland, Locke, East Walnut Grove, West walnut Grove/Ryde, and the city of Isleton.

3.2.3 Potential Ecosystem Restoration Opportunities

Restoration opportunities adjacent to the East Walnut Grove study area potentially include: 1) rehabilitation of the community's defunct sewage ponds, which could support seasonal wetland or managed freshwater marsh, 2) enhancing the combination of wildlife habitat and recreation opportunities within the Delta Meadows State Park adjacent to the communities of Locke and East Walnut Grove, 3) Shaded Riverine Aquatic (SRA) habitat creation or enhancement in tandem with levee repairs, and 4) potential expansion, widening of Snodgrass Slough to create greater connectivity with the ongoing restoration efforts across Snodgrass Slough on McCormick Williamson Tract, upstream of and near Deadhorse Slough. *See* Appendix D for additional information on ecosystem opportunities within or adjoining the study area.

3.2.4 Enhance Resiliency and Reliability of Through-Delta Conveyance

Levees within the study area are vulnerable to potential subsidence, earthquakes, climate change and sea level rise, and most levee reaches do not meet current 100-year FEMA accreditation standards. These levees are used to protect both people and property and help convey water used to support the agricultural economy within the community of East Walnut Grove and beyond, inclusive of south of Delta interests. SPFC levees and key non-SPFC levees adjoining the DCC in the north Delta are particularly critical since they assist with the conveyance of water to and downstream of the DCC, which augments the flow of the Sacramento River water through the Delta to the collective SWP and CVP export pumps in the south Delta near Tracy. In the event of a levee failure, sea water intrusion from the San Francisco Bay could enter areas that are critical to the distribution of fresh water, threatening water supply.

Over time, through the DWR Delta Levee Subventions local-State cost share program, the levees have been maintained throughout the Delta, and some have been enlarged or geometrically improved to various Delta standard levels. Although not improving the Delta levees to modern 100-year FEMA accreditation criteria, continuing to maintain and improve levees within the Delta not only enhances flood protection for those people and properties within the study area and the Delta, but enhances the resiliency and reliability of through-Delta water conveyance. To

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promote this resiliency and reliability, levees both upstream and adjacent to the DCC along the Delta's freshwater corridor should be modernized to at least current 44 CFR §65.10 levee standards but also ultimately to a seismic standard to guard against earthquakes. Of key note: the DCC levees are not currently certified by FEMA, and by improving the DCC right bank levee and adjoining Snodgrass Slough (both non-SPFC levees) the levees adjacent to the DCC would be improved to current, modern engineering FEMA accreditation standards, resulting in improved reliability and resiliency of the current water conveyance features that will remain in service with or without the potential DCA intakes/tunnels.

3.3 Constraints

3.3.1 Limited Local Funding Sources

LMAs partner with the State through the Delta Levee Subventions program to fund maintenance and repair of their flood control systems. However, the landscape by which levees are maintained by LMAs has drastically changed since levees were first constructed. Today, engineering design standards are more rigorous and environmental regulations are more stringent. In concert with deferred maintenance, these new requirements have increased costs to maintain the levee systems, and lack of funding is a common problem facing many LMAs. This is particularly notable in small communities with limited resources and reduced tax base. LMAs derive assessment valuation per acre for each parcel in proportion to benefits derived from reclamation operation. Notably, improvements on parcels including buildings are not included in the assessment calculation per provisions of the California Water Code. With residential properties often falling below an acre, there is thus a limitation on how much properties within these communities can be assessed (California Water Code § 50000 et seq.).

3.3.2 Proposition 218 Assessments and Other Funding Issues

Performing levee upgrades or improvements often requires a cost sharing between local and State agencies. State funding for investments in flood management systems has been largely supported by general obligation bonds (DWR, 2017a). Multiple State programs with the purpose of rehabilitating levees within the Delta have been established as a result of these bond funds, including the SCFRRP, the Delta Subventions Program and the Delta Levees Special Projects Program.

At the local level, LMAs rely primarily on taxes or special assessments on an acreage basis to make up their share of the funding for flood control projects. In 1996, California voters passed Proposition 218, the so-called "Right to Vote on Taxes Act." Proposition 218 amended the California Constitution by adding procedural and substantive requirements that must be met prior to levying new assessments (California Special Districts Association, 2013). As a result, all new assessments that are used for flood management must be voter approved. This directly impacts a LMA's ability to raise funding for local flood management projects, and without a local funding source, LMAs are unable to partner in cost-sharing programs through the State.

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Direct RD assessments to homeowners are constrained by the California Water Code, and are approximately $25 per home, annually, in the nearby upstream community of Courtland. This is an order of magnitude lower than average assessments for flood protection in nearby urban areas (for comparison, Sacramento Flood Control Agency's assessment for a residential property located behind levees in Sacramento is over $250 annually, excluding costs for applicable flood insurance).

For large repair and improvement projects, like what may be proposed in this feasibility study, LMAs must access a line of credit to implement repairs, but then substantial time may pass before cost-share reimbursements or assessment funds are available for repayment. Thus, large cash reserves are often needed in advance of securing project funds for the State or other entities.

Another difficulty in funding repairs is that LMAs are responsible for mitigation costs associated with repairs and maintenance. These cost increase over time, especially as offsite mitigation opportunities become limited and are a requirement under State cost-share programs.

In addition to assessing properties within the East Walnut Grove study area for levee remediation repairs and improvements, said improvements and additional infrastructure may require additional O&M funds, and thus additional Proposition 218 Assessments may be required to address the incremental increases in O&M costs for new infrastructure such as a new cross levee.

3.3.3 Existing Delta Levee Standards

There are three agricultural levee standards that are widely applied within the Delta: Hazard Mitigation Plan (HMP), PL 84-99, and the DWR Bulletin 192-82. These standards are summarized below in Figure 3-4 (DWR, 2019). The HMP levee configuration is widely used in the Delta on non-SPFC levees and is regarded as providing the minimal level of flood protection that is required for federal disaster assistance eligibility.

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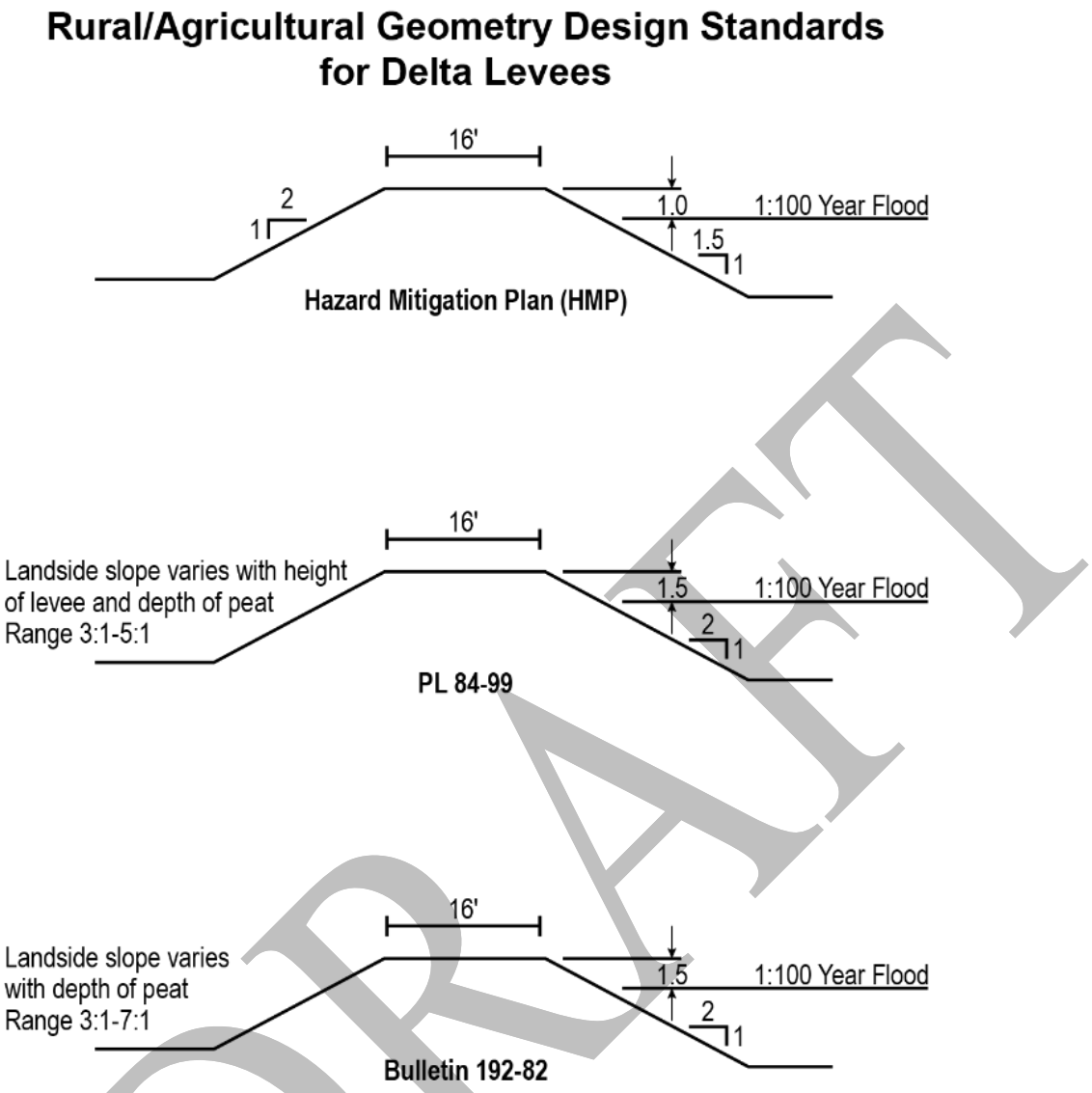

Figure 3-4. Rural/Agricultural Geometry Design Standards for Delta Levees

PL 84-99 guidance provides for somewhat better flood protection than the HMP standard, however it does not provide adequate protection from more extreme floods and earthquakes and does not provide a basis for adaption should sea level rise at an enhanced rate. The DWR Bulletin 192-82 standard is similar to the PL 84-99 criteria, except that it is designed relative to a one in 300-hundred-year flood event (0.33% annual chance of flooding).

The three Delta levee standards mentioned above are focused on protecting agricultural portions of the Delta and fall substantially short of the FEMA accreditation standards for meeting a 100-year level of flood protection pursuant to in 44 CFR §65.10 generally used for urban levees (Figure 3-5)(DWR, 2019). The economic sustainability of the Delta Legacy Communities cannot be assured when applying the lower agricultural levee standards previously established for the Delta.

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Urban Geometry Design Standards for Delta Levees

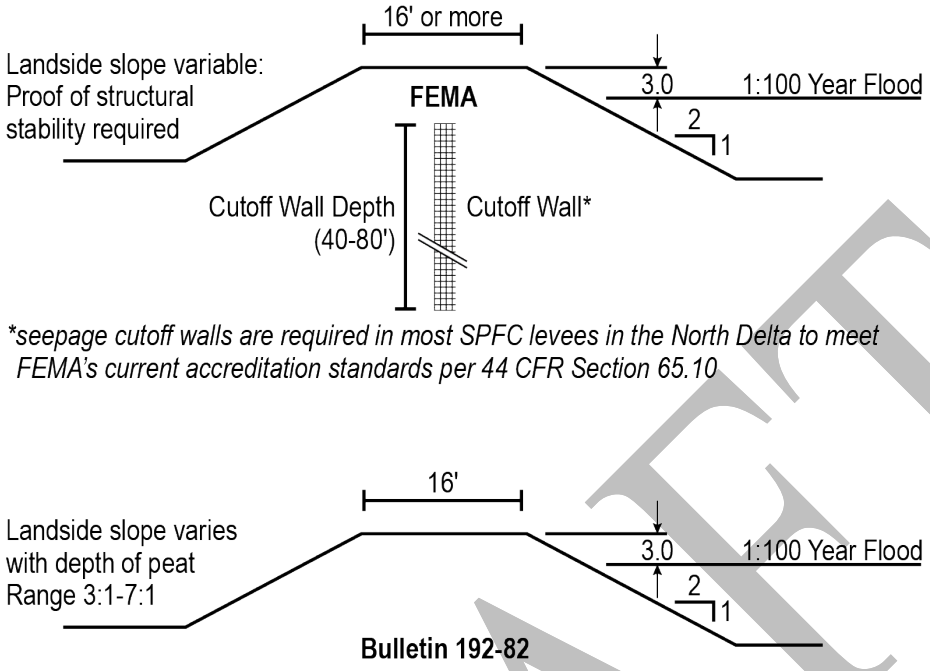

Figure 3-5. Urban Geometry Design Standards for Delta Levees

Agricultural levees within the Delta and those offering protection to the East Walnut Grove study area are largely improved to the PL 84-99 or Bulletin 192-82 geometry standards. However, FEMA accreditation requires levees to also meet USACE criteria contained in 44 CFR §65.10 generally used for urban levees, which goes beyond simple geometry standards. As previously discussed, this includes criteria for through and underseepage, stability, settlement, erosion, and other operations and maintenance criteria. Currently, very few Delta levees outside of urban areas meet the USACE criteria required for FEMA accreditation.

The RD 554 portion of the Walnut Grove East Study ultimately requires FEMA accreditation to obtain a 100-year level of flood protection pursuant to 44 CFR §65.10. The cost of repairing and strengthening-in-place the entire 3.45 mile long perimeter RD 554 levee system south of the DCC to current FEMA accreditation standards will be costly and a challenge to finance without the assistance of other significant cost-sharing partners.

3.3.4 Delta Plan Land Use Constraints

As previously discussed in 3.1.2, the Delta Plan prescribes requirements for land use and floodproofing. However, there are a number of other requirements in the Delta Plan aimed at protecting, restoring, and enhancing the Delta which constrain development within the Delta Legacy Communities located in the Primary Zone of the Delta. Levee improvements made within the study area must be consistent with these Plan requirements, in addition to local

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ordinances or regulations. By prioritizing protection and enhancement of the Delta, the Delta Plan effectively restricts the loss of agricultural lands and/or the displacement of Delta Legacy Communities. This can limit structural levee remediations to more costly alternatives, such as cutoff walls, over less costly alternatives, such as seepage/stability berms, since these berms are constructed on the landside toe of the levee and often require a displacement of agricultural lands or structures with a setback of anywhere from 150 to 350 feet.

Additionally, the Delta Reform Act established a certification process for projects within and affecting the Delta. This requires any State or local agency proposing to undertake a "covered action" to submit to the DSC a written certification of consistency with detailed findings as to whether the covered action is consistent with the Delta Plan (California Water Code, § 85225). The project must not have significant adverse impacts on the achievement of the coequal goals or affect implementation of government-sponsored flood control programs to reduce risks to people and property in the Delta. Development of a consistency determination is usually prepared concurrently and alongside the regulatory documentation for a project, and thus represents a variable cost.

3.3.5 Biological Constraints

As described in Section 2.1.7, the study area contains sensitive vegetation communities and habitat for several special-status species. Project activities that have the potential to affect these sensitive resources will require additional studies and environmental permits, prior to project implementation.

Major biological constraints to projects in the study area include limited work windows in the 3-month period between August 1 through October 31 to perform any in-water work below the ordinary high-water line due to restrictions tied to the presence of several special status and endangered species within the Delta. Repairs of waterside erosion have been deferred around East Walnut Grove due to the permitting difficulty of completing these projects. There is also significant difficulty in obtaining space for mitigation for any impacts to existing vegetation along the levees. Many past projects in the study area attempted to be "self-mitigating" but this can only occur where the space and opportunity exist on a project site. There are limited (or no) mitigation credits remaining to purchase for SRA impacts in the area.

Any levee improvement project will need to consider biological impacts and resulting mitigation measures. Appendix B for additional information on biological resources within the study area. It is hoped that a programmatic biological mitigation program can be established leading to a practical and effective program to repair and strengthen the levees surrounding the community of East Walnut Grove, and possibly other neighboring Delta Legacy Communities as well.

3.3.6 Cultural Resources Constraints

As described in Section 2.1.8, a total of 17 cultural resources were identified during the records search and from information provided by the county of Sacramento but only seven have been

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formally evaluated for their eligibility for listing in either the NRHP or CRHR. However, before implementation of any project activities, a smaller area of potential effect (APE) would need to be defined and any resources within the APE would be formally evaluated for their cultural or historical significance during the project's California Environmental Quality Act (CEQA)/National Environmental Protection Act (NEPA) permitting process. This evaluation involves consultation with interested Tribes/tribal organizations and consultation under Section 106 of the Historic Preservation Act (with a concurrence from the State Office of Historic Preservation).

If any significant resources are determined to likely be affected by project construction, then proper treatment of the resource would be determined. Since one form of treatment for cultural resources is avoidance, this could represent a constraint for implementation of a project element. Even if resources are not avoided and the project moves forward for construction, a cost would be incurred during excavation, archiving, or development of interpretive facilities and information, required to mitigate effects to the cultural resource.

See Appendix C for additional information regarding known and potential cultural resources within the project study area of East Walnut Grove and how they need to be addressed prior to any ground disturbing activities. Appendix C also further describes the National Heritage Designation Area within the study area and greater Delta.

3.3.7 Additional Regulatory Considerations

A permit under Section 14 of the Rivers and Harbors Appropriation Act of 1899, as amended, and codified in 33 U.S. Code 408 (Section 408 Permission) is required for permanent or temporary alteration or use of facilities that were built as part of a USACE civil works project (the Sacramento-San Joaquin Flood Control Project, along the Sacramento River portion of the study area). A 408 permission is generally needed for any work on SPFC levees and within easements, unless the work is classified as maintenance. However, maintenance and repair activities conducted by LMAs on SPFC levees for which they have O&M responsibilities that do not require Section 408 Permission may still require coordination or concurrence from the USACE Sacramento District.

Additionally, a permit under Section 10 of the Rivers and Harbors Act of 1899 (applicable to construction of any structure in or over any navigable water of the U.S.) may be needed for work along the Sacramento River and portions of Snodgrass Slough adjacent to RD 554, depending on the nature of project implementation. The law applies to any dredging or disposal of dredged materials, excavation, filling, rechannelization, or any other modification of a navigable water of the U.S., particularly any navigable waters in the North Delta.

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4. Plan Formulation

The problems and opportunities described above led to the formulation of the study goals (Section 1) and planning objectives, detailed in this Section. These goals and objectives provide solutions for East Walnut Grove while capitalizing on opportunities to maximize multi-benefit projects and investment efficiency. Additionally, these goals and objectives, as well as stakeholder input, are utilized to measure how well plan flood risk reduction management actions meet the objectives of this study.

4.1 Planning Objectives

To achieve the study goal of modernizing SPFC levees to meet FEMA 100-year certification criteria, several broad objectives were identified as a framework for developing the preliminary suite of flood risk reduction elements and ultimately the final array of flood risk reduction management actions for East Walnut Grove. In prioritized order, these include:

- Reducing risk to life
- Reducing risk to property damage
- Reducing probability of levee failure
- Limitation of high insurance premiums
- Improved flood preparedness and response
- Enhance resiliency and reliability of through-Delta water conveyance
- Foster environmental stewardship

These objectives help to address the problems described in the preceding Section and are aligned with the State's interest as expressed within the framework of the CVFPP, the 2014 RFMP, the SCFRRP, and the goals of other Delta agencies, where possible.

4.1.1 Reducing Risk to Life

Reducing risk to life is the first objective used to meet the goal of achieving 100-year flood protection for the East Walnut Grove study area. Life loss is the most devastating consequence of flooding. Since the mid-1800s, catastrophic flooding and life loss has been documented in California, particularly in the Central Valley. Deficiencies in the flood control system, fast-moving floodwaters, deep floodplains, and lack of preparedness and emergency response procedures have all contributed to this life loss. Most of these are of similar concern to the East Walnut Grove study area.

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The risk of life loss is of greatest concern for the East Walnut Grove study area within the densely populated residential area of East Walnut Grove. Should a levee breach occur along the Sacramento River, DCC, or Snodgrass Slough, floodwaters would likely inundate the community at high velocities and depths, leaving little time to respond or evacuate, resulting in substantial life loss. Section 3.1.1.5, including Figure 3-1, provides in detail how and where the greatest risk of life loss exists to the community of East Walnut Grove and the greater study area encompassed by RD 554 and a portion of RD 563.

Reducing risk to life is achieved by reducing flood risk. As described earlier, flood risk within the community and the larger study area is of concern and is based on the probability of flooding and the consequences of levee failure. By implementing flood risk reduction measures which reduce overall flood risk, either by reducing the probability of flooding or reducing the consequences of levee failure, risk of life loss is similarly reduced.

4.1.2 Reducing Risk to Property Damage

Property damage is another significant consequence of flooding. According to the USACE, as documented in the 2017 CVFPP Update, flooding in 1986 and 1997 together caused over $1 billion in damage to the areas protected by the Sacramento River Flood Control Project. Within the East Walnut Grove study area, as previously discussed in Section 3, the value of land and structural improvements, agricultural crops, highways and streets, and vehicles are valued at over $141.5M. These inventories and their associated values for the East Walnut Grove study area are provided in 3.1.1.4, including baseline values of EADs under existing conditions and future conditions with climate change adjustments (Table 3-7). A levee failure could result in substantial property damage in East Walnut Grove, including the larger study area and significant portions of RD 563 - Tyler Island. Additionally, damage to property as a result of flooding could also have a ripple effect within the community, with economic impacts sustained due to damages to businesses, homes, and agricultural operations. This study prioritizes flood risk reduction management actions which reduce the risk to property damage and to achieve the goal of 100-year flood protection for the study area. The net reductions in EAD values for several structural-based management actions developed specifically for the subject East Walnut Grove study area are provided in Section 6.3.1.2 - Reducing Risk to Property Damage, with Table 6-5 and Table 6-6 providing a summary comparison of net EAD reductions for current baseline conditions and future conditions with climate change adjustments.

4.1.3 Reducing Probability of Levee Failure

Since flood risk is defined as the product of probability of levee failure and the consequences of levee failure, reducing the probability of levee failure is integral to reducing flood risk and thus achieving the goal of 100-year flood protection.

Reducing the probability of levee failure for the East Walnut Grove study area can be accomplished by implementing a number of measures:

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- Conduct annual inspections of the levee system and correct any known deficiencies inclusive of non-compliant encroachments that may pose a threat to the structural integrity of the levee system
- Enhance existing flood warning, preparedness, flood-fight and response systems and practices as identified in the Flood ESPs developed by Sacramento County
- Secure 100-year FEMA Certification for the community of East Walnut Grove (the entirety of RD 554 south of the DCC), and possibly for the entire East Walnut Grove project study area inclusive of the Walnut Grove industrial park area in RD 563 pursuant to 44 CFR §65.10

4.1.4 Limit of High Insurance Premiums

Of the estimated 249 structures in the East Walnut Grove study area valued at an estimated $132.4M, there are only 26 NFIP polices (valued at $350,000 maximum per policy inclusive of structure contents, presently capped at $250,000/structure and $100,000 for structure contents) providing $9M[13] in coverage. Rising insurance premiums over the last decade are a contributing factor to this differential and are an increasing problem within the study area. Lowering flood risks, and thus increasing flood protection, is a key action that can be taken to reduce flood insurance costs each year under the existing NFIP or under a new community-based flood insurance program.

4.1.5 Improved Flood Preparedness and Response

Improved flood preparedness and response is another objective used to complement the goal of 100-year flood protection. Improved preparedness and emergency response can limit the loss of life and property damage as a result of flooding by developing the framework needed to enhance the understanding of local flood risks, foster communication, and to promote public awareness of flood risks, thus reducing flood risk.

4.1.6 Enhancing Resiliency and Reliability of Through-Delta Water Conveyance

As previously noted, the vulnerability of levees protecting through-Delta water conveyance is a problem within the study area. Levees within the study area are vulnerable to through seepage and underseepage, earthquakes, climate change and sea level rise, and in most places, do not meet current engineering and FEMA 100-yr. accreditation standards. These levees are needed to protect both people and property and support the agricultural economy within the community of East Walnut Grove and the adjoining project study area. SPFC levees in the north Delta are particularly critical since they convey water to the DCC, which augments the flow of the Sacramento River water through the Delta to the collective SWP and CVP export pumps in the

[13] These estimates are sourced from the FEMA Open Source policy database: https://www.fema.gov/about/openfema/data-sets

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south Delta near Tracy. In the event of a levee failure, sea water intrusion from the San Francisco Bay could enter areas of the freshwater corridor that are critical to the distribution of fresh water, threatening water supply to areas south of the Delta.

Continuing to improve levees within the Delta along the freshwater corridor not only enhances flood protection for those people and properties within the study area and the Delta, but it also contains the multi-benefit of enhancing the resiliency and reliability of through-Delta water conveyance. The existing through-Delta water conveyance system conveying water to the collective SWP and CVP export pumps in the south Delta provides water to over 3M acres of agricultural lands and to over 25M residences south of the Delta.

Of key note: The DCC levees are not currently certified by FEMA, and by improving the DCC right bank levee and adjoining Snodgrass Slough (both non-SPFC levees) the levees adjacent to the DCC would be improved to current engineering FEMA accreditation standards, resulting in improved reliability and resiliency of the current water conveyance features that will remain in service with or without the potential DCA intakes/tunnels.

4.1.7 Environmental Stewardship and Multi-Benefits

In 2010, DWR formally adopted an Environmental Stewardship Policy to advance a department-wide "Total Resource Management" approach to planning and design of projects. By building environmental benefits into projects on a meaningful scale, DWR supports sustainability from an engineering, economic, social, and environmental perspective. The CVFPP includes the supporting goal of integrating recovery and restoration of key physical processes, self-sustaining ecological functions, native habitats, and species into flood management improvements (DWR, 2017c). Additionally, the SCFRRP increases the State cost-share for projects which advance multi-benefit flood protection for small communities (protection of State facilities, contribution to the State's sustainability objectives, water supply, and open space and recreation).

Waterside levee repairs such as known erosion sites can provide opportunities to introduce more SRA habitat valuable to fisheries and other aquatic species.

4.2 Future Baseline Conditions

The future baseline conditions provide the basis to formulating flood risk reduction management actions and assessing their benefits and impacts. Since impact assessment is the basis for plan evaluation, comparison, and selection, clear definition and full documentation of future baseline conditions are essential (DWR, 2014). These conditions are influenced by climate change, sea level rise, development, and land subsidence, and are summarized as the future without project condition. Future baseline conditions in the Lower Sacramento River also consider system-wide benefits that are being implemented upstream in the Sacramento and Yolo Bypass/weirs that have the added benefit of diverting more flood waters into the bypasses and lowering flood stages in the Lower Sacramento River in the North Delta downstream of Sacramento.

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By incorporating EAD assessments for existing baseline conditions (consistent with the values and methodologies utilized by DWR for the 2022 CVFPP update) and comparing them to future baseline conditions (consistent with the adjustments for climate change and sea level rise utilized by DWR for the 2017 CVFPP update) this feasibility study was able to compare net reductions in EAD values for various management actions under existing and future conditions. Appendix E provides more details on the EAD methodologies, net reductions in EAD values for various levels of flood risk reductions measures, and findings based on existing conditions and future conditions that include adjustments for climate change and sea level rise.

4.2.1 Climate Change and Sea Level Rise

Climate change is expected to significantly affect California's water resources in the form of changes to the hydrologic regime, sea level rise, and warmer temperatures. Although sea level rise is a minor issue in the North Delta, Californians will face a higher flood risk due to more rain and decreasing snowfall. Snow will melt faster and earlier in the season meaning more frequent flooding and less opportunity for natural storage in the mountains and will result in higher flood flows in the Delta. Reservoirs may fill earlier due to changing runoff patterns and operators will need to release water earlier in the season to make space for flood storage.

As discussed previously in Section 3.1.6, climate change and sea level rise have the potential to increase peak flows and flood stages in the Sacramento River, which would have some effects on the East Walnut Grove study area. Peak flows in the Sacramento River could increase by 4 percent for the 100-year flood and 2.3 percent for the 200-year flood as a result of climate change. Additionally, climate change combined with sea level rise could increase the 100-year flood stage in the Sacramento River between Steamboat Slough and Georgiana Slough by nearly 1.12 feet on average, with the 200-year flood stage along the same extent increased by 0.71 feet on average. Increased flows and flood stages can not only result in more frequent flooding, which can lead to levee failure through overtopping, but can also result in greater stresses to the levee system as levees are loaded with water for longer periods of time and via other mechanisms resulting from increased flow/flood stages (e.g., erosion). Note, however, that within the East Walnut Grove study area, the effects of climate change rise are less pronounced along the mainstem of the Sacramento River, as a result of improvements in the upstream/adjacent bypass systems, than they are for the more isolated Snodgrass Slough.

Climate change and sea level rise also have the potential to impact the estimates of flood damage, or EAD, under future conditions within the East Walnut Grove study area. The effects of inland climate change projections and sea level rise were incorporated into the EAD analyses performed as part of this study using a median estimate consistent with the methods and results of the 2017 CVFPP Update. These effects are described in greater detail in Section 6.3.1.2 and a full inventory of potential EAD values for the East Walnut Grove study area under future conditions is provided in Appendix E.

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4.2.2 Development in the Floodplain

Improvement of levees can induce population growth and encourage development within the floodplain. This is true for all areas within the Central Valley, except for those areas within the Primary Zone of the Legal Delta. As noted in previous Sections, development within the Primary Zone of the Delta, inclusive of the East Walnut Grove study area, is constrained by the Delta Plan and SPA ordinances which limit new residential, commercial, and industrial development. As such, future development within the study area is not expected to be substantial as a result of either removing the entire community of East Walnut Grove and/or large parts of the East Walnut Grove Study Area from the current (2012) FEMA 100-year floodplain or Zone X.

4.2.3 Land Subsidence in the Delta

While land subsidence is prevalent throughout large portions of the Delta due to underlying peat soils and land use practices, the effects are most pronounced within the central Delta and are least pronounced along the perimeter of the legal Delta. As such, the East Walnut Grove study area, particularly underlying and adjacent to most of its perimeter levee system, is not subject to notable subsidence.

Substantial land subsidence in the study area, particularly along the alignment of the SPFC levee system along the left bank of the Sacramento River and Georgiana Slough, is not expected in the future.

4.3 Alignment with Goals and Policies of Delta Agencies

Actions required to meet the objectives outlined above need to be in alignment with goals and policies of other requirements. Projects and management actions should be qualitatively measured against the requirements of various Delta planning and regulatory agencies. A multitude of broad policies and goals are described in various planning documents drafted by the DPC, DSC, and Conservancy and an exhaustive matrix of potentially relevant Delta goals and policies is included as Appendix G.

4.3.1.1 Delta Protection Commission

DPC's LURMP includes several broad goals regarding land use and sustainability in the Delta. Specific to the study area is a goal to direct new non-agriculturally oriented non-farmworker residential development within the existing unincorporated Delta communities (*Walnut Grove*, Clarksburg, Courtland, Hood, Locke, and Ryde), to help encourage a critical mass of farms, agriculturally-related businesses and supporting infrastructure to ensure the economic vitality of agriculture within the Delta. Improved flood protection would indirectly contribute to this goal. Further LURMP goals are summarized in Appendix G.

DPC's Economic Sustainability Plan includes a detailed evaluation of the larger Walnut Grove area (which includes the East Walnut Grove study area) as part of their Locke Vision and

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Opportunity Sites evaluation (discussed further in 5.3.3). Additionally, the report mentions that all Delta levees should be brought to the HMP standard, if not to the more stringent PL 84-99 Standard. Many broad policies generally applicable to the study area are summarized in Appendix G.

4.3.1.2 Delta Stewardship Council

The Delta Reform Act (California Water Code §85306) requires that the DSC, in consultation with the CVFPB, recommend Delta Plan priorities for State investments in levee operations, maintenance, and improvements in the Delta, including project levees that are part of the SPFC and non-SPFC levees that are constructed and maintained by LMAs.

The Delta Plan outlines a process to prioritize O&M State investments in Delta levees, O&M and levee improvements, and sets interim priorities to guide budget and funding for levee improvements, as detailed in Table 4-1. Levee improvements in the Delta should attempt to be responsive to the 3 x 3 goals established by the DSC in the Delta Plan outlined below in Table 4-1.

Table 4-1. 3x3 Goals of the DSC for State Investment in Delta Integrated Flood Management.

Goals	Localized Network	Levee Network	Ecosystem Conservation
1	Protect existing urban and adjacent areas by providing 200-year flood protection.	Protect water quality and water supply conveyance in the Delta, especially levees that protect freshwater aqueducts and the primary channels that carry fresh water through the Delta.	Protect existing and provide for a net increase in channel-margin habitat.
2	Protect small communities and critical infrastructure of statewide importance (located outside of urban areas).	Protect floodwater conveyance in and through the Delta to a level consistent with the State Plan of Flood Control for project levees.	Protect existing and provide for net enhancement of the floodplain habitat.
3	Protect agriculture and local working landscapes.	Protect cultural, historic, aesthetic, and recreational resources (Delta as Place).	Protect existing and provide for net enhancement of wetlands.

As described previously, the DSC also developed an overall DLIS, that: 1) quantifies flood risk, by considering the threats to Delta levees and the assets protected by these levees and 2) prioritizes investments for levee repairs, improvements and rehabilitation, as Very High, High, or Other Priority. Generally, the priorities address the relationship between the flood risk of each island or tract, and the number of State interests that island's or tract's assets encompass (people, property, ecosystem, water supply, and Delta as place). The entirety of the East Walnut Grove study area is currently designated as "Other Priority" under the DLIS prioritization. However, this prioritization is largely based upon levee geometry and availability of freeboard to the noted project area in comparison to other tracts within the Delta. Geotechnical evaluations by DWR under the NULE program and recent explorations collectively confirm there are significant

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deficiencies with known seepage concerns. The noted deficiencies warrant immediate attention and repair to reduce the risk of flooding to the Delta Legacy Community of East Walnut Grove.

The Delta Plan includes many performance measures (including net reductions in EAD values) focused on reducing flood damages and loss of life, multi-hazard coordination, levee improvements, water supply reliability, sustainability, and recreation and economic opportunities associated with the Delta Legacy Communities. Additional Delta Plan goals generally applicable to the study area are summarized in Appendix G.

4.3.1.3 Delta Conservancy

The Conservancy's Delta Public Lands Strategy includes integrated conservation for publicly funded lands in the Delta and identifies small areas in the study area for implementation of dryland habitat, woody riparian habitat, and "urban greening" around the developed area of East Walnut Grove. Additional Conservancy goals generally applicable to the study area are also summarized in Appendix G.

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5. Preliminary Suite of Flood Risk Reduction Elements

The following Section details the structural and non-structural preliminary suite of flood risk reduction elements considered as part of this feasibility study. These elements will be used to form management actions which can be implemented by the community of East Walnut Grove as funding sources are identified and become available. Potential multi-objective components which could be incorporated as part of the structural elements and non-structural measures are also discussed.

5.1 Structural Elements

Structural elements are those that repair or improve the existing levee/flood control system as it exists today. Structural elements considered in this feasibility study include repair-in-place levee repairs and improving the levee system to meet the objectives outlined in Section 4.1

Structural elements discussed in this Section propose various remediations, such as cutoff walls, stability berms, seepage berms, and combination seepage/stability berms to address levee vulnerabilities within the study area. Potential cross levees are also presented as a measure to improve the flood control system in the East Walnut Grove study area. A brief discussion of these remediations is provided below. The proposed remediations are Feasibility Level, developed using limited available data. Additional geotechnical explorations and analysis are recommended to refine these remediations, and to ensure they are designed to FEMA criteria in an effort to secure FEMA accreditation for the community of East Walnut Grove within RD 554 and potentially for the larger study area within RD 563 in the future.

Cutoff Wall: A cutoff wall is a vertical trench in the levee filled with a slurry material that becomes nearly impermeable. It is used to reduce permeability through and under levee systems that may be susceptible to seepage. Cutoff walls are designed and installed to depths necessary to minimize through seepage and underseepage vulnerabilities. One advantage to this method is that it stabilizes the levee by constructing a barrier at either the levee centerline or near the levee waterside hinge-point and does not require the displacement/reclamation of land on the landside toe, as required by other methods to address seepage as described below. A typical cutoff wall is shown in Figure 5-1.

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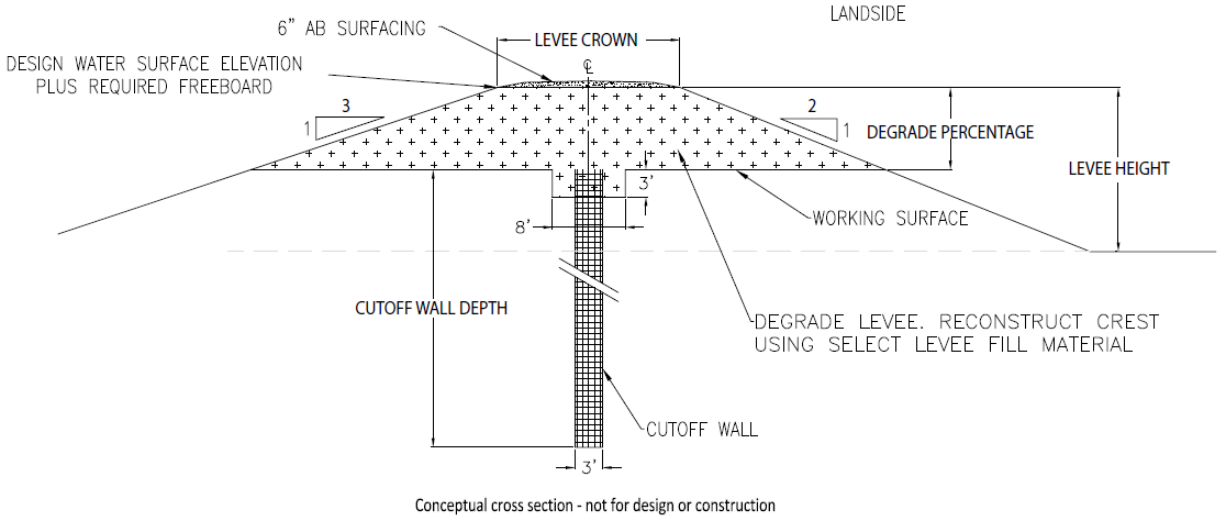

Figure 5-1. Typical Cutoff Wall.

Stability Berm: Stability berms are earthen berms constructed on the levee landside slope to address through seepage and stability vulnerabilities. When a levee is only vulnerable to through seepage, a stability berm can be a more cost-effective alternative to a cutoff wall. However, this remediation requires construction on the levee landside and results in a loss of usable land. The overall width and depth of the stability berm depends upon the degree to which the levee is vulnerable to stability. A typical stability berm is shown in Figure 5-2.

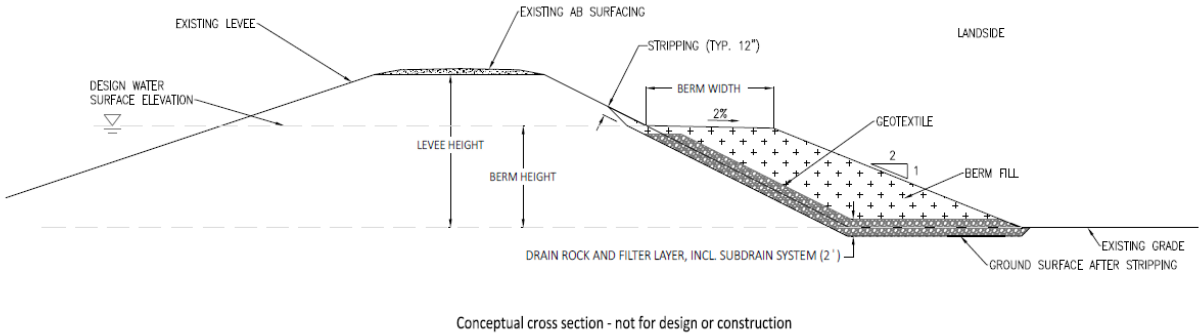

Figure 5-2. Typical Stability Berm.

Seepage Berm: Seepage berms are earthen berms constructed on the levee landside to address underseepage. These berms are constructed on the levee landside toe and extend outwards away from the levee anywhere from 150 to 350 feet in width in order to lengthen the seepage path. As a result, construction of seepage berms requires more land than construction of stability berms. A typical seepage berm is provided below in Figure 5-3.

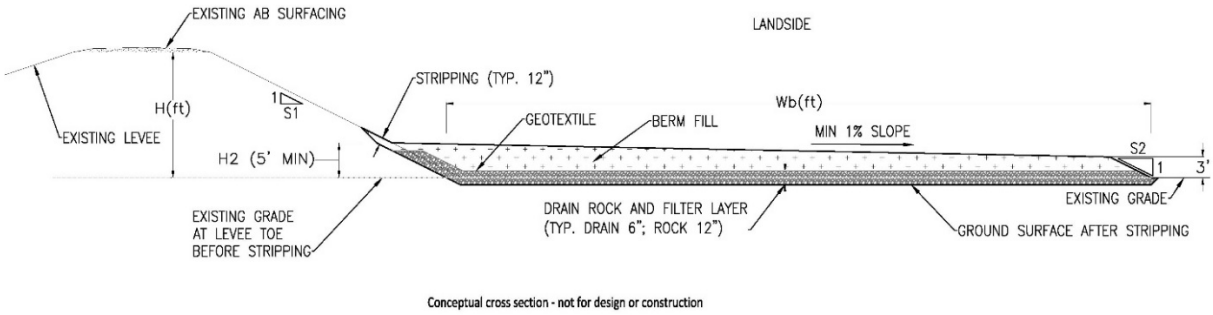

Figure 5-3. Typical Seepage Berm.

Combination Seepage and Stability Berm: Combination seepage and stability berms are constructed to address levees which have both underseepage and through seepage vulnerabilities. A typical combination seepage and stability berm is shown in Figure 5-4.

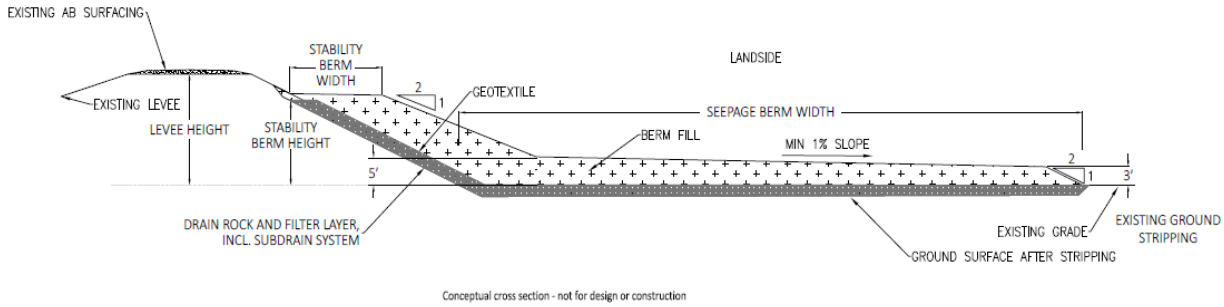

Figure 5-4. Typical Combination Seepage and Stability Berm.

5.1.1 Identified Repair and Strengthen-in-Place Needs: RD 554

A number of studies and evaluations have identified various issues within RD 554 south of the DCC in the study area associated with through seepage, underseepage, slope stability, and erosion. The following is a summary of these studies and evaluations.

5.1.1.1 Repair and Strengthen-in-Place Sacramento River and Georgiana Slough Left (east) Bank SPFC Levees Adjacent to East Walnut Grove in RD 554 (NULE Segment 128)

As previously discussed, a breach on the levee immediately fronting the community poses potential risk to East Walnut Grove and the larger study area since a failure would likely result in significant property damage and life loss as a result of high floodwater depths and velocities and little time to evacuate. This flood risk reduction element improves the 0.9-mile-long portion of levee immediately adjacent to the community of East Walnut Grove along the left bank of the

Sacramento River south of the DCC, including Georgiana Slough within RD 554 (NULE Segment 128) (Figure 5-5).

Improvement of this portion of levee was investigated as part of the NULE Phase 1 study, as documented in the NULE GAR and in the 2014 RFMP. This feasibility study leverages data from the NULE Phase 1 study and recent investigations geotechnical conducted by RD 554 and analyses prepared by Blackburn Consulting to develop two sets of remedial alternatives for this segment of levee, which has been divided into three reaches (A, B, and C) based on topography, levee geometry, available subsurface explorations, and surface features.

Remediations for this element were developed primarily by Blackburn Consulting (with input provided by DCC Engineering representing RD 554) considering through seepage, underseepage, and slope stability. Based on the available data, two remedial alternatives were generally developed by Blackburn Consulting with limited input from RD 554 engineers for each reach to primarily address vulnerabilities for through seepage and stability. Note that the evaluation that was performed by Blackburn Consulting to develop these remediations did not consider erosion or freeboard, which has been evaluated separately by the District Engineer for RD 554. The remediation proposed by the District Engineer for RD 554 to address erosion vulnerabilities includes approximately 750 feet of rock slope protection (RSP) in reach 128-C just downstream of the Delta Cross Channel as shown on Figure 5-6. A typical cross section for the proposed RSP is provided in Figure 5-7. A summary of the proposed remediations to address the vulnerabilities along the left bank of the Sacramento River and Georgiana Slough in RD 554 (NULE Segment 128) is provided in Table 5-1. Further geotechnical investigations are recommended to refine the identified remediations (primarily for reaches 128-B and 128-C along the Sacramento River left bank) in connection with obtaining FEMA accreditation. Additional information regarding the data used to develop these remediations and how levee vulnerabilities were identified can be found in Appendix A-1, Appendix A-2, and Appendix A-3.

In addition to the analyses conducted by Blackburn Consulting, DCC Engineering on behalf of RD 554 has prepared improvement plans, dated October 2020, to address erosion concerns that exist along the left bank levee of the Sacramento River immediately downstream of the Delta Cross Channel. The extent of the repairs and improvements and typical section of the improvements, including waterside SRA riparian habitat enhancements are identified below in Figure 5-6 and Figure 5-7, and further detailed in Appendix A-4.

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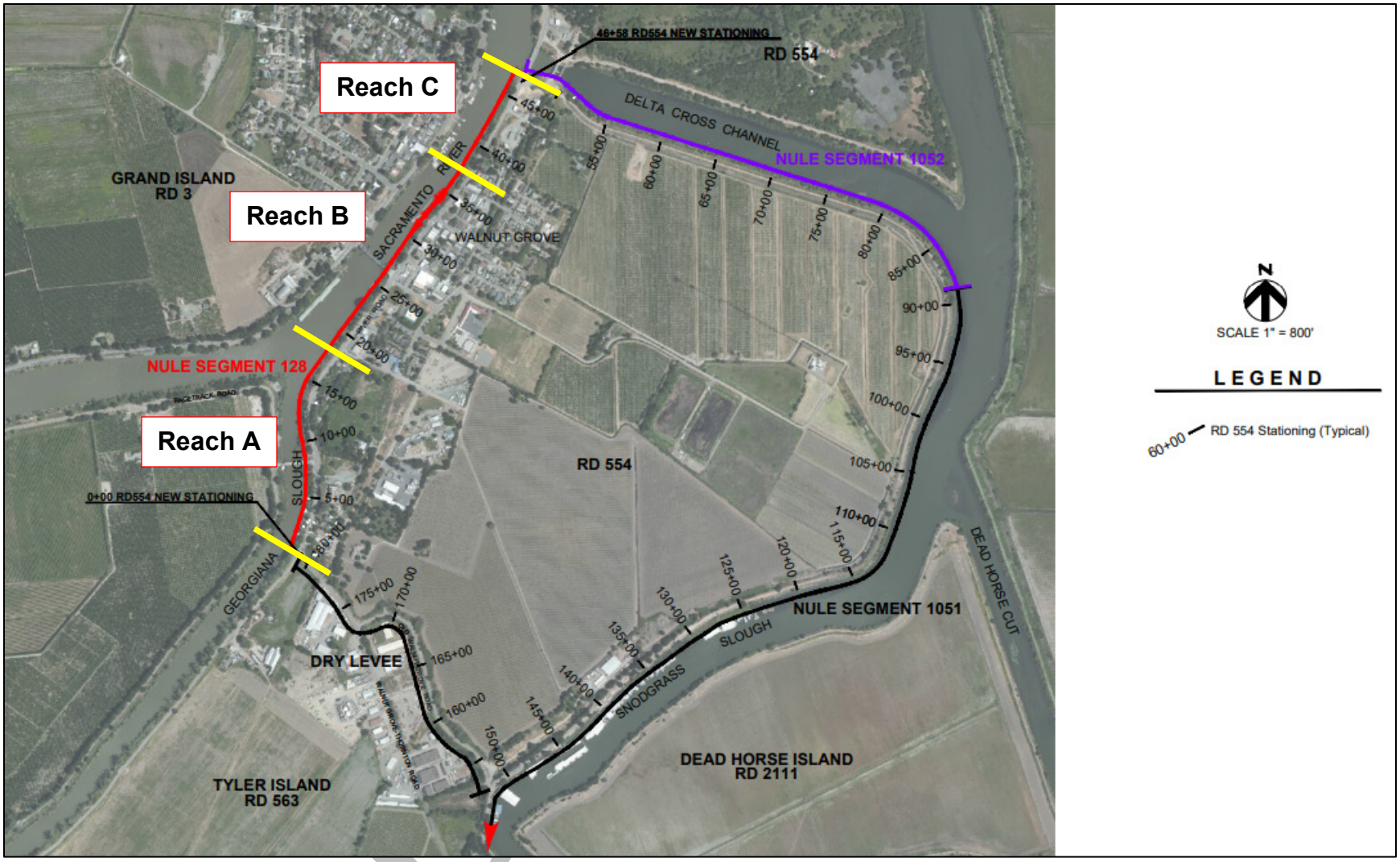

Figure 5-5. Left Bank of the Sacramento River and Georgiana Slough in RD 554 (NULE Segment 128) (Blackburn Consulting, 2020a), updated by Sacramento County in 2020

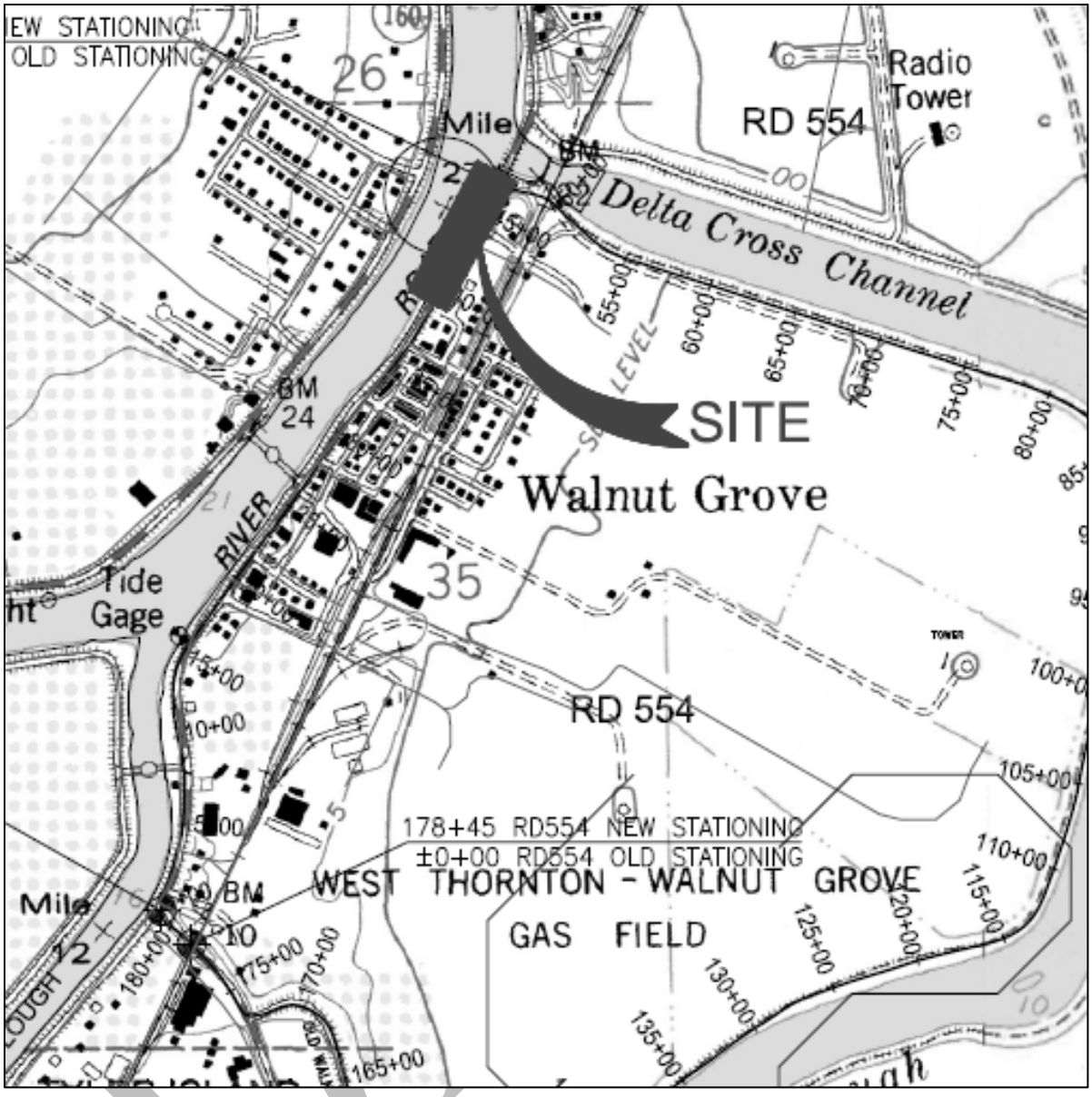

Figure 5-6. Extent of Proposed RSP along the Left Bank of the Sacramento River in RD 554 (DCC Engineering, 2020)

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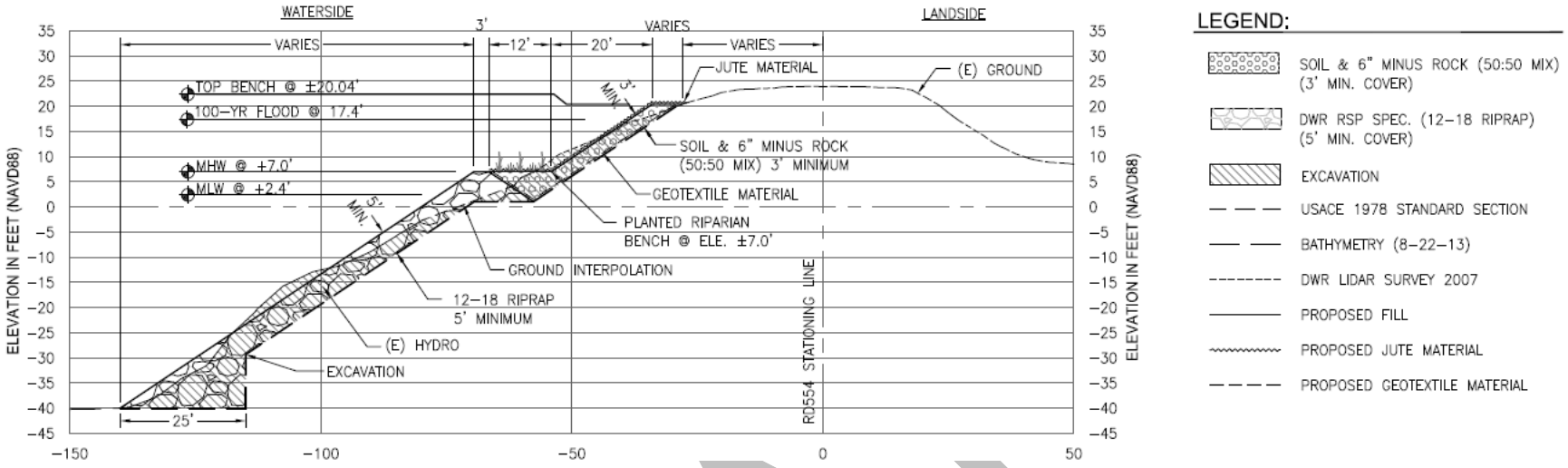

Figure 5-7. Riparian/Wetland Bench and Typical Cross Section to Address Erosion Vulnerabilities along the Left Bank of the Sacramento River in RD 554 (DCC Engineering, 2020)

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Table 5-1. Summary of Remedial Alternatives to Address Through Seepage, Stability, and Erosion on the SPFC Levee Segment Immediately Fronting the Community of East Walnut Grove within RD 554 (Blackburn Consulting, 2020b) and (DCC Engineering, 2020)

Levee Segment Location	NULE Segment	Reach	Start Station	End Station	Reach Length (ft.)[1]	Remediation Alternative 1	Remediation Alternative 2	Vulnerability		
								Through-Seepage	Slope Stability	Erosion
Left Bank Sacramento River and Georgiana Slough – RD 554	128 (SPFC Levee Segment)	A Georgiana Slough	0+00	18+50	1,900	Stability berm and landside slope flattening to 2:1 above the berm	**35 ft. deep cutoff wall and landside slope flattening to 2:1**	X	X	-
		B* Georgiana Slough & Sac River	18+50	37+50	1,900	35-ft.-deep cutoff wall *(may or may not be required upon further data and analyses)*	-	-	X	-
		C* **Sac River**	37+50	46+58	900	55 ft. landside levee widening with 2:1 landside slope. 750 ft. of RSP *(may or may not be required upon further data and analyses)*	35' ft. deep cutoff wall. Waterside slope flattening to 3:1. Landside slope flattening to 2:1. 750 ft. of RSP *(may or may not be required upon further data and analyses)*	-	X	X

Notes:
***** Pending further geotechnical analysis
[1] Reach lengths rounded to the nearest 100 feet

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5.1.1.2 Repair and Strengthen-in-Place Right (west) Bank non-SPFC Levee of Snodgrass Slough (portion of NULE Segment 1051) in RD 554

A levee breach along the right bank of Snodgrass Slough within RD 554 has the potential to result in life loss and property damage within RD 554, inclusive of the community of East Walnut Grove, as well as the larger study area. This element repairs and strengthens the 1.2-mile portion of non-SPFC levee located along the right bank of Snodgrass Slough within RD 554 (portion of NULE Segment 1051) (Figure 5-8). As described in 5.1.1.2, improvement of this portion of levee was investigated as part of the NULE Phase 1 study, as documented in the NULE GAR and in the 2014 RFMP. Remediations for this element were developed by DWR based on the assessment performed as documented in the NULE GAR and as provided in the 2011 RACER for the North NULE study area. To develop these remediations, the levee was assessed for four potential failure modes (through seepage, underseepage, slope stability, and erosion) and for freeboard and geometry. For each hazard, the levee segment was categorized based on its overall vulnerability to the various failure mechanisms (low, moderate, high) and the likelihood of levee failure. The hazard extent, or the percentage of levee that was deemed vulnerable to each hazard, was also identified. With this assessment, a suite of remedial alternatives was identified primarily to address through seepage, underseepage, slope stability, and geometry deficiencies. A preferred alternative was selected to address each hazard or group of hazards through a least coast approach. The preferred alternatives as identified by DWR to address vulnerabilities on the 1.2 miles of levee located along the right bank of Snodgrass Slough in RD 554 (portion of NULE Segment 1051) are provided in Table 5-2. As noted in the NULE GAR, NULE Segment 1051 in RD 554 is partially lacking sufficient data for underseepage, stability, and through seepage, and the levee is not currently categorized as described above. Additional geotechnical explorations and analysis are thus highly recommended by RD 554 and the Sacramento County consultant team to refine these remediations.

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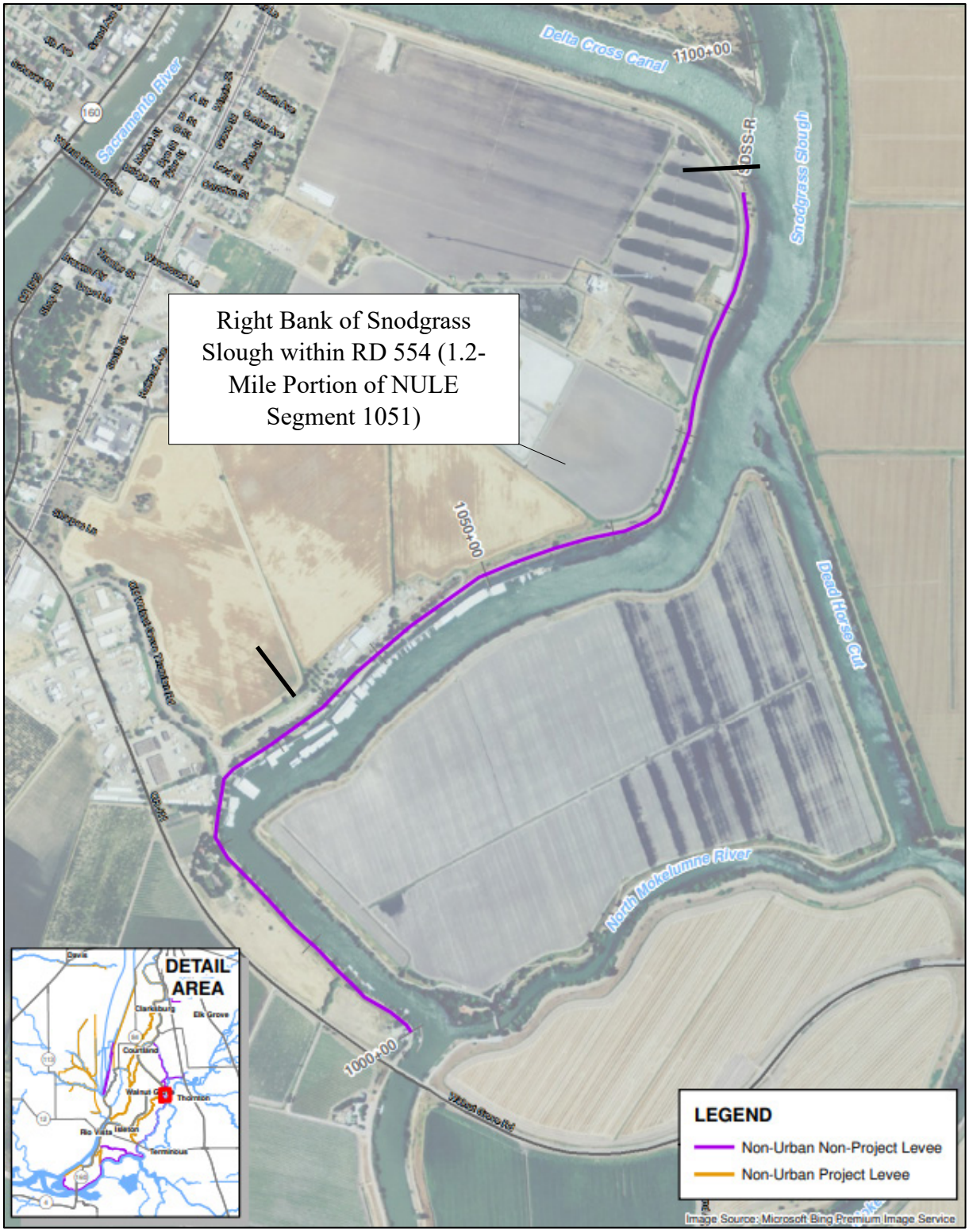

Figure 5-8. Snodgrass Slough Right Bank Non-SPFC Levee in RD 554 (Portion of NULE Segment 1051) (URS, 2011a), updated in 2020 by Sacramento County

Table 5-2. Summary of Remedial Alternatives to Address Levee Vulnerabilities along Snodgrass Slough in RDs 554 and 563 (URS, 2011b).

Levee Segment Location	NULE Segment (8,880 ft. Length)	Hazard Remediated	Percent of 8,880 ft. Total Levee Segment	Remedial Alternatives
Right Bank Snodgrass Slough – RDs 554 & 563. Between Delta Cross Channel and North Fork Mokelumne River	1051 (Non-SPFC Levee Segment); RD 554: 6,360 ft.; RD 563: 2,520 ft.	T + U + S	60% @ 5,530 ft.	20-ft.-high levee, 100-ft.-wide combination berm
		T + U	40% @ 3,550 ft.	20-ft.-high levee, 100-ft.-wide combination berm
		FG	75% @ 6,660 ft.	19-ft.-high levee geometry deficiency only

Notes: T = Through Seepage, U = Underseepage, S = Slope Stability, E = Erosion, FG = Freeboard and/or Geometry

5.1.1.3 Repair and Strengthen-in-Place Right (south) Bank Non-SPFC Levee of the Delta Cross Channel (NULE Segment 1052)

Levees along the right bank of the DCC in RD 554 are documented by DWR to have a moderate risk of levee failure or the need to flood fight based on vulnerabilities to underseepage and erosion. To reduce the risk of life loss and property damage within RD 554, inclusive of the community of East Walnut Grove, and the larger study area, this element repairs and strengthens the entirety of the 0.8 miles of non-SPFC levee located along the right bank of the DCC in RD 554 (NULE Segment 1052) (Figure 5-9). Improvement of this portion of levee was investigated as part of the NULE Phase 1 study, as documented in the NULE GAR and in the 2014 RFMP. Remediations for this element were developed by DWR based on the assessment performed as documented in the NULE GAR and as provided in the 2011 Remedial Alternatives and Cost Estimates Report (RACER) for the North NULE study area. To develop these remediations, the levee was assessed for four potential failure modes (through seepage, underseepage, slope stability, and erosion) and for freeboard and geometry. For each hazard, the levee segment was categorized based on its overall vulnerability to the various failure mechanisms (low, moderate, high) and the likelihood of levee failure. The hazard extent, or the percentage of levee that was deemed vulnerable to each hazard, was also identified. With this assessment, a suite of remedial alternatives was identified primarily to address underseepage, slope stability, erosion, and geometry deficiencies. A preferred alternative was selected to address each hazard or group of hazards through a least coast approach. The preferred alternatives as identified by DWR to address vulnerabilities on the 0.8 mile of levee located along the right bank of the DCC (NULE Segment 1052) are provided in Table 5-3. Additional geotechnical explorations and analysis are thus highly recommended by RD 554 and the Sacramento County consultant team to refine these remediations.

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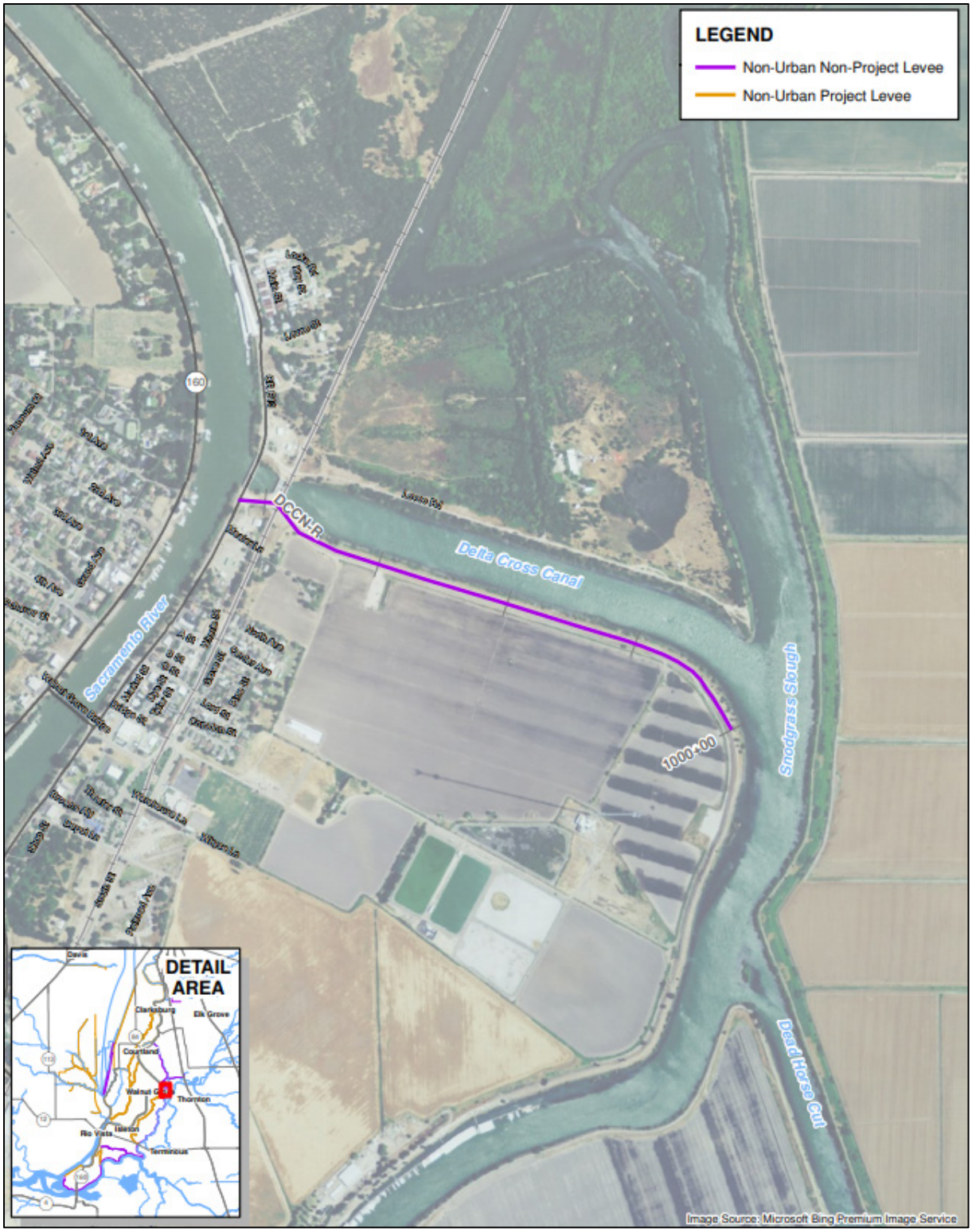

Figure 5-9. Right Bank non-SPFC Levee of the Delta Cross Channel in RD 554 (NULE Segment 1052) (URS, 2011a)

Table 5-3. Summary of Remedial Alternatives to Address Levee Vulnerabilities along the Right Bank non-SPFC Levee of the Delta Cross Channel (URS, 2011b).

Levee Segment Location	NULE Segment (4,200 ft. Length)	Hazard Remediated	Percent of 4,200 ft. Total Levee Segment	Remedial Alternatives
Right Bank Delta Cross Channel – RD 554	1052 (Non-SPFC Levee Segment)	U + S	30% @ 1,260 ft.	19-ft.-high levee; 95-ft.-wide combination berm
		U	60% @ 2,520 ft.	19-ft.-high levee; 95-ft.-wide seepage berm
		U	10% @ 420 ft.	16-ft.-high levee; 80 ft.-wide seepage berm
		E	10% @ 420 ft.	19-ft.-high levee
		FG	35% @ 1,470 ft.	19-ft.-high levee geometry deficiency only

Notes: U = Underseepage, S = Slope Stability, E = Erosion, FG = Freeboard and/or Geometry

5.1.1.4 Repair and Strengthen-in- RD 554 Dry Cross Levee (non-SPFC) Adjoining RD 563 along Old Walnut Grove-Thornton Road

This flood risk reduction element is largely limited to filling the former landside borrow ditch adjacent to the landward toe of the subject RD 554 dry cross levee adjoining RD 563. It is possible that additional improvements to the cross levee beyond filling in the landward borrow ditch may be warranted to have this levee achieve a FEMA 100-year level of protection to fend off RD 563 floodwaters originating from within RD 563-Tyler Island as experienced during the Tyler Island flood of 1986.

5.1.1.5 Secure 100-Year FEMA Certification for Community of East Walnut Grove within RD 554 South of the Delta Cross Channel

This element builds on the previous collection of elements by improving all levee segments (SPFC and non-SPFC) within RD 554 south of the DCC, including the 0.9-mile-long portion of SPFC levee immediately adjacent to the community of East Walnut Grove along the left bank of the Sacramento River (NULE Segment 128); the 0.8-mile-long portion of non-SPFC levee along the right bank of the DCC (NULE Segment 1052); the 1.20-mile-long portion of non-SPFC levee along the right bank of Snodgrass Slough within RD 554 (portion of NULE Segment 1051), and; the 0.54-mile-long dry cross levee adjoining RD 563 along Old Walnut Grove-Thornton Road. These improvements would be performed in accordance with FEMA standards for freeboard, seepage, erosion, and stability and settlement concerns pursuant to 44 CFR §65.10 as described previously. In addition to the proposed structural remediations, certain FEMA design criteria, O&M requirements, and documentation requirements specified in 44 CFR §65.10 are also addressed. To secure FEMA accreditation, these levee improvements would be performed in concert with the construction of an improved dry cross levee adjoining RD 563 along Old

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Walnut Grove-Thornton Road to form a complete perimeter levee system. FEMA accreditation requirements are discussed briefly below.

Freeboard: Riverine levees must provide a minimum freeboard of 3 feet above the 100-year water-surface level, preferably that addresses both climate change and sea level rise. An additional 1 foot above the minimum is required within 100 feet on either side of structures (such as bridges) riverward of the levee or wherever the flow is constricted.

Embankment Protection: Engineering analyses must be submitted that demonstrate no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through reduction of the seepage path and subsequent instability. The factors to be addressed in such analyses include but are not limited to: Expected flow velocities (especially in constricted areas); expected wind and wave action; ice loading; impact of debris; slope protection techniques; duration of flooding at various stages and velocities; embankment and foundation materials; levee alignment, bends, and transitions; and levee side slopes.

Embankment and Foundation Stability (Including Through Seepage and Underseepage): Engineering analyses that evaluate levee embankment stability must be submitted. The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability. An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in the USACE (COE) manual, "Design and Construction of Levees" (EM 1110-2-1913, Chapter 6, Section II), may be used. The factors that shall be addressed in the analyses include, Depth of flooding, duration of flooding, embankment geometry and length of seepage path at critical locations, embankment and foundation materials, embankment compaction, penetrations, other design factors affecting seepage (such as drainage layers), and other design factors affecting embankment and foundation stability (such as berms).

Settlement: Engineering analyses must be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum standards set forth in paragraph (b)(1) of this section. This analysis must address embankment loads, compressibility of embankment soils, compressibility of foundation soils, age of the levee system, and construction compaction methods. In addition, detailed settlement analysis using procedures such as those described in the COE manual, "Soil Mechanics Design - Settlement Analysis" (EM 1100-2-1904) must be submitted.

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Design Criteria

Closures/Encroachments: All openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.

Interior Drainage: An analysis must be submitted that identifies the source(s) of such flooding, the extent of the flooded area, and, if the average depth is greater than 1 foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters.

Other Design Criteria: In unique situations, such as those where the levee system has relatively high vulnerability, FEMA may require that other design criteria and analyses be submitted to show that the levees provide adequate protection. In such situations, sound engineering practice will be the standard on which FEMA will base its determinations. FEMA will also provide the rationale for requiring this additional information.

Operations Plans and Criteria

Closures: Operation plans for closures must include the following:

- Documentation of the flood warning system, under the jurisdiction of federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure.
- A formal plan of operation including specific actions and assignments of responsibility by individual name or title.
- Provisions for periodic operation, at not less than 1-year intervals, of the closure structure for testing and training purposes.

Interior Drainage Systems: Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. These drainage systems will be recognized by FEMA on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan:

- Documentation of the flood warning system, under the jurisdiction of federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system.
- A formal plan of operation including specific actions and assignments of responsibility by individual name or title.
- Provision for manual backup for the activation of automatic systems.
- Provisions for periodic inspection of interior drainage systems and periodic operation of any mechanized portions for testing and training purposes. No more than 1-year shall elapse between either the inspections or the operations.

Operations Plans and Criteria

Other Operations Plans and Criteria: Other operating plans and criteria may be required by FEMA to ensure that adequate protection is provided in specific situations. In such cases, sound emergency management practice will be the standard upon which FEMA determinations will be based.

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Maintenance Plans and Criteria

For levee systems to be recognized as providing protection from the base flood, the maintenance criteria must be as described herein. Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner. All maintenance activities must be under the jurisdiction of a federal or State agency, an agency created by federal or State law, or an agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance. This plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained. At a minimum, maintenance plans shall specify the maintenance activities to be performed, the frequency of their performance, and the person by name or title responsible for their performance.

5.1.2 Identified Repair and Strengthen In-Place Needs and Potential Cross Levee: RD 563

A number of studies and evaluations have identified various issues within RD 563 associated with through seepage, underseepage, slope stability, and erosion. The following is a summary of these studies and evaluations as they may relate to the levee reaches within the East Walnut Grove study area that are within RD 563.

5.1.2.1 Repair and Strengthen-in-Place Snodgrass Slough Right (west) Bank Non-SPC Levee from RD 554 South Boundary to the North Fork of the Mokelumne River (portion of NULE Segment 1051)

The approximately 0.50-mile portion of non-SPFC levee located along the right bank of Snodgrass Slough from the south boundary of RD 554 to the confluence with the North Fork of the Mokelumne River is identified as one of the weakest links in the RD 563 levee system. This flood risk reduction element repairs and strengthens this segment of levee as shown in Figure 5-10 as discussed in the preceding Section 5.1.1.2. A suite of remedial alternatives was developed by DWR as documented in the 2011 RACER primarily to address through seepage, underseepage, slope stability, and geometry deficiencies. From this suite of alternatives, a preferred alternative was selected to address each hazard or group of hazards through a least coast approach. The preferred alternatives as identified by DWR to address vulnerabilities on the 0.5 mile of levee located along the right bank of Snodgrass Slough in RD 563 (portion of NULE Segment 1051) are provided above in Section 5.1.1.2.

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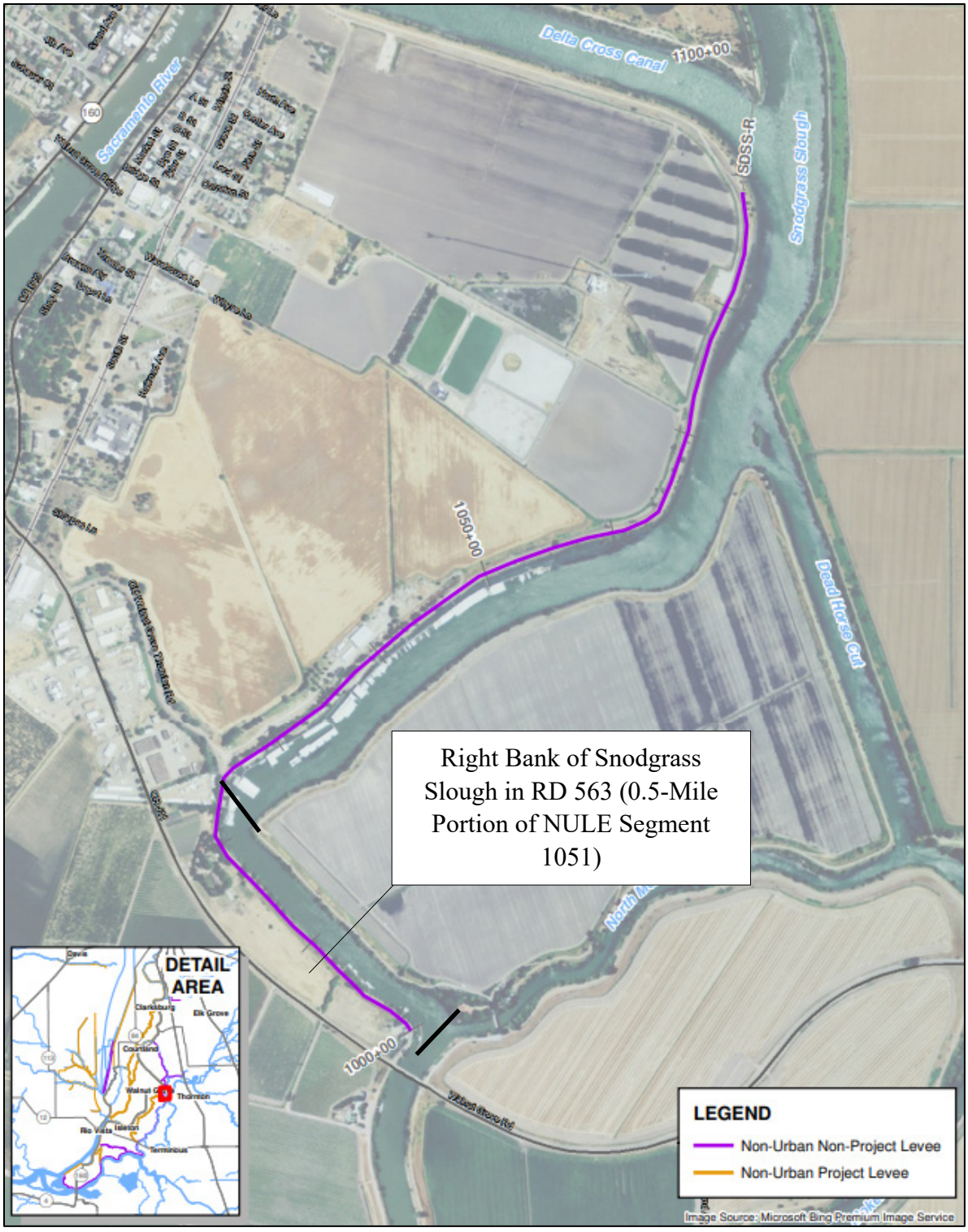

Figure 5-10. Snodgrass Slough Right Bank non-SPFC Levee in RD 563 (Portion of NULE Segment 1051) (URS, 2011a), updated in 2020 by Sacramento County

5.1.2.2 Repair and Strengthen-in-Place Mokelumne River Right (west) Bank non-SPFC Levee (950 ft. portion of NULE Segment 1043)

As documented by DWR in the NULE GAR, levees along the right bank of the Mokelumne River within RDs 554 and 563 have a high likelihood of failure or the need to flood fight due to vulnerabilities to underseepage and stability. To reduce flood risk within the study area, this element repairs and strengthens the 950-foot length of non-SPFC levee located along the right bank of the Mokelumne River from the confluence with Snodgrass Slough to approximately 625 feet downstream of the Walnut Grove-Thornton Road bridge (portion of NULE Segment 1043) (Figure 5-11). As discussed in the preceding discussions, remediations for this element were developed by DWR based on the assessment performed for NULE Segment 1043 as documented in the NULE GAR and as provided in the 2011 RACER for the North NULE study area. With this assessment, a suite of remedial alternatives was identified primarily to address through seepage, underseepage, slope stability, erosion, and geometry deficiencies. A preferred alternative was selected to address each hazard or group of hazards through a least coast approach. A summary of the preferred alternatives to address vulnerabilities on the 950 feet portion of levee located along the right bank of the Mokelumne River from the confluence with Snodgrass Slough to approximately 625 feet downstream of the Walnut Grove-Thornton Road bridge (portion of NULE Segment 1043) is provided in Table 5-4. Additional geotechnical explorations and analysis are recommended to further refine these remediations.

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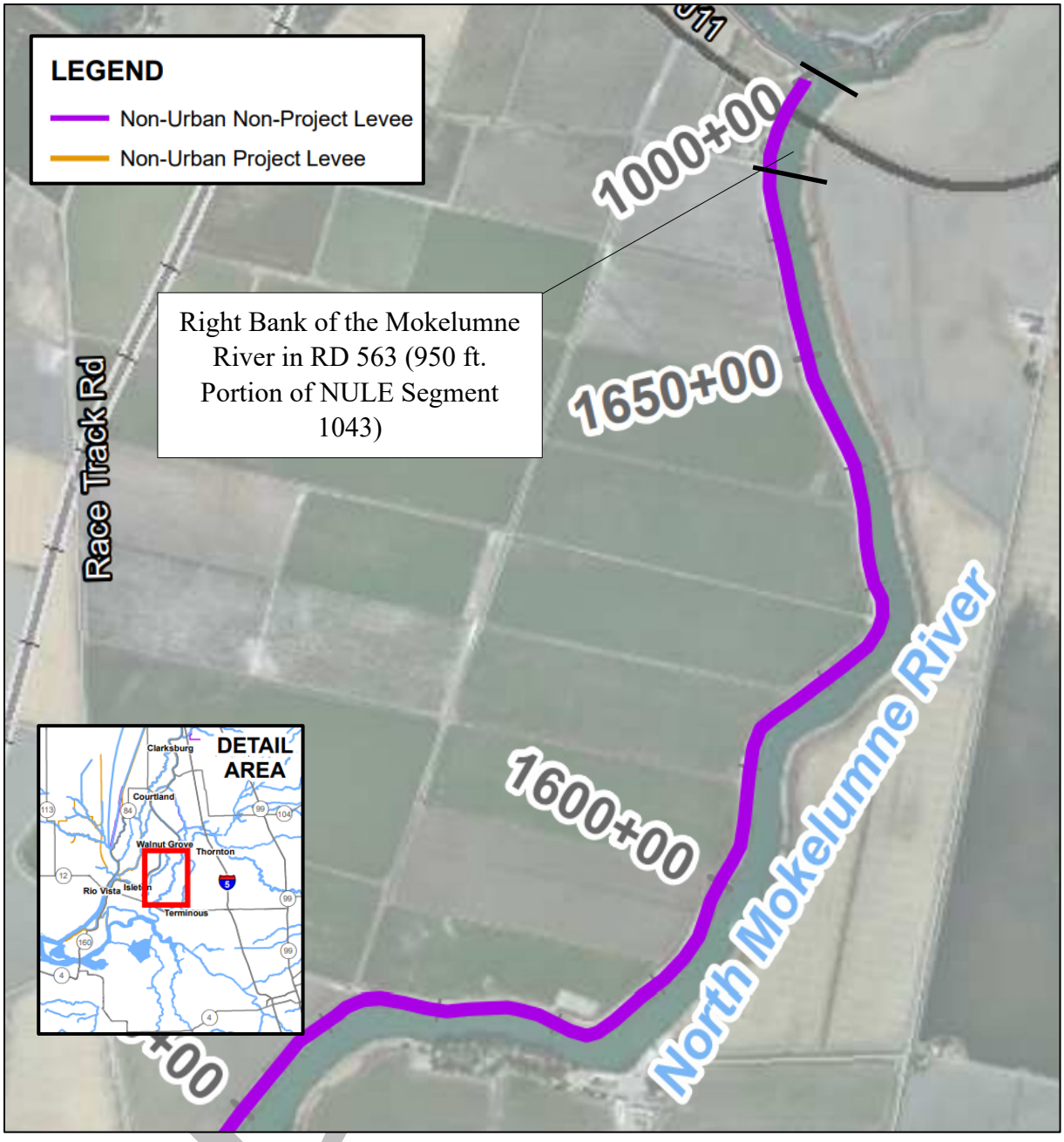

Figure 5-11. 950 ft. Portion of Mokelumne River Right Bank Non-SPFC Levee - NULE Segment 1043 in RD 563 (URS, 2011a), updated in 2020 by Sacramento County

Table 5-4. Summary of Remedial Alternatives to Address Levee Vulnerabilities along the Right Bank of the Mokelumne River in RD 563 (URS, 2011b).

Levee Segment Location	NULE Segment	Hazard Remediated	Extent*	Remedial Alternatives
Right Bank Mokelumne River – RD 563	1043 (Non-SPFC Levee Segment)	T + U + S	50	21-ft.-high levee 126-ft.-wide combination berm
		U	50	126-ft.-wide seepage berm
		E	50	21-ft.-high levee
		FG	95	21-ft.-high levee geometry deficiency only

Notes: T = Through Seepage, U = Underseepage, S = Slope Stability, E = Erosion, FG = Freeboard and/or Geometry

* Extent is percentage of total segment length

5.1.2.3 Repair and Strengthen-in-Place Georgiana Slough Left (east) Bank SPFC Levee in RD 563 (portion of NULE Segment 130)

The levee along the left bank of Georgiana Slough in RD 563 is estimated by DWR to have a high likelihood of failure or the need to flood fight due to vulnerabilities to underseepage and erosion. To reduce the risk of life loss and property damage within the study area, this element repairs and strengthens the portion of SPFC levee in RD 563 (portion of NULE Segment 130) located along the left bank of Georgiana Slough, beginning at levee mile (LM) 0.0 at Walnut Grove-Thornton Road and terminating approximately 0.70 miles downstream at LM 0.70 (Figure 5-12). As discussed in the preceding discussions, remediations for this element were developed by DWR based on the assessment performed for NULE Segment 130 as documented in the NULE GAR and as provided in the 2011 RACER for the North NULE study area. With this assessment, a suite of remedial alternatives was identified primarily to address through seepage, underseepage, slope stability, erosion, and freeboard/geometry deficiencies. A preferred alternative was selected to address each hazard or group of hazards through a least coast approach. A summary of the preferred alternatives to address vulnerabilities on the 0.70-mile portion of levee located along the left bank of Georgiana Slough from LM 0.0 to LM 0.70 as depicted in Figure 5-12 is provided in Table 5-5. Additional geotechnical explorations and analysis are recommended to further refine these remediations.

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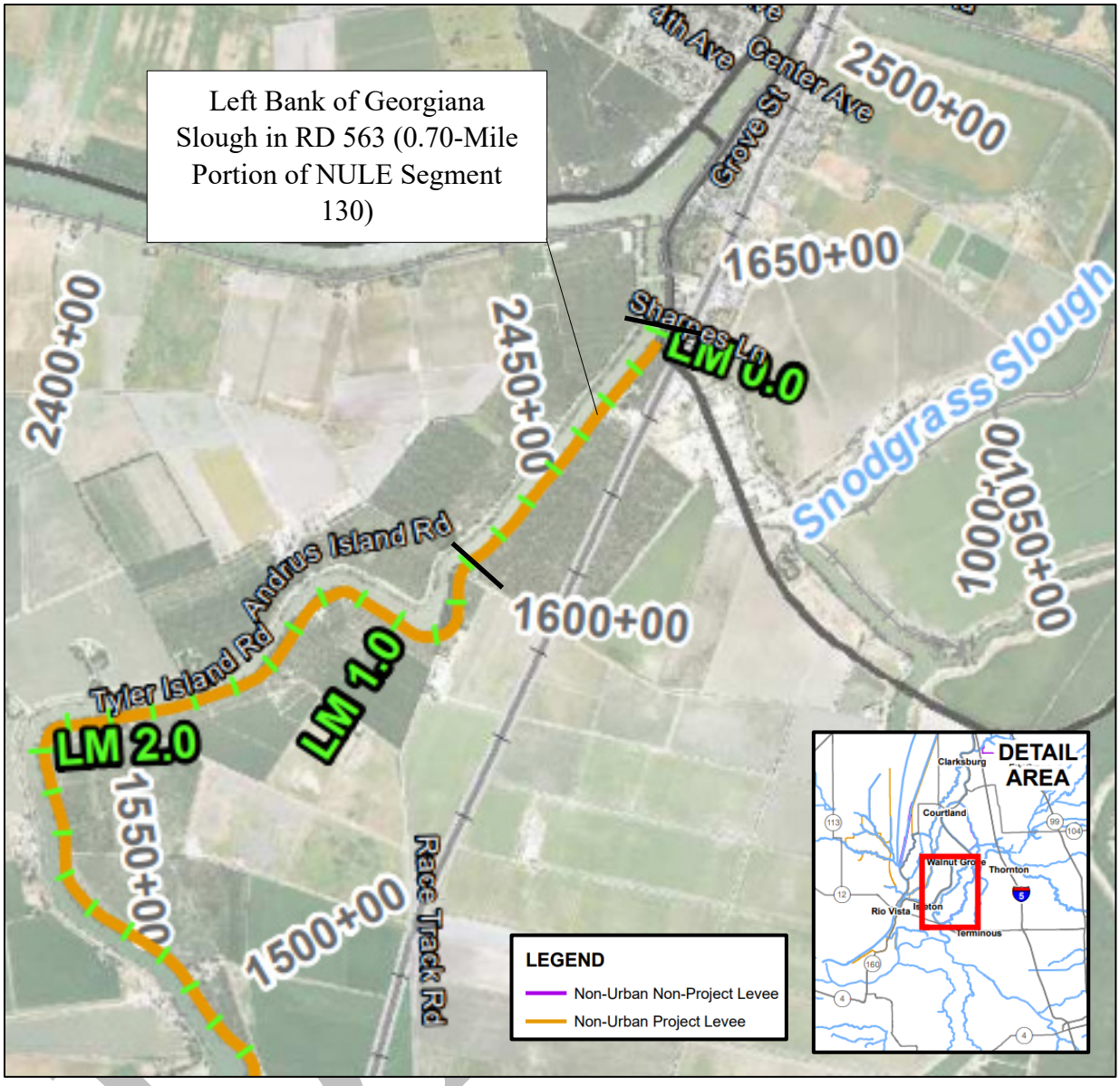

Figure 5-12. 0.70-Mile Portion of Georgiana Slough Left (east) Bank SPFC Levee - NULE Segment 130 in RD 563 (URS, 2011a), updated in 2020 by Sacramento County

Table 5-5. Summary of Remedial Alternatives to Address Levee Vulnerabilities along the Left Bank of Georgiana Slough in RD 563 (URS, 2011b).

Levee Segment Location	NULE Segment	Hazard Remediated	Extent*	Remedial Alternatives
Left Bank Georgiana Slough – RD 563	130 (SPFC Levee Segment)	T + S	40	14-ft.-high levee; 12-ft.-high stability berm
		T + U	30	14-ft.-high levee 75-ft.-wide combo berm
		T + U	20	14-ft.-high levee 70-ft.-wide combo berm
		T	10	14-ft.-high levee 12-ft.-high stability berm
		E	30	14' High Levee
		FG	41	31% freeboard deficiency; 14-ft.-high levee – 2.5 ft. freeboard deficiency (1%); 14-ft.-high levee – 0.5 ft. freeboard deficiency (30%); 14-ft.-high levee – geometry deficiency

Notes: T = Through Seepage, U = Underseepage, S = Slope Stability, E = Erosion, FG = Freeboard and/or Geometry

* Extent is percentage of total segment length

5.1.2.4 Cross Levee in RD 563 Previously Identified by DWR, paired with Repair and Strengthen-in-Place of: (1) 3,700 ft. of Georgiana Slough Right Bank SPFC Levee, (2) 950 ft. of North Fork of the Mokelumne River Right (west) Bank Non-SPFC Levee, and (3) 2,500 ft. of Snodgrass Slough Right (west) Bank Non-SPFC Levee in RD 563

As previously discussed, levees along the left bank of Georgiana Slough (NULE Segment 130) and along the right bank of the Mokelumne River (NULE Segment 1043) in RD 563 have a high likelihood of either levee failure or the need to flood fight to prevent levee failure primarily as a result of vulnerabilities to underseepage, stability, and erosion as documented by DWR in the NULE GAR. This flood risk reduction element repairs and improves portions of these levee segments, along with a new cross levee, to reduce flood risk to the community of East Walnut Grove and the larger study area within RD 563 (Figure 5-13). The new cross levee would be constructed with a 20-foot minimum crown width, 3H:1V landside and waterside slopes, and levee crest elevation of 13 feet, assuming design WSEL of 10 feet NAVD 88 and 3 feet of freeboard. Levee improvements would be made in RD 563 north of the proposed cross levee along the right bank of Snodgrass Slough between the boundary with RD 554 and the Mokelumne River (portion of NULE Segment 1051 – 0.5 miles), along the right bank of the Mokelumne River from the confluence with Snodgrass Slough to approximately 625 feet downstream of the Walnut Grove-Thornton Road bridge (portion of NULE Segment 1043 – 950 ft.), and along the left bank of Georgiana Slough between LM 0.0 and LM 0.70 (portion of NULE Segment 130 – 0.70 miles). The proposed remediations for these improvements are described above in Sections 5.1.2.1 through 5.1.2.3.

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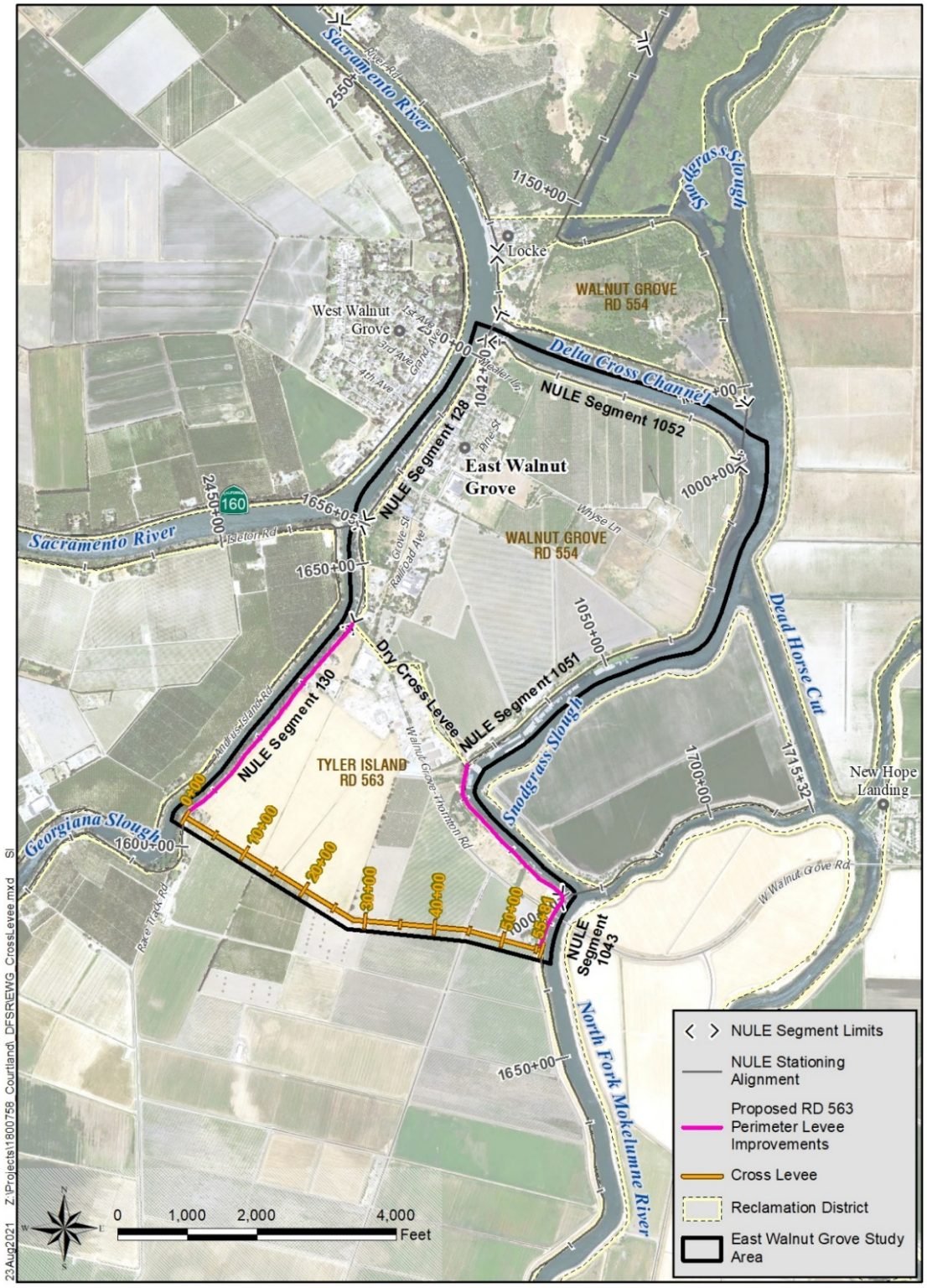

Figure 5-13. Potential Cross Levee in RD 563 and RD 563 Perimeter Levee Improvements Previously Identified by DWR (2012 CVFPP and 2014 RFMP)

5.1.2.5 Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area

This element builds on the previous collection of elements by improving the entire 4.25 miles of SPFC and non-SPFC perimeter levees in the study area including a 0.70-mile portion of SPFC levees along the left bank of Georgiana Slough (portion of NULE Segment 130); the entire 0.9 mile of SPFC levee along the left bank of Georgiana Slough and the Sacramento River (NULE Segment 128); the entire 0.8 mile of non-SPFC levee along the right bank of the DCC (NULE Segment 1052); the entire 1.7 miles of non-SPFC levee along the right bank of Snodgrass Slough (NULE Segment 1051) and; a 950-foot. portion of non-SPFC levee along the right bank of the Mokelumne River from the confluence with Snodgrass Slough to approximately 625 feet downstream of the Walnut Grove-Thornton Road bridge (NULE Segment 1043). Levee repairs and improvements within RDs 554 and 563 would be performed in accordance with FEMA standards for freeboard, seepage, erosion, and stability and settlement concerns pursuant to 44 CFR §65.10, as described in Section 5.1.2.4. FEMA accreditation requirements are discussed briefly in Section 5.1.1.5.

5.2 Non-Structural Measures

Non-structural measures improve flood system performance and reduce exposure, vulnerability, and consequences of flooding. The suite of non-structural measures can be implemented in most cases with or without modifying the existing levee and flood control system. The full suite of non-structural measures considered in this feasibility study for the community of East Walnut Grove and the adjoining North Delta Legacy Communities within Sacramento County are described in detail in Appendix H and summarized below:

1. Flood Fight Berm or a Ring Levee System
2. Voluntary Elevation of Structures
3. Wet or Dry Floodproofing
4. Acquisition and Relocation
5. Flood Emergency Safety Plans
6. Sacramento County Office of Emergency Services (OES) Decision Support Tool
7. Local Hazard Mitigation Plan and Relief Cuts
8. Alternatives to FEMA's NFIP – Private, Community-Based Flood Insurance
9. NFIP Flood Insurance Enhancements *via* AFOTF
10. Mokelumne River Conveyance Improvements & Staten Island Overflow Area
11. Improve FEMA's CRS Score for Sacramento County/Isleton
12. Land Use Regulations and Limitations
13. Improved Governance Between Neighboring LMAs/RDs

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14. System-Wide Improvement Frameworks (SWIFs) & Period Inspections with USACE
15. Public Education/Public Awareness

The key non-structural measures identified above and within Appendix H that are community-specific to the East Walnut Grove Study Area and warrant further discussions and descriptions are described in more detail below. All of the above non-structural measures identified above were presented to the East Walnut Grove Study Area planning committee with most measures were deemed acceptable, as summarized in 7.3, Appendix H also provides a description of why some measures may be more applicable to neighboring Delta Legacy Communities or why they may not be applicable to each specific Delta Legacy Community.

5.2.1 All-Weather Access Road/Flood Fight Berm in RD 563 and Road Widening along Walnut Grove-Thornton Road

This measure includes construction of an all-weather access road and flood fight berm to reduce flood risk within the community of East Walnut Grove within RD 563 (Figure 5-14). Similar to a ring levee, an all-weather access road and flood fight berm would encircle the industrialized portion of the existing community of East Walnut Grove within RD 563 and isolate the community from potential flood waters that could occur due to levee breaches occurring anywhere outside of the immediate community study area but within the larger, downstream agricultural basin within RD 563. An all-weather access road and flood fight berm is essentially a slightly elevated all-weather roadway to accommodate the temporary placement of interlocking Muscle Wall during flood fight conditions in RD 563. The noted access road would accommodate the temporary flood fight installation of a 4- to 8-foot-high Muscle Wall. The access road/flood fight berm would follow the alignment depicted in Figure 5-14, with an 8- to 20-foot-wide crown width, 3H:1V landside and waterside slopes, and maximum likely road crown elevation of 6 feet, to accommodate a potential levee breach in the lower reaches of Tyler Island (as occurred in 1986) that may result in a maximum flood WSEL of 10 feet NAVD 88 (inclusive of adjustments for sea level rise). The flood fight Muscle Wall (similar to a plastic Jersey barrier containing a 4- to 8-ft. minimum wide base) would be stored nearby within the Delta by either the community, the local RDs, the county, and/or by DWR and could be transported, handled, and assembled expeditiously to fend off rising flood waters that may occur in the larger, downstream agricultural basin of RD 563. A storage site for the Muscle Wall and other flood-fight materials in the North Delta has been established by Sacramento County OES and others near Walnut Grove Elementary School and the Fire Station in Walnut Grove East (within RD 544).

In lieu of just raising the west shoulder of the Walnut Grove – Thornton Road where the flood fight berm alignment is adjacent to and parallel to the subject roadway, it may be advantageous to raise the entire underlying roadway bed and it shoulders (*see* Figure 5-15 and Figure 5-16 below). By raising the roadway and its adjoining shoulders the entire segment of the Walnut Grove-Thornton Road (when paired with the all-weather access road segment west of the noted roadway) could be elevated out of potential flood waters originating in the lower, downstream

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portion of Tyler Island as occurred in 1986. With Walnut Grove-Thornton County Road elevated at this location, the road in its entirety within RD 563 could remain as a flood evacuation route between the north Delta Legacy Communities and Interstate 5 located to the east as previously identified by DWR and Sacramento County.

See Appendix L and Appendix M for feasibility-level design drawings and cross sections for the proposed access road and road raising.

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Figure 5-14. Proposed Alignment for the All-Weather Access Road/Flood Fight Berm in RD 563 (Kjeldsen et. al., 2020a)

Figure 5-15. Plan View of Proposed Road Widening along Walnut Grove-Thornton Road in RD 563 (Kjeldsen et. al., 2020b)

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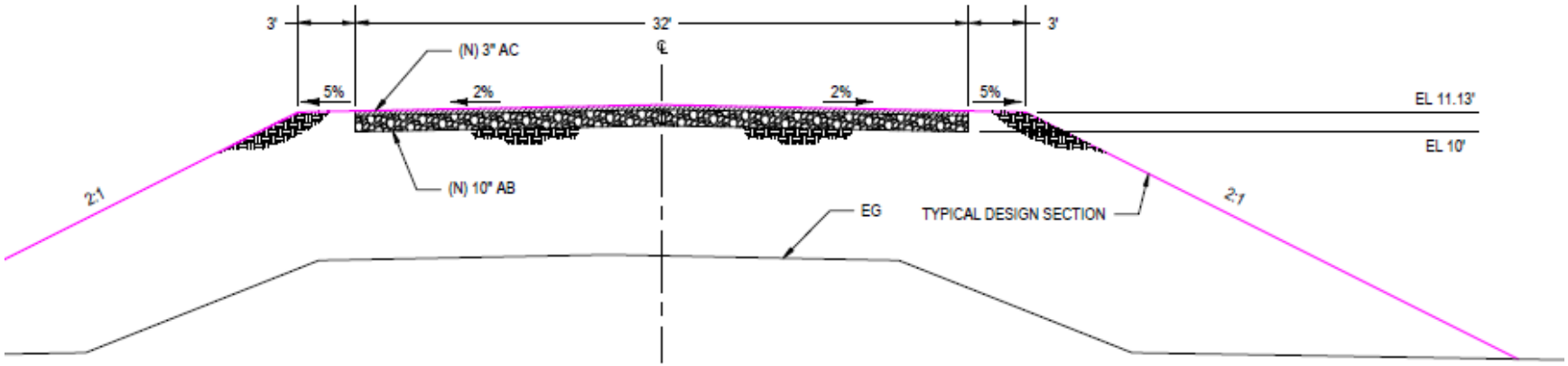

Figure 5-16. Typical Raised Road Section along Walnut Grove-Thornton Road in RD 563 (Kjeldsen, Sinnock, and Neudeck, 2020b)

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5.2.2 Voluntary Elevation of Structures

The voluntary structural elevation program collectively administered by FEMA and Sacramento County (and possibly others) is a flood risk reduction measure that involves physically raising existing structures to an elevation 1.5 feet or greater above the FEMA BFE resulting from natural overland flows and/or a levee breach. For the East Walnut Grove study area, the BFE is presently set at 9 feet NAVD 88. This is a common and effective way to minimize damage from flooding and is a key flood protection provision of the NFIP; however, three historic districts are located along the left bank of the Sacramento River in the community of East Walnut Grove as previously depicted in Figure 2-10. Elevating structures within these districts is not recommended due to their historic nature, however the elevation of structures outside of these historic districts may be considered.

Hydraulics and hydrologic modeling of the Lower Sacramento River system indicates that the structures in the study area would require raising between 5 and 10 feet to be elevated to or above the maximum floodplain. Elevations of this height may require additional seismic (and other practical) considerations to ensure stability and continued utility of the structures in question.

Below is a summary table (excerpted from Appendix H) that indicates the number and types of structures located within the community of East Walnut Grove (SAC 52), and within the greater East Walnut Grove Study Area within RDS 554 and 563 (SAC 53 - Urban). The table also indicates the likely minimum cost of raising each of the noted structures, acknowledging that commercial and industrial structures will undoubtedly be more than the current estimate of $170,000/ea. to raise residential structures.

Table 5-6.Total Count and Cost to Elevate Structures in East Walnut Grove Study Area

Community and Study Area	CVFPP Impact Area	Total Structure Count and Cost to Elevate @ $170,000 min./Structure				
		Residential	Commercial	Industrial	Public	Total
East Walnut Grove RD 554 portion	SAC 52	141	45	21	15	222
		$23,970,000	$7,650,000	$3,570,000	$2,550,000	$37,740,000
East Walnut Grove RD 563 portion	SAC 53-Urban	5	0	22	0	27
		$850,000	$0	$3,740,000	$0	$4,590,000
Total East Walnut Grove Study Area	SAC 52 & SAC 53-Urban	146	45	43	15	249
Total		**$24,820,000**	**$7,650,000**	**$7,310,000**	**$2,550,000**	**$42,330,000**

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5.2.3 Wet or Dry Floodproofing

Damages to structures behind levees can be greatly reduced through effective floodproofing. Floodproofing can be cost effective for most structures where maximum depths of potential flooding are not expected to exceed 5 feet However, agricultural-related structures have been known to be flood-proofed for flood depths far exceeding 5 feet If the flood depth at a site is above the practical height limits of available floodproofing barriers, an alternate mitigation method, such as raising of structures should be considered.

Though the current BFE in the East Walnut Grove study area is 9 feet NAVD 88, wet or dry floodproofing could be implemented for select structures in the study area where maximum potential flood depths are not expected to exceed 5 feet

5.2.4 Acquisitions or Relocations

This flood risk reduction element involves acquiring land or relocating dwelling units, businesses, or agricultural structures to reduce flood risk. This element is included for comparison purposes, but it is not a preferred action for the subject Delta Legacy Community of East Walnut Grove due to relocations of homes and businesses being disruptive to residents and the overall community. DWR and others have suggested select communities subject to either deep or repetitive flooding should consider relocation to higher ground that is not subject to flooding.

Relocating entire communities within the Delta, particularly Delta Legacy Communities, is inconsistent with the goals and objectives of both the Delta Plan and the Sacramento-San Joaquin Delta National Heritage Area designation.

5.2.5 Improved Emergency Response – Flood Emergency Safety Plans and County OES Decision Support Tool

Flood ESPs are one tool aimed at improving emergency response within Sacramento County. Public information, posted at the county's webpage, includes the following for individual RD ESPs: a Delta Area Flood Map; flood depth maps; how long it will take to flood the individual RDs; evacuation routes, and time tables indicating the duration of time in hours, days, weeks, or months to pump-out and entirely drain the individual RDs, depending upon the rate of pumping capacity.

The Flood Operation Decision Support System (FODSS) tool is another effort aimed at improving emergency response within Sacramento County. Funded by DWR and sponsored by the county of Sacramento, Governor's OES, the FODSS tool aims to improve emergency response, emergency management and coordination during high water and flood emergencies within the county.

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5.2.6 Local Hazard Mitigation Plan and Relief Cuts

The Sacramento County Local Hazard Mitigation Plan (LHMP) is a multi-jurisdictional plan that geographically covers the entire area within Sacramento County's jurisdictional boundaries (planning area), including RDs 554 and 563. The LHMP identifies hazards within Sacramento County, including those from floods and levee failure, assesses the vulnerability of the planning area to these hazards, and identifies mitigations to reduce or eliminate long-term risk to life loss and property damage from these hazards. The county of Sacramento developed the initial LHMP in 2005 and was last updated in 2016. The Sacramento County LHMP is updated every 5 years and is currently scheduled for a new update in 2021 that will likely include a greater discussion regarding potential relief cuts in RDs 554 and 563.

As a mitigation measure which can be used to reduce risk to life loss and property damage as a result of flooding or levee failure, potential locations of relief cuts could be formalized within the LHMP. The levee systems protecting the East Walnut Grove study area in RDs 554 and 563 act somewhat as separate bowls with the water filling up to the top of the lowest downstream levee, typically at the lowest elevations within RD 563. However, a carefully planned relief cut excavated into the levee at the lower downstream end along the RD 554 dry cross levee adjoining RD 563 would allow the water to escape or drain out of RD 554 before filling up the entire basin. For example, if there is 3 feet of freeboard at the lower downstream end of the RD, the relief cut could potentially reduce flood depths by as much as 3 feet over the entirety of the RD, while waiting for the lower, downstream levee reach to overtop. The RD personnel will determine if a relief cut will be necessary should flooding occur; however, in most cases there is no written description nor agreement for a planned relief cut. Potential relief cut locations should be identified and further evaluated while updating the LHMPs which address both RD 554 and RD 563.

5.2.7 Alternatives to NFIP – Community- and Flood-Risk Based Insurance Programs

The NFIP is managed by FEMA through its subcomponent, known as the Federal Insurance and Mitigation Administration. It is currently the only federally-backed flood insurance program, so the introduction of alternative flood insuring options for homeowners (such as private community-based flood insurance) carries the advantage of offering potentially more favorable terms to residents within any of the noted Delta Legacy Communities of Sacramento County, including the city of Isleton.

A review of FEMA's current and planned mapping procedures, insurance, requirements, insurance rates, and policies indicates that agricultural facilities in leveed areas of the

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Potential Benefits of a Community-Based Flood Insurance Program

- Potential source for project finance to reduce risk to community and assets
- Improved understanding of underlying risks and resilience opportunities
- Communities could renegotiate contracts every 5- to 7-years and decide how much risk to retain and how much to transfer
- Project financing would not be accounted for as debt on the community's balance sheet, providing added flexibility to the community
- Insurance could cover additional items such as funding for continuity of services, community equipment, and other items that are currently self-insured

Sacramento Valley, including East Walnut Grove, have been bearing a disproportionately large share of the financial burden of the NFIP. Private sector involvement in the flood insurance industry could protect this area's flood insurance premiums by matching rates to risk through an emerging market for private community-based flood insurance policies.

As NFIP premiums continue to increase for residents in East Walnut Grove, private insurers are entering the market. They are taking advantage of better flood mapping, modeling, the accessibility of increasingly high-resolution national data sets, innovations in statistical analysis, and sophisticated global financial markets to fill the affordability gap. In 2019, over 10,000 private insurance policies were written in California (Wholesale & Specialty Insurance Association, 2019).

Private insurers use their own models to establish the price of a policy. For example, the nonprofit First Street Foundation recently released a nationwide flood model accessible from any mobile device similar to many used by private insurers. It is an easily understood, easily accessible nationwide tool for presenting flood risk information. By visiting FloodFactor.com a resident in East Walnut Grove can easily get a general picture of their flood risk. Flood risk is specified by assigning a risk score from 1 to 10. The score is based on cumulative likelihood of flooding at different flood depths based on riverine analyses which indicate flood depths can exceed 10 feet in certain North Delta Communities.

Flood risk information obtained from sites like FloodFactor.com will be different than flood information produced by DWR or FEMA because the methods to assess risk are different.

An alternative to individual homeowner policies is a community-based flood insurance program. A community-based flood insurance program would have the opportunity to lower flood insurance costs by working with an insurer to provide better risk information and by actively implementing agreed upon mitigation measures. A community might choose to: (1) sell their risk to an insurer; (2) finance the risk through capital markets; or (3) implement a combination of risk financing mechanisms. By actively managing the flood risk, the community flood risk program would provide the opportunity to both reduce flood insurance premiums and finance levee improvements and/or implement non-structural measures identified herein Sections 5.2 and 7.3.

One way that a community might choose to implement a community-based flood insurance program is through the establishment of a Geologic Hazard Abatement District (GHAD). A

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GHAD is a State-level public agency for the purpose of providing prevention, rapid response, and funding to address hazardous geologic conditions. They were established in 1979 by the Beverly Act to allow local residents to develop self-funding mechanisms that address the long-term abatement and maintenance of structures that protect real property from geologic hazards.

The city of Isleton has already taken the initial steps in June-July of 2021 to formalize a path for property owners within its city limits to aggregate their resources and establish a community-based flood insurance program that can be used to augment and/or replace the current set of NFIP policies held within the city of Isleton. Sacramento County is also encouraging the unincorporated North Delta Legacy of East Walnut Grove to consider alternatives to the current NFIP, including a community-based flood insurance program that could be administered with or without developing a GHAD. A similar community-based flood insurance program is being considered for the San Francisquito Creek Joint Powers Authority, located in the south Bay Area (*see* Appendix J prepared by Kathleen Schaefer, P.E., CFM, former FEMA regional administrator of NFIP).

5.2.8 NFIP Flood Insurance Enhancements via AFOTF

The AFOTF via its Technical Memorandum of December 28, 2016, has recommended as many as seven administrative refinements of the NFIP to sustain agriculture as a wise use of the floodplain in leveed SFHAs. The NFIP administrative refinements (and amendments proposed by H.R. 830) are focused on improving agricultural sustainability while collectively reducing flood risks. The recommendations address how rules and practices could be modified to: (1) reduce or remove elevation and floodproofing requirements for new and substantially improved agricultural structures, and (2) reduce the cost of flood insurance for agricultural structures with a federally backed mortgage to a more appropriate risk-based portion of the financial risk in the NFIP. The key elements include the following, of which most are applicable to the East Walnut Grove study area:

a) Levee relief cuts with emergency operation plans and floodplain management ordinance
b) Zone X for certified levee reaches: the partial accreditation of a basin or levee reach could potentially lead to lower NFIP insurance rates as portions of levee systems are approved
c) Wet floodproofing rules for agricultural structures
d) Insurance rates for nonaccredited levees: the AFOTF recommends that FEMA use sound actuarial science to amend its insurance rates to reflect flood protection provided by a non-accredited levee as documented by a civil engineer
e) Insurance rates for agricultural structures
f) Insurance rates for wet floodproofed structures
g) Add levee risk management activities to FEMA CRS

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5.2.9 Mokelumne River Conveyance Improvements/Flood Easements

In October 2010, a Final Environmental Impact Report (EIR) was published by DWR for the North Delta Flood Control and Ecosystem Restoration Project. The purpose of this project was to implement flood control improvements in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes. Specifically, improvements were sought which were expected to reduce damage to land uses, infrastructure, and the Bay-Delta ecosystem resulting from overflows caused by insufficient channel capacities and catastrophic levee failures in the North Delta study area. One option analyzed and presented in this EIR included dredging components of the channel along the North and South Forks of the Mokelumne River. Dredging is expected to directly reduce flood stages in the Mokelumne River and Snodgrass Slough providing a flood risk reduction benefit to the adjoining nearby communities, including East Walnut Grove. Another option yielding similar results involves raising levee segments along these reaches. The implementation of these screened alternatives has the potential to directly reduce flood risk for the East Walnut Grove study area which is impacted by high water stages in the Snodgrass Slough.

Another option specific to this area which could reduce flood risks to the study area involves allowing flood stages along the North and South Forks of the Mokelumne River to overtop into Staten Island, or portions thereof, and serve as a flood relief overflow area. This option's feasibility stems largely from the fact that this area is sparsely populated, and its use for a flood easement would allow for significant lowering of water stages in the North Delta Region adjoining and upstream of the North and South Forks of the Mokelumne River.

In addition to the 2010 Final EIR published by DWR for the North Delta Flood Control and Ecosystem Restoration Project there have been a series of other documents developed by DWR and the CALFED Bay Delta Program to reduce flood risks and improve water conveyance through the North Delta following the flooding of the RD 563 portion of East Walnut Grove and Thornton within the New Hope Tract during February of 1986. These documents are described in more detail as Item 10 of Appendix H. The documents suggest improving channel capacity in the Mokelumne River on either side of Staten Island and/or securing flood easements on Staten Island to accept excess flood waters would significantly reduce flood stages upstream in Snodgrass Sough for the nearby communities of East Walnut Grove, Locke and possibly as far upstream as Courtland and Hood.

5.2.10 Improve FEMA Community Rating System Score for Sacramento County

Sacramento County, via its floodplain administrator program, is a very active participant of the NFIP, and through its county-wide Flood Protection Ordinance the county strives to reduce flood risks throughout the unincorporated areas of Sacramento County while also attempting to reduce NFIP premium policy rates. Through different flood mitigation activities outlined within the NFIP, Sacramento County has been able to reduce flood insurance through the FEMA CRS.

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Since 1992, Sacramento County has steadily improved its CRS score and as of May 2017, Sacramento County has maintained a Class 2 designation, which has yielded a 40 percent reduction of NFIP insurance premiums for SFHAs (an average reduction of $547 in annual NFIP premiums), within Sacramento County, inclusive of the entire East Walnut Grove study area. The county currently has the opportunity to improve their CRS score to achieve the highest possible Class 1 designation by implementing and participating in Emergency Action Plans and associated Table Top Exercises for nearby, upstream dams/reservoirs (namely Folsom Reservoir, and possibly others) that could have a sizeable impact on flooding portions of Sacramento County if said reservoir(s) were to fail and cause flooding. This last jump from a CRS Class 2 to Class l designation would result in the last available 5 percent decrease in NFIP premiums and would place Sacramento County as the 2nd highest ranked CRS community in the entire United States behind Placer County.

5.2.11 Improved Governance between Neighboring LMAs and RDs and Community

The RDs in the North Delta are protected by a system of leveed channels, multipurpose reservoirs, and other structures that now comprise the SRFCP. The goal of the SRFCP is to reduce the chance of flooding for the communities in Sacramento County. Under the Standardized Emergency Management System (SEMS), Sacramento County establishes an Operational Area (OA). Traditionally, LMAs have not been included in planning or exercises. LMAs have relied mainly on DWR as their primary flood fight trainer, resources provider, and the next link in the SEMS chain of command rather than the local OA management structure. The Sacramento County Delta Flood ESP, written in June 2017, is an effort to improve communication between Sacramento County and the Delta LMAs by providing a better understanding of the river system, providing rescue and evacuation mapping, laying out the flood emergency response process, formulating detailed hazard information for LMAs, and providing flood response trainings.

Due to assessment limitations imposed by the California Water Code, RDs 554 and 563 and other similar RDs are traditionally limited to assessing properties within their district(s) by acreage and not by property improvements. However, RD 563 is one of the few District in the Delta that has successfully passed a 218 benefit assessment to assess structures beyond the conventional agricultural, acreage-based assessments. Thus, it may be advantageous for the RDs to work closer together in potentially developing an improved assessment and or GHAD for implementing flood risk reduction measures specific to the community. Framework exists for community-specific assessments similar to the county assessments that are in place for regional sanitation services, water supply and storm drainage services that are provided by Sacramento County and/or others beyond those provided by RDs 554 and 563. RD 563 has had experience with

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5.2.12 Public Education and Awareness

There are currently three programs within the Delta that provide public education, awareness, and notifications about flood risk. One is the Delta Flood Preparedness Week hosted annually by the DPC. As part of this effort the DPC provides calendars that consolidate important flood-related information specific to the Delta including emergency phone numbers and websites with flood education as well as safety information.

A second is the Sacramento County Program for Public Information that aims to increase awareness through informational materials (such as the Storm Ready Booklets) and multiple levels of outreach, ranging from radio spots to specific stakeholder engagement. This program can act as a conduit of flood risk information and coordination directly with the community members of East Walnut Grove.

The third program is the California DWR Flood Risk Notification Program that includes sending annual notices in advance of the flood season to every property owner who is located behind a SPFC levee within the Delta. The individual notices include the property owner's address and informs the owners their property may be exposed to potential flood risk from the failure of the levee system. The notice also suggests each property owner visit DWR's Flood Risk Notification and enter their address to get the most information on State-federal levees in their area.[1]

5.3 Multi-Objective Components

There are several opportunities for including multi-objective components during construction of structural elements and implementation of select non-structural measures. Multi-objective options could offer benefits outside of the East Walnut Grove Legacy Community study area boundaries to other regions in the Delta and possibly south of the Delta.

5.3.1 Water Quality and Water Supply, including Through-Delta Conveyance Reliability and Operational Flexibility

With or without the DCA intake and associated tunnel improvements as presently proposed in 2020, through-Delta conveyance will continue to rely on the freshwater corridor established upstream, within, and directly downstream of the DCC. Presently there are 37 miles of non-urban SPFC levees upstream and 25 miles downstream of the DCC in the North Delta that help convey water through the Delta (a total of 62 miles of SPFC levees comprise significant portions of the Delta's freshwater corridor – *refer to* Figure 3-3). Improving 1.6 miles of SPFC levees in the study area to current, modern levee standards consistent with FEMA's 100-year accreditation standards would constitute improving 2.5 percent of the total non-urban SPFC levees in the Delta's freshwater conveyance corridor. Improving the non-SPFC levee segments adjoining the DCC and along Snodgrass Slough immediately downstream of the DCC will also improve the

[1] http://water.ca.gov/myfloodrisk

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reliability and resiliency of the through-Delta water conveyance system, with or without the DCA intakes and associated tunnel improvements proposed in 2020.

5.3.2 Ecosystem Restoration/Enhancement

Ecosystem restoration opportunities must be balanced with flood management requirements and in support of continued agricultural land uses in the Delta. Restoration opportunities adjacent to East Walnut Grove include: 1) rehabilitation of the community's defunct sewage ponds, which could support seasonal wetland or managed freshwater marsh, 2) enhancing the combination of wildlife habitat and recreation opportunities within the Delta Meadows State Park adjacent to the communities of Locke and East Walnut Grove, and 3) in concert with erosion repairs with rock slope protection or other means, potential opportunities may exist for enhancements to the SRA along the left bank levee of the Sacramento River. This later opportunity for SRA habitat enhancement of the Sacramento River could be a potential extension and offer greater connectivity to the SRA opportunities outlined in the Lower Sacramento-North Delta RFMP of 2014 between Sacramento RM 35 and RM 46 within MA9 between Freeport and Courtland. *See* Appendix D for a detailed discussion of ecosystem opportunities.

Another opportunity may exist the potential expansion, widening of Snodgrass Slough to create greater connectivity with the ongoing restoration efforts across Snodgrass Slough on McCormick Williamson Tract, upstream of and near Deadhorse Slough.

5.3.3 Public Recreation and Education Multi-Benefit Opportunities

The Delta Legacy Communities and encompassing study areas provide a unique mix of modern working agricultural lands, wildlife habitat and viewing opportunities, pastoral landscapes, and a glimpse into history. This provides an opportunity to encourage public education and recreation opportunities for community residents and visitors from outside the Delta and to provide economic stimulus from Delta-centric tourism.

Cross Levee/Flood Fight Berm Trail Options

The dry cross levee along the Old Walnut Grove-Thornton Road could be potentially modified slightly to act as a short loop community trail for walking or biking and possibly connecting this levee segment with the Snodgrass Slough levee segments stretching between the North Fork of the Mokelumne River to the DCC south levee located between East Walnut Grove and Locke. The proposed flood fight berm on the south side of EWG, southwest and parallel to Walnut Grove-Thornton Road within RD 563, could also be modified to accommodate a trail and create a much longer loop trail. Either berm/levee trail could include restricted access for portions of the alignment adjacent to private property. Either of these loops could connect to the Snodgrass Slough levee or through Walnut Grove to the levees along the Sacramento River or Georgiana Slough, creating a myriad of options for a community trail network.

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Due to the presence of an all-weather surface along the majority of the study area's perimeter levees if the maintenance easement for the RD could be modified to allow public access, an even longer loop trail around the entire study area could be facilitated during levee improvements. No riparian enhancements are planned along the northeast portion of the study area, along Snodgrass Slough near the Walnut Grove Marina, and there is little existing habitat along this reach, facilitating easier levee enhancements to support a trail.

Parking for visitors could be developed by widening the shoulders along the Old Walnut Grove-Thornton or working with the owners of the Walnut Grove Marina or in tandem with the planned flood-fight supply stockpile to be located behind Walnut Grove Elementary School, on county-owned property. Parking in this area would be beneficial to pedestrians and cyclists, since users would be able to connect to additional loop trails near the Delta Meadows State Recreation Area just south of the adjoining community of Locke.

Historic District Access

There are two remarkably well-preserved, nationally designated historic districts within East Walnut Grove, one each for Chinese- and Japanese-Americans. By the early 1900s, Walnut Grove supported the largest Chinatown in the Delta and was a center of culture and commerce including dry goods and grocery stores, restaurants, laundries, shoe stores, fish and meat markets, saloons, gambling halls, boarding houses, herbal shops, temples, and baths. Walnut Grove's Bing Kong Tong Society was established to manage labor relationships, regulate gambling, and provide mail and bank services. It also sent the bones of the deceased back to China for burial and helped Chinese immigrants return to their native land. After several fires, most Chinese relocated to Locke in the early 1900s. After the Chinese Exclusion Act was passed in 1886, Japanese immigration increased to the West Coast. By 1905, Japanese farmers were working 80% of the land around Walnut Grove and had begun settling in the northern portion of Walnut Grove's existing Chinatown. The Japanese American community in Walnut Grove thrived throughout the 1930s and into the early 1940s but most moved away after World War II. Most of the town's original buildings are still standing and there are also many businesses operating in East Walnut Grove's historic buildings and interpretive signage could be included with any trail creation or improvements to share this history with visitors.

Regional Connection Trail

Improvements to perimeter levees around the study area could include installation of an all-weather surface (or improvements to existing surfaces) along the existing crown road, parking, and signage. A trail leading around the perimeter of the study area could be usable for local residents and out-of-Delta visitors. This trail could connect with smaller loop trails described above, to direct visitors into the heart of East Walnut Grove, Locke, Delta Meadows State Recreation Area and potentially to the Walnut Grove Marina, and as far south as Giusti's at the downstream terminus of Snodgrass Slough at its confluence with the North Fork of the Mokelumne River.

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Improvements to the old Sacramento Southern Railroad – Walnut Grove Branch right-of-way through East Walnut Grove could connect visitors with the town park and, if the existing railroad bridge over the DCC could be opened to the public, which would create a direct connection between the historic districts of East Walnut Grove and Locke without requiring visitors to walk or ride along the heavily trafficked River Road. Additionally, with the installation of a foot/bike bridge or small ferry at the location of the now defunct railroad turnstile bridge across Snodgrass Slough in the Delta Meadows State Recreation Area, hikers or cyclists could potentially travel from East Walnut Grove, over the DCC. North of the DCC trial users could travel north along the improved railroad embankment levee adjacent to Locke, and then connect to other Delta Legacy Communities, to the adjacent Delta Meadows State Park (with facility improvements in partnership with State Parks), north to Stone Lakes National Wildlife Refuge, and further north to Freeport and Old Sacramento.

These concepts must be balanced with maintaining the quality of life for residents and agricultural practices of the greater East Walnut Grove community and require further refinement and discussion with landowners, stakeholders, including the Walnut Grove Town Association and Planning Committee and Sacramento County. However, East Walnut Grove has much to share with visitors, as detailed on the Story Map for the community, accessible here: East Walnut Grove Story Map - Sacramento County Small Communities Flood Risk Reduction Program.[2]

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[2] https://sacramentocounty.maps.arcgis.com/apps/MapJournal/index.html?appid=3e6a7a1f41184e4f8d1445fc9d90b69e

6. Identification and Trade-Off Analysis of Flood Risk Reduction Management Actions

This Section uses the structural elements and non-structural measures previously described above in Section 5 to develop and prioritize management actions based on risk reduction and responsiveness to planning objectives, as well as constraints regarding funding, implementation, and capital costs. These management actions are recommended to be implemented in a successive fashion as funding is collectively identified and secured. This Section also provides the capital costs associated with each Management Action (MA), as well as a trade-off analysis using the planning objectives identified above in Section 4.1.

The structural elements and non-structural measures identified in the Preliminary Suite of Flood Risk Reduction Elements (Section 5) were prioritized into 12 management actions based on the most efficient approaches to reducing risk and achieving the previously identified objectives of:

- Reducing risk to life
- Reducing risk to property damage
- Reducing probability of levee failure
- Limitation of high insurance premiums
- Improved preparedness and response
- Enhancing resiliency and reliability of through-Delta water conveyance
- Prioritizing environmental stewardship and multi-benefit projects

As previously discussed, risk reduction is defined as the product of the probability of levee failure and the consequences of failure. The consequences of levee failure are defined in this study in terms of life loss and property damage. Of the 12 management actions, those which resulted in the greatest risk reduction by reducing the probability of levee failure of the weakest levee segments and reducing the consequences of levee failure through reduced life loss and property damage were given priority. However, funding, implementation, and capital cost were also considered during the prioritization process.

6.1 Identification of Flood Risk Reduction Management Actions

The 12 structural-based management actions are summarized below. These management actions are compared against the no action, future without project condition to quantify how well each management action addresses the objectives of this study using the planning objectives identified above in Section 4.1.

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6.1.1 No Action, Future Without Project

Future without project conditions represent the current level of flood protection within the study area, does not incorporate any structural or non-structural flood risk reduction elements, and incorporates expected changes to the study area from climate change, sea level rise, and future land uses. These conditions do not include any flood management improvements that have been authorized and have funding, or that have started construction or implementation.

Without any changes to the flood management system or implementation of non-structural measures:

- The study area remains at a high risk of flooding. As previously discussed, according to ongoing EAD analyses and previous studies conducted by DWR it is estimated that the community of East Walnut Grove within RD 554 may have less than a 50-year level of flood protection. The **industrial portion of** RD 563, under the current EAD analysis is also estimated to have less than a 50-year level of flood protection due to potential deficiencies in the larger, downstream levee system within RD 563.
- There is a high risk of life loss for the densely populated portion of the East Walnut Grove study area inclusive of, but not limited to its three historic districts, namely the Chinese American, Japanese American and the commercial/residential districts identified above, in Figure 2-10. In the event of a levee failure along the left bank of the Sacramento River or Georgiana Slough fronting the community, significant life loss is likely as a result of high floodwater depths and velocities which would leave little time to evacuate.
- There is also a high risk of property damage for the community of East Walnut Grove within both RDs (554 and 563). A levee breach along the left bank of the Sacramento River and/or Georgiana Slough adjoining or downstream from the community of East Walnut Grove could result in flood depths in the community upwards of 10 feet These flood depths could result in damages to the community on the order of $141.5M when accounting for the value of structures and their contents, highways and streets, agricultural crops, and vehicles (excluding agricultural equipment). With the current level of flood protection noted above this equates to an EAD for East Walnut Grove (combined SAC 52 and SAC 53 – Urban impact areas) of $7.5M under existing conditions and nearly $35.5M under future conditions with the effects of inland climate change and sea level rise.
- The community and the larger study areas within RDs 554 and 563 remain susceptible to high NFIP annual premium increases, which could result in a net reduction of insured homes and agricultural businesses, further increasing flood risk.
- Levees within the Delta remain at risk of failure, which could significantly impact the agricultural economy within and adjacent to the community of East Walnut Grove and the conveyance of water to SWP and CVP water contractors south of the Delta.

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6.1.2 Management Action 1: Repair and Strengthen-in-Place Sacramento River and Georgiana Slough SPFC Left Bank Levees in RD 554 (NULE Segment 128)

As previously discussed, the risk of life loss is of greatest concern within the densely populated community of East Walnut Grove since a levee breach along the Sacramento River east (left) bank levee directly adjacent to the community could likely result in high floodwater depths and velocities, leaving little time to evacuate. A levee breach along the community of East Walnut Grove could result in significant property damage in the community and in RDs 554 and 563 as a result of deep flooding. As a result, repairing and strengthening the levee along the left bank of the Sacramento River and Georgiana Slough fronting the community of East Walnut Grove was selected as the most efficient, and no regrets means of reducing flood risk in the community of East Walnut Grove. The proposed remediations for MA 1 are provided in 5.1.1.1.

6.1.3 Management Action 2: Repair and Strengthen-in-Place Snodgrass Slough Right Bank Non-SPFC Levee (NULE Segment 1051) in RD 554

A levee breach along the right bank of Snodgrass Slough in RD 554 has the potential to result in significant property damage in both RD 554, inclusive of the community of East Walnut Grove, and RD 563. Considering capital cost, implementation, and funding, repairing and strengthening the right bank of Snodgrass Slough (NULE Segment 1051) in RD 554 was prioritized as MA 2. The proposed remediations for MA 1 are provided in 5.1.1.2, and are subject to change with additional geotechnical data and analyses recommended prior to implementing any of the currently identified remediation measures.

6.1.4 Management Action 3: Repair and Strengthen-in-Place Delta Cross Channel Right Bank Non-SPFC Levee (NULE Segment 1052) in RD 554

A levee breach along the right bank of the DCC in RD 554 also has the potential to result in significant property damage in East Walnut Grove and the larger study area inclusive of RDs 554 and 563. Considering capital cost, implementation, and funding, repairing and strengthening the right bank of the DCC (NULE Segment 1052) in RD 554 was prioritized as MA 3. The proposed remediations for MA 1 are provided in Section 5.1.1.3, and are subject to change with additional geotechnical data and analyses recommended prior to implementing any of the currently identified remediation measures.

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6.1.5 Management Action 4: Repair and Strengthen-in-Place Non-SPFC Dry Cross Levee Adjoining RD 563 along Old Walnut Grove-Thornton Road in RD 554

Improving the 2,800-foot-long or approximate 0.54-mile segment of the RD 554 dry cross levee common with RD 563 by filling in the landward borrow ditch of the subject levee will further protect RD 554 from future flood events that could occur within RD 563, as last experienced in 1986. Improving the RD 554 south cross levee common with RD 563 is an integral component of securing a 100-year level of FEMA certification for the entire RD 554 perimeter levee system protecting the community of East Walnut Grove within RD 554. Further details for acquiring FEMA certification for the RD 554 portion of East Walnut Grove is outlined below in MA 5. These improvements would help to protect lives and property within both the community of East Walnut Grove and within both RDs, and as a result, would result in a great reduction in flood risk for RD 554 and the community of East Walnut Grove. However, repairing and strengthening this perimeter levee system may be cost-prohibitive without support from through- and south-of-Delta water conveyance interests associated with the CVP and SWP. As a result, this collection of flood risk reduction element was prioritized as MA 4. The proposed remediations for MA 4 are provided in 5.1.1.4, and are subject to change with additional geotechnical data and analyses recommended prior to implementing any of the currently identified remediation measures.

6.1.6 Management Action 5: Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554 South of the Delta Cross Channel

Similar and consistent with MAs 1 through 4, securing FEMA accreditation of the entire 3.45-mile-long perimeter levee system in RD 554 as part of MA 5 would result in a great reduction in flood risk for RD 554 and the community of East Walnut Grove within RD 554, as well as RD 563. However, FEMA certification of the entire perimeter levee system may be cost-prohibitive without support from through- and south-of-Delta water conveyance interests associated with the CVP and SWP. As a result, securing 100-year FEMA certification for the entire perimeter levee system was prioritized as MA 5. FEMA certification would be performed once the perimeter levee system is remediated and improved to FEMA criteria for erosion, through seepage, underseepage, slope stability, and freeboard. All design criteria, O&M requirements, and documentation requirements included in 44 CFR §65.10 would also need to be addressed to secure 100-year FEMA certification for RD 554, inclusive of the community of East Walnut Grove.

These improvements would help to protect lives and property within both the community of East Walnut Grove and within both RDs, and as a result, would result in a great reduction in flood risk for RD 554 and the community of East Walnut Grove. However, repairing and strengthening this perimeter levee system may be cost-prohibitive without support from through- and south-of-Delta water conveyance interests associated with the CVP and SWP. As a result, this collection of flood risk reduction element was prioritized as MA 5. The proposed remediations for the

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respective elements that comprise MA 5 are further described in MAs 1 through 4, in Sections 5.1.1.1 through 5.1.1.5, and are subject to change with additional geotechnical data and analyses recommended prior to implementing any of the currently identified remediation measures.

6.1.7 Management Action 6a: All-Weather Access Road/Flood Fight Berm in RD 563

Construction of an all-weather access road/flood fight berm within RD 563 would not result in reduced probability of levee failure in either RD 554 or 563; however, constructing an all-weather access road/flood fight berm would prevent floodwaters originating downstream within the RD 563 basin from entering the industrial area of the community within RD 563. In addition to preventing floodwaters from entering the community, the access road/flood fight berm would allow additional time for evacuation, thus further reducing life loss and property damage, and ultimately reducing flood risk for the community. An all-weather access road/flood fight berm could also lend multi-benefit opportunities for public recreation and education along the perimeter limits of the community. When considering capital cost, implementation, and funding, constructing an all-weather access road/flood fight berm in RD 563 was selected as MA 6a. The proposed all-weather access road/flood fight berm as part of MA 6a is described in Section 5.2.1.

6.1.8 Management Action 6b: All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut Grove-Thornton Road in RD 563

MA 6b includes all of the components of MA 6a and the addition of road raising/widening along Walnut Grove-Thornton Road. Elevating Walnut Grove-Thornton Road will ensure the road can serve as a flood evacuation route between River Road in Walnut Grove to the west and Interstate 5 to the east. These additional improvements are also described in Section 5.2.1.

6.1.9 Management Action 7: Repair and Strengthen-in-Place Snodgrass Slough Right Bank non-SPFC Levee (portion of NULE Segment 1051 in RD 563) from RD 554 to the North Fork of the Mokelumne River

While levees along the right bank of Snodgrass Slough in RDs 554 and 563 are not currently categorized by DWR due to insufficient data, the segment of levee along the right bank of Snodgrass Slough between the boundary of RD 554 and the North Fork of the Mokelumne River is currently documented as one of the weakest links in the RD 563 levee system largely due to freeboard deficiencies and seepage/stability concerns. Thus, repairing and strengthening this segment of levee could greatly reduce the probability of levee failure that could threaten not only the RD 563 portion of East Walnut Grove, but also to the greater balance of RD 563 – Tyler Island. As a result, and considering capital cost, implementation, and funding, repairing and strengthening the 0.50-mile portion of non-SPFC levee located along the right bank of Snodgrass Slough from the boundary of RD 554 to the confluence with the North Fork of the Mokelumne River was prioritized as MA 7. The proposed remediations for MA 7 are provided in 5.1.2.1.

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6.1.10 Management Action 8: Repair and Strengthen-in-Place Mokelumne River Right Bank Non-SPFC Levee (portion of NULE Segment1043 in RD 563)

As previously discussed, the right bank of the Mokelumne River in RD 563 (NULE Segment 1043) is estimated by DWR to have a high likelihood of failure or the need to flood fight. Repairing and strengthening the 950-foot reach of levee located along the right bank of the Mokelumne River (NULE Segment 1043) from the confluence with Snodgrass Slough *(at Giusti's)* to approximately 625 feet downstream of the Walnut Grove-Thornton Road bridge would greatly reduce the risk of flooding the northern upstream portion of RD 563. This is of significant value for the industrial area of East Walnut Grove within RD 563, and potentially more so when paired with MA 10, a cross levee between Georgiana Slough and the North Fork of the Mokelumne River. The repair and strengthening-in-place of this section of the levee along the North Fork of the Mokelumne River would also further reduce the risk to flooding of Giusti's Place, a long-term business establishment of over 100 years in the North Delta and an existing residence located just downstream and within 500 feet of the Walnut Grove-Thornton Road bridge. As a result, this flood risk reduction element was prioritized as MA 8. The proposed remediations for MA 8 are described in 5.1.2.2.

6.1.11 Management Action 9: Repair and Strengthen-in-Place Georgiana Slough Left Bank Non-SPFC Levee (portion of NULE Segment 130 in RD 563)

As previously discussed, the left bank of Georgiana Slough in RD 563 (NULE Segment 130) is estimated by DWR to have a high likelihood of failure or the need to flood fight. Repairing and strengthening the 0.70-mile-long portion of levee located along the left bank of Georgiana Slough (NULE Segment 130) would greatly reduce the risk of flooding in RDs 563 and 554. As a result, this flood risk reduction element was prioritized as MA 9. The proposed remediations for MA 9 are described in 5.1.2.3.

6.1.12 Management Action 10: Previously Identified Cross Levee in RD 563

Constructing a new cross levee in RD 563 would fend off floodwaters in the event of a levee breach in the larger portion of RD 563 located south of the proposed cross levee, reducing flood risk in the most upstream portion of RD 563. The proposed cross levee could also reduce flood risks within the larger downstream portion of the RD 563 basin in the event of a levee breach in this most upstream portion of RD 563. The new cross levee could be constructed with a 20-foot minimum crown width, 3H:1V landside and waterside slopes, and levee crest elevation of 13 feet, assuming design WSEL of 10 feet NAVD 88 and 3 feet of freeboard. In contrast, the cross levee developed by DWR for the 2012 CVFPP included a 12-foot crown width with an average height of 18 feet This flood risk reduction element was prioritized as MA 10 due to funding, capital cost, implementation considerations, and marginal community support. The proposed improvements associated with a cross levee for MA 10 are discussed in 5.1.2.4.

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6.1.13 Management Action 11: Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area with Previously Identified Cross Levee for RD 563

Similar to MA 5 for RD 554, constructing a cross levee within RD 563 combined with repairing and strengthening portions of the perimeter levee system in RD 563 in accordance with FEMA standards for freeboard, seepage, erosion, and stability and settlement concerns pursuant to 44 CFR §65.10 would result in a great reduction in flood risk for the northerly portion of RD 563. Perimeter levee improvements would be made along: (1) the right bank of Snodgrass Slough between the boundary with RD 554 and the Mokelumne River (portion of NULE Segment 1051 – 0.5 miles); (2) the right bank of the Mokelumne River from the confluence with Snodgrass Slough to approximately 625 feet downstream of the Walnut Grove-Thornton Road bridge (portion of NULE Segment 1043 – 950 ft.) and; (3) along the left bank of Georgiana Slough between LM 0.0 and LM 0.70 (portion of NULE Segment 130 – 0.70 miles). To secure FEMA accreditation for this portion of RD 563, MA 11 would need to be implemented in tandem with (or following) MA 5, which secures FEMA accreditation for the RD 554 perimeter levee system. In doing so, MA 11 ensures 100-year flood protection for the RD 563 portion of the East Walnut Grove Study Area and helps to limit high NFIP insurance premiums. However, improving the study area perimeter levee system in accordance with FEMA standards may be cost-prohibitive without support from regional, State, and federal interests, including through- and south-of-Delta water conveyance interests associated with the CVP and SWP. As a result, securing 100-year FEMA certification for the northerly portion of RD 563 was prioritized as MA 11. The proposed remediations for MA 11 are provided in Sections 5.1.2.1 through 5.1.2.5.

6.1.14 Management Action 12: Secure 100-Year FEMA Certification for the Entire Study Area of East Walnut Grove

MA 12 is simply the summation of securing 100-year FEMA Certification for the entirety of the East Walnut Grove study area, including the portion of RD 554 south of the Delta Cross Channel (MA 5), and the RD 563 portion north of and inclusive of a potential new cross levee in the northern portion of RD 563 (MA 11). As with both MAs 5 and 11, 100-year FEMA certification for the entire study area will greatly reduce flood risks and reduce high NFIP insurance premiums. However, improving the entire study area in accordance with FEMA standards may be cost-prohibitive without support from regional, State, and federal interests, including through- and south-of-Delta water conveyance interests associated with the CVP and SWP. As a result, securing 100-year FEMA certification for the entire project study area was prioritized as MA 12. The proposed remediations for MA 12 are provided in Section 5.

6.2 Capital Costs

Cost estimates were developed for each of the structural elements identified in Section 5.1 and for the construction of an all-weather access road/flood fight berm in concert with raising portions of the Walnut Grove-Thornton Road in RD 563. These estimates were largely

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developed using previous estimates prepared by DWR as documented in the RACER. These estimates are used as the basis to develop the range of costs for each of the repair/strengthen-in-place structural elements. Costs presented in this Section are intended to be Class 4 (Feasibility Level) estimates as defined by the Association for Advancement of Cost Engineering International, and additional geotechnical explorations and analysis are recommended to further refine these cost estimates. Costs for all approaches are escalated to a cost basis of July 2020 using the 20 cities average from the Engineering News-Record Construction Cost Index. Further description of the development of the capital costs can be found in Appendix F.

6.2.1 Repair and Strengthen-in-Place Sacramento River and Georgiana Slough Right Bank SPFC Levee Adjacent to East Walnut Grove in RD 554 (NULE Segment 128) (Management Action 1)

The estimated cost to repair and strengthen the levee along the left bank of the Sacramento River and Georgiana Slough within RD 554 (NULE Segment 128) was estimated using the cutoff wall and RSP remediations identified previously in Section 5.1.1.1. The remediation efforts are currently limited to sub-reaches A and C of NULE segment 128 with no remediations efforts currently identified for sub-reach B. Note that the cost for sub-reach C only includes RSP and no costs for levee widening or cutoff walls on this sub-reach have been developed. The remediation efforts for all sub-reaches within Segment 128 are subject to change with new geotechnical data and subsequent analyses that are highly recommended prior to proceeding with final design and permitting plans. The cost estimate for this element is the summation of costs associated with implementing a cutoff wall on sub-reach A and RSP on sub-reach C, totaling approximately $9,030,000 in July 2020 dollars. Further description of the development of this cost estimate can be found in Appendix F.

6.2.2 Repair and Strengthen-in-Place Snodgrass Slough Right Bank Non-SPFC Levee (portion of NULE Segment 1051) in RD 554 (Management Action 2)

The estimated cost to repair and strengthen the 1.2-mile segment of levee along the right bank of Snodgrass Slough in RD 554 (portion of NULE Segment 1051) as documented in the RACER and escalated to July 2020 dollars is $22,967,000. However, based upon the latest, favorable NULE Hazard ratings of A through B (for underseepage, stability, through-seepage, and erosion criterion) collectively updated by DWR and Sacramento County, and input received from RD 554 representatives in 2020, the NULE remediation costs have been reduced by 50 percent to a current estimate of $11,484,000. Further description of the development of this cost estimate can be found in Appendix F.

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6.2.3 Repair and Strengthen-in-Place Delta Cross Channel Right Bank Non-SPFC Levee (NULE Segment 1052) (Management Action 3)

The estimated cost to repair and strengthen the levee along the right bank of the DCC in RD 554 (NULE Segment 1052) as documented in the RACER and escalated to July 2020 dollars is $12,601,000. However, based upon the latest, favorable NULE Hazard ratings of A through B (for underseepage, stability, through-seepage, and erosion criterion) collectively updated by DWR and Sacramento County, and input received from RD 554 representatives in 2020, the NULE remediation costs have been reduced by 50 percent to a current estimate of $6,301,000. Further description of the development of this cost can be found in Appendix F.

6.2.4 Repair and Strengthen-in-Place Non-SPFC RD 554 Dry Cross Levee Adjoining RD 563 along Old Walnut Grove-Thornton Road (Management Action 4)

The estimated cost to fill in the former landside borrow ditch adjacent to the landward toe of the subject RD 554 dry cross levee adjoining RD 563 is $864,000. Further description of the development of this cost estimate can be found in Appendix F.

6.2.5 Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554 South of the Delta Cross Channel (Management Action 5)

The cost of securing 100-year FEMA certification for the community of East Walnut Grove and the larger RD 554 basin is the summation of all the costs associated with: (1) repairing and strengthening the entirety of the perimeter levees (3.45 miles of SPFC and non-SPFC levees) in RD 554 to current FEMA standards identified above in Sections 6.2.1 through 6.2.4; (2) addressing any reaches that contain an immediate freeboard issues or long-term settlement issues (unknown) as noted above in Section 5.1.1.5; (3) correcting all encroachments (closures, pipelines, and structures) within and/or adjacent to the entirety of the perimeter levee system that pose a threat to the structural and/or operational integrity of the levee system pursuant to 44 CFR §65.10, as noted above in Section 5.1.1.5; (4) conducting the applicable interior drainage studies and operational plans as noted above in Section 5.1.1.5; and (5) updating applicable operation and maintenance plans following all repairs and improvements and modifications to ensure the entirety of the perimeter levee system is operated and maintained by RD 554 in accordance with FEMA, USACE, and CVFPB standards. For cost estimating purposes, FEMA certification items (2) through (5) noted herein and described in more detail within Section 5.1.1.5, are estimated at 5 percent of the total cost of item (1) herein associated with repairing and strengthening the entirety of the RD 554 perimeter levee system. The estimated cost to secure 100-year FEMA certification for the community of East Walnut Grove is $29,063,000 (Table 6-1).

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Table 6-1. Estimated Costs to Secure 100-Year FEMA Certification for the Portion of East Walnut Grove within RD 554

Cost Component	Estimated Cost
1. Improve and Strengthen-in-Place Entire RD 554 Perimeter Levee System	$27,679,000
2. FEMA Certification (5% of item 1 above)	$1,384,000
Total	**$29,063,000**

6.2.6 All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut Grove-Thornton Road in RD 563 (Management Actions 6a and 6b)

The estimated cost to construct the all-weather access road/flood fight berm described in Section 6.1.7 is $2,898,000. The estimated cost to construct the all-weather access road/flood fight berm with road widening along Old Walnut Grove – Thornton Road is $5,338,000.

6.2.7 Repair and Strengthen-in-Place Snodgrass Slough Right Bank Non-SPFC Levee (portion of NULE Segment 1051) within RD 563 from RD 554 South Boundary to the North Fork of the Mokelumne River (Management Action 7)

The estimated cost to repair and strengthen the approximately 0.5-mile segment of levee along the right bank of Snodgrass Slough in RD 563 (portion of NULE Segment 1051) as documented in the RACER and escalated to July 2020 dollars is $9,187,000. Further description of the development of this cost estimate can be found in Appendix F.

6.2.8 Repair and Strengthen-in-Place North Fork Mokelumne River Right Bank Non-SPFC Levee (950 ft. portion of NULE Segment 1043 in RD 563) (Management Action 8)

The estimated cost to repair and strengthen the 950-foot-long segment of levee along the right bank of the Mokelumne River from the confluence with Snodgrass Slough to approximately 700 feet downstream of the Walnut Grove-Thornton Road bridge in RD 563 (portion of NULE Segment 1043) as documented in the RACER and escalated to July 2020 dollars is $4,938,000. Further description of the development of this cost estimate can be found in Appendix F.

6.2.9 Repair and Strengthen-in-Place Georgiana Slough Right Bank SPFC Levee in RD 563 (portion of NULE Segment 130) (Management Action 9)

The estimated cost to repair and strengthen the levee along the left bank of Georgiana Slough in RD 563 from the northern boundary of RD 563 to approximately 0.70 miles downstream

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(portion of NULE Segment 130) as documented in the RACER and escalated to July 2020 dollars is $9,213,000. These repairs and strengthening-in-place include geometry/freeboard improvements and remediation efforts to correct seepage and stability concerns. Further description of the development of this cost estimate and those below as provided by the DWR in the 2011 RACER can be found in Appendix F.

6.2.10 Previously Identified Cross Levee in RD 563 (Management Action 10)

The estimated cost for the previously identified cross levee in RD 563 as previously described in Section 5.1 and shown in Figure 5-13 is $13,763,000. Further description of the development of this cost estimate can be found in Appendix F.

6.2.11 Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area (Management Action 11)

Securing 100-year FEMA certification for just the industrial area within RD 563 would be best if it were implemented following the certification of the RD 554 perimeter levee system upstream and south of the Delta Cross Channel, identified as MA 5 and above in Section 6.2.5. Certification for the RD 563 portion of the study area would rely heavily on the certification of the improved RD 554 perimeter levee system south of the DCC; or the industrial park portion of East Walnut Grove in RD 563 would need to replace or build a similar cross adjoining the RD 554 cross levee to current standards and of sufficient height as if the RD 554 levee system south of the DCC did not exist. Assuming the RD 554 levees were certified in advance, securing FEMA certification for the RD 563 portion of the study area would include the following: (1) constructing a new cross levee in RD 563 as identified in 6.2.10 in concert with improving 0.7 miles of SPFC levees and 0.65 miles of non-SPFC levees within RD 563 north of and upstream of said cross levee; (2) addressing any reaches that contain an immediate freeboard issue (portions of levee along the right bank of Snodgrass Slough and the Mokelumne River and portions of levee along the left bank of Georgiana Slough) or long-term settlement issues (unknown) as noted above in Section 5.1.1.5; (3) correcting all encroachments (closures, pipelines, and structures) within and/or adjacent to the perimeter levee system upstream of the cross levee that pose a threat to the structural and/or operational integrity of the levee system pursuant to 44 CFR §65.10, as noted above in Section 5.1.1.5; (4) conducting the applicable interior drainage studies and operational plans as noted above in Section 5.1.1.5; and (5) updating applicable operation and maintenance plans following all repairs and improvements and modifications to ensure the entirety of the perimeter levee system is operated and maintained by both RDs 554 and 563 in accordance with FEMA, USACE, and CVFPB standards. For cost estimating purposes, FEMA certification items (2) through (5) noted herein and described in more detail within Section 5.1.1.5 are estimated at 5 percent of item (1) herein associated with constructing a new cross levee and repairing and strengthening the northerly levees in RD 563. The estimated cost to secure 100-year FEMA certification for the RD 563 portion of the study area (subsequent to following certification of the RD 554) is estimated at $38,956,000 (Table 6-2).

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Table 6-2: Estimated Costs to Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area

Cost Component	Estimated Cost
1. Improve and Strengthen-in-Place Northerly RD 563 Perimeter Levees	$23,338,000
2. Construction of a New Cross Levee	$13,763,000
3. FEMA Certification (5% of items 1 & 2 above)	$1,855,000
Total	**$38,956,000**

6.2.12 Secure 100-Year FEMA Certification for the Entire Study Area of East Walnut Grove (Management Action 12)

MA 12 is simply the summation of securing 100-year FEMA Certification for the entirety of the East Walnut Grove study area, including the portion of RD 554 south of the Delta Cross Channel (MA 5, including the cost of the RD 554 dry cross levee improvements), and the RD 563 portion north of and inclusive of a potential new cross levee in the northern portion of RD 563 (MA 11). The cost of securing 100-year FEMA certification for the entire study area, inclusive of the community of East Walnut Grove within RD 554, and the industrial area in RD 563, is the summation of all the costs associated with: (1) repairing and strengthening the entirety of the study area perimeter levees (4.25 miles of SPFC and non-SPFC levees) to current FEMA standards identified above in Sections 6.2.1 through 6.2.3 and 6.2.7 through 6.2.9; (2) improving the existing RD 554 dry cross levee, constructing a new cross levee in RD 563 as identified in Section 6.2.10 in concert with improving 0.7 miles of SPFC levees and 0.65 miles of non-SPFC levees within RD 563 north of and upstream of said cross levee (as described in item [1]); (3) addressing any reaches that contain an immediate freeboard issue (portions of levee along the right bank of the right banks of Snodgrass Slough and the Mokelumne River and portions of levee along the left bank of Georgiana Slough) or long-term settlement issues (unknown) as noted above in Section 5.1.1.5; (4) correcting all encroachments (closures, pipelines, and structures) within and/or adjacent to the entirety of the perimeter levee system that pose a threat to the structural and/or operational integrity of the levee system pursuant to 44 CFR §65.10, as noted above in Section 5.1.1.5; (5) conducting the applicable interior drainage studies and operational plans as noted above in Section 5.1.1.5; and (6) updating applicable operation and maintenance plans following all repairs and improvements and modifications to ensure the entirety of the perimeter levee system is operated and maintained by RDs 554 and 563 in accordance with FEMA, USACE, and CVFPB standards. For cost estimating purposes, FEMA certification items (3) through (6) noted herein and described in more detail within Section 5.1.1.5 are estimated at 5 percent of the total combined cost of items (1) and (2) herein associated with repairing and strengthening the entirety of the study area perimeter levee system. The estimated cost to secure 100-year FEMA certification for the entire study area is $68,019,000 (Table 6-3).

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Table 6-3. Estimated Costs to Secure 100-Year FEMA Certification for the Entire Study Area of East Walnut Grove

Cost Component	Estimated Cost
1. Improve and Strengthen-in-Place Entire RD 554 Perimeter Levee System (including RD 554 dry cross levee)	$27,679,000
2. FEMA Certification of RD 554 Perimeter Levee System (5% of item 1, above)	$1,384,000
3. Improve and Strengthen-in-Place RD 563 Perimeter Levee System within the Study Area and Construct Cross Levee Previously Identified by DWR	$37,101,000
4. FEMA Certification of said RD 563 Perimeter Levee System (5% of item 3, above)	$1,855,000
Total	**$68,019,000**

6.2.13 Capital Cost Summary

A summary of capital costs associated with MAs 1 through 12 is summarized below in Table 6-4.

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Table 6-4. Estimated Costs for Management Actions 1-12 Including FEMA Certification(s) for Entire East Walnut Grove Study Area

Management Action	Project Area/ Reclamation District	Estimated Capital Cost	FEMA Certification	Total
1: Repair and Strengthen-in-Place Sacramento River and Georgiana Slough Left Bank SPFC Levees in RD 554 (NULE Segment 128)	FEMA Certification Element for Portion of RD 554	$9,030,000	--	$9,030,000
2: Repair and Strengthen-in-Place Snodgrass Slough Right Bank Non-SPFC Levee (NULE Segment 1051) in RD 554		$11,484,000	--	$11,484,000
3: Repair and Strengthen-in-Place Delta Cross Channel Right Bank Non-SPFC Levee (NULE Segment 1052) in RD 554		$6,301,000	--	$6,301,000
4: Repair and Strengthen-in-Place RD 554 Non-SPFC Dry Cross Levee Adjoining RD 563 along Old Walnut Grove-Thornton Road in RD 554		$864,000	--	$864,000
5: Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554		$27,679,000	$1,384,000	$29,063,000
6a: All-Weather Access Road/Flood Fight Berm in RD 563	RD 563	$2,898,000	--	$2,898,000
6b: All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut-Grove Thornton Road in RD 563	RD 563	$5,338,000	--	$5,338,000
7: Repair and Strengthen-in-Place Snodgrass Slough Right Bank Non-SPFC Levee (portion of NULE Segment 1051 in RD 563) from RD 554 to the North Fork Mokelumne River	FEMA Certification Element for Portion of RD 563	$9,187,000	--	$9,187,000
8: Repair and Strengthen-in-North Fork Mokelumne River Right Bank Non-SPFC Levee (portion of NULE Segment 1043 in RD 563)		$4,938,000	--	$4,938,000
9: Repair and Strengthen-in-Place Georgiana Slough Left Bank SPFC Levee (portion of NULE Segment 130 in RD 563)		$9,213,000	--	$9,213,000
10: Cross Levee Previously Identified by DWR within RD 563		$13,763,000	--	$13,763,000
11: Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area with Cross Levee System, following Certification of RD 554 South of Delta Cross Channel		$37,101,000	$1,855,000	$38,956,000
12: Secure 100-Year FEMA Certification for the Entire East Walnut Grove Study Area (MAs 5 and 11, omitting the dry cross levee in RD 554)	Entire Study Area: Portions of RDs 554 and 563	$64,780,000	$3,239,000	$68,019,000

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6.3 Trade-Off Analysis of Flood Risk Reduction Management Actions

Management actions were compared in a trade-off analysis against the study goal of obtaining 100-year flood protection for the East Walnut Grove study area and against the objectives described in Section 4.1. Other considerations, such as agricultural sustainability, local support, cost, cultural resources, ecosystem, and consistency with existing Delta regulations and policies were also used to compare each of the management actions. The trade-off analyses also incorporate the net reduction in EAD values determined for most structural-based management actions, including net EAD reductions for implementing the proposed all-weather access road/flood-fight berm.

6.3.1 Quantitative and Qualitative Responses to Meet Planning Objectives

6.3.1.1 Reducing Risk to Life

A breach within the levee system anywhere in the RD 554 system south of the Delta Cross Channel directly fronting the community of East Walnut Grove could contain high instantaneous floodwater velocities and depths of imminent danger within the community that would most likely result in life loss in East Walnut Grove. MAs 1-3 and 5, are the only management actions which fortify the levees along the highly populated portion of the community. Consequently, these management actions would likely result in the greatest measurable reduction in life loss. MAs 6a and 6b could also result in a measurable reduction in life loss as they include construction of an all-weather access road/flood fight berm which would provide additional time for evacuation in the event of a levee failure downstream from the community/RD 554 in RD 563. However, in the event of a levee breach downstream of the community in RD 563, the duration of time prior to reaching a 1-foot depth of flooding within the community of East Walnut Grove is estimated to be upwards of 200 hours. As a result, MAs 6a and 6b may not result in a net reduction in life loss, since the no-action condition already contains ample evacuation time approaching 200 hours. MAs 7-10 associated with improving levees within RD 563 are also not likely to result in a net reduction in life loss due to flood depths increasing at slow rates in the larger downstream basin within RD 563.

6.3.1.2 Quantification of Reducing Risk to Property Damage Utilizing EAD Evaluations

As previously discussed, EAD represents the annualized expected damages through the consideration of potential flooding conditions and is one of the primary drivers for flood management funding within the Delta. EAD includes potential flood damages to structures, structure contents, land improvements, adjoining crops, regional infrastructure, and vehicles. Reduction in EAD is a common metric used to evaluate flood risk reduction measures and is used in this feasibility study to evaluate how well each management action meets the objective of reducing risk to property damage. Further details on the EAD analysis performed as part of this study are provided in Appendix E.

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As shown previously in Table 3-7, baseline (or without project) EAD for the East Walnut Grove study area under existing and future conditions (with climate change adjustments) is nearly $7.5M and $35M, respectively. Existing without project conditions represent the current level of flood protection within the study area and does not incorporate any new structural or any new proposed non-structural flood risk reduction elements. Future without project conditions represent the current level of flood protection within the study area, does not incorporate any structural or non-structural flood risk reduction elements, and incorporates expected changes to the study area from climate change, sea level rise, and future land uses. These baseline conditions do not include any flood management improvements in the study area that have been authorized and have funding, or that have started construction or implementation.

Table 6-5 and Table 6-6 below provide the estimated net reduction in EAD to the East Walnut Grove study area under existing and future conditions as a result of implementing MAs 5, 6a, 6b, 11 and 12. The net reduction in EAD in each table is formulated by subtracting the estimated EAD value for each impact area, which is estimated assuming a fractional, partial, or full improvement, from the baseline (or without project) EAD. The pay-back period in years (excluding interest) is then calculated using the estimated cost of each management action.

Overall, the greatest reduction in EAD for the East Walnut Grove study area is provided by MA 12 (FEMA certification of the entire perimeter levee system). As shown in Table 6-5, implementing MA 12, which is inclusive of MAs 1 through 5 and 7 through 11, would reduce EAD for the study area by over $7.3M under existing conditions. On an annualized basis, this represents an EAD of $72,000 for the portion of East Walnut Grove in RD 554 (SAC 52), with EAD for the portion of East Walnut Grove in RD 563 estimated at $111,000 (SAC 53 – Urban). However, at a cost of up to $67M, the flood risk reduction payback period is over 9 years (excluding interest).

Securing FEMA certification for the RD 563 portion of the study area with a cross levee system (MA 11, inclusive of MAs 7-10) results in the next greatest net reduction in EAD to the East Walnut Grove study area. By implementing MA 11, EAD for the portion of East Walnut Grove located within RD 563 is also reduced to $111,000, presenting a total net reduction to the study area of $3.8M. However, this management action does not reduce EAD for the portion of East Walnut Grove in RD 554 and at a total estimated cost of nearly $39M, the flood risk reduction payback period is 10 years (excluding interest).

The proposed all-weather access road/flood fight berm in RD 563 (MAs 6a and 6b) also provide direct measurable value to the community of East Walnut Grove. Both management actions are estimated to result in a net reduction in EAD to the community of East Walnut Grove of over $3.7M under existing conditions, with estimated payback periods of nine months (MA 6a) to 18 months (MA 6b). Similar to MAs 11 and 12, these management actions do not directly result in a reduction in EAD for the portion of East Walnut Grove in RD 554.

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Securing 100-year FEMA certification for the portion of East Walnut Grove in RD 554 (MA 5, inclusive of MAs 1-4) is estimated to result in a net reduction in EAD to the community of East Walnut Grove of nearly $3.5M under existing conditions. This management action results in an annualized EAD for the portion of East Walnut Grove in RD 554 of $72,000 but does not directly reduce EAD for the portion of East Walnut Grove in RD 563. The estimated flood risk reduction payback period for MA 5 is over 8 years.

The discussion above also applies under future conditions as shown in Table 6-6. As shown in Table 6-6, the effects of climate change and sea level rise result in both an increase in the baseline EAD for the East Walnut Grove study area ($35M increased from nearly $7.5M under existing conditions), and a greater benefit from each of the management actions as seen by the higher net reductions in EAD.

In general, when considering the estimated capital cost to construct or implement each management action, the proposed all-weather access road/flood fight berm, with or without the potential road widening, provides the largest incremental value to the community of East Walnut Grove and the larger study area. With the implementation of these management actions, the total net reduction in EAD for the East Walnut Grove study area is estimated at $3.7M under existing conditions and nearly $11.6M under future conditions. Notably, as shown in Table 6-5 and Table 6-6, the all-weather access road/flood-fight berm with or without the potential road widening (at an estimated cost of up to nearly $5.5M) provides similar value to the community of East Walnut Grove as securing 100-year FEMA certification for the portion of East Walnut Grove within RD 554 (at an estimated cost of $29M) and for the entire study area (at an estimated cost of $67M). In both cases, the net reduction in EAD to the East Walnut Grove study area is around $3.8M under existing conditions and $12M under future conditions. However, these management actions do not result in a net reduction in EAD to the portion of East Walnut Grove within RD 554. With respect to the portion of East Walnut Grove within RD 554, securing 100-year FEMA certification for the perimeter levee system in RD 554 provides the greatest value to this portion of the community, resulting in an estimated EAD of $72,000 under existing conditions and $237,000 under future conditions for the portion of East Walnut Grove in RD 554.

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Table 6-5: East Walnut Grove Study Area EAD Values for Existing Conditions Consistent with the 2022 CVFPP Update

Scenarios for Select Management Actions (MAs)	Estimated Cost	RD 554 Portion SAC 52 EAD	RD 563 Portion SAC 53-Urban EAD	Total Net Reduction to East Walnut Grove Study Area	Flood Risk Reduction Pay Back Period in Years (excluding interest)
Baseline EAD, SAC 52 (East Walnut Grove): **$3,546,000**[(1)] Baseline EAD, SAC 53-Urban: **$3,949,000**[(1)] Total Baseline EAD for the East Walnut Grove Study Area (SAC 52 & SAC 53-Urban): **$7,495,000**[(1)]					
Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554 **(MA 5, inclusive of MA 1-4)** [(4)]	$29,063,000	$72,000	N/A	$3,546,000 - $72,000 = $3,474,000	$29,063,000/$3,474,000 = 8.4 years
All-Weather Access Road/Flood Fight Berm in RD 563 **(MA 6A)** [(3)]	$2,898,000	N/A	$225,000	$3,949,000 - $225,000 = $3,724,000	$2,898,000/$3,724,000 = 0.8 years
All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut-Grove Thornton Road in RD 563 **(MA 6B)** [(3)]	$5,338,000	N/A	$225,000	$3,949,000 - $225,000 = $3,724,000[*]	$5,338,000/$3,724,000 = 1.4 years
Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area with Cross Levee System **(MA 11, inclusive of MA 7-10)** [(4)]	$38,956,000	N/A	$111,000	$3,949,000 - $111,000 = $3,838,000	$38,956,000/$3,838,000 = 10.1 years
Secure 100-Year FEMA Certification for the Entire East Walnut Grove Study Area **(MA 12, inclusive of MA 1-5 & MA 7-11)** [(4)]	$67,112,000	$72,000	$111,000	$7,495,000 - $72,000 - $111,000 = $7,312,000	$67,112,100/$7,312,000 = 9.2 years

Notes:

Levee Performance Data Curve for EAD Values: [(1)] Baseline w/o Improvements; [(2)] Fractional Improvements;[(3)] Partial Improvements;[(4)] Full FEMA Cert. Improvements

[*] MA 6B would also include life loss reduction by elevating and widening of Walnut-Grove Thornton Road in RD 563 as a flood evacuation route to Interstate 5, which was not quantified as part of this EAD analysis

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Table 6-6: East Walnut Grove Study Area EAD Values for Future Conditions Consistent with the 2017 CVFPP Update

Scenarios for Select Management Actions (MAs)	Estimated Cost	RD 554 Portion SAC 52 EAD	RD 563 Portion SAC 53-Urban EAD	Total Net Reduction to East Walnut Grove Study Area	Flood Risk Reduction Pay Back Period in Years (excluding interest)
Future conditions Baseline EAD, SAC 52 (East Walnut Grove): **$17,088,000**[(1)] Future conditions Baseline EAD, SAC 53-Urban: **$18,405,000**[(1)] Future conditions Total Baseline EAD for the East Walnut Grove Study Area (SAC 52 & SC 53-Urban): **$35,493,000**[(1)]					
Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554 **(MA 5, inclusive of MA 1-4)** [(4)]	$29,063,000	$237,000	N/A	$17,088,000- $237,000 = $16,851,000	$29,063,000/$16,851,000 = 1.72 years
All-Weather Access Road/Flood Fight Berm in RD 563 **(MA 6A)** [(3)]	$2,898,000	N/A	$6,816,000	$18,405,000 - $6,816,000 = $11,589,000	$2,898,000/$11,589,000 = 0.25 years
All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut-Grove Thornton Road in RD 563 **(MA 6B)** [(3)]	$5,338,000	N/A	$6,816,000	$18,405,000 - $6,816,000 = $11,589,000*	$5,338,000/$11,589,000 = 0.46 years
Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area with Cross Levee System **(MA 11, inclusive of MA 7-10)** [(4)]	$38,956,000	N/A	$5,742,000	$18,405,000 - $5,742,000 = $12,663,000	$38,956,000/$12,663,000 = 3.08 years
Secure 100-Year FEMA Certification for the Entire East Walnut Grove Study Area **(MA 12, inclusive of MA 1-5 & MA 7-11)** [(4)]	$67,112,000	$237,000	$5,742,000	$35,493,000 - $237,000 - $5,742,000 = $29,514,000	$67,112,000/$29,514,000 = 2.27 years

Notes:

Levee Performance Data Curve for EAD Values: [(1)] Baseline w/o Improvements; [(2)] Fractional Improvements;[(3)] Partial Improvements;[(4)] Full FEMA Cert. Improvements

* MA 6B would also include life loss reduction by elevating and widening of Walnut-Grove Thornton Road in RD 563 as a flood evacuation route to Interstate 5, which was not quantified as part of this EAD analysis

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6.3.1.3 Reducing Probability of Levee Failure

MA 1 repairs and strengthens the levee fronting the community along the left bank of the Sacramento River and Georgiana Slough. This segment of levee was previously documented by DWR to have a low probability of levee failure or the need to flood fight. However RD 554's engineer, DCC Engineering, has acknowledged there is a sizeable erosion site that requires attention just downstream of the Delta Cross Channel, and Blackburn has identified some potential seepage concerns near the confluence of the Sacramento River and Georgiana Slough . As a result, MA 1 results in a moderate reduction in the probability of levee failure.

MA 2 repairs and strengthens the portion of levee in RD 554 located along the right bank of Snodgrass Slough. The levees along Snodgrass Slough are currently uncategorized by DWR due to insufficient data. As a result, MA 2 is likely to result in a low to high reduction in the probability of levee failure.

MA 3 repairs and strengthens the levees along the right bank of the DCC in RD 554. These levees are documented by DWR to have a moderate likelihood of levee failure or the need to flood fight. As a result, MA 3 results in a moderate reduction in the probability of levee failure.

MA 4 improves the dry cross levee in RD 554 adjoining RD 563 along Old Walnut Grove-Thornton Road. MA 4 is likely to result in a low reduction in the probability of levee failure.

MA 5 includes repairing and improving all of the SPFC and non-SPFC levee reaches surrounding the community/RD 554. Although the levees along the left bank of the Sacramento River are documented to have a moderate probability of levee failure, the levees along Snodgrass Slough and the right bank of the DCC are currently categorized by DWR to have a low risk to failure. The non-SPFC levees require further evaluation to determine full applicable remediation measures to reduce flood risks. Thus, further evaluation and ultimate improvement to the RD 554 perimeter levee system is likely to result in a moderate to high reduction in the probability of levee failure.

MA 6a and 6b integrate an all-weather access road/flood fight berm and are non-structural measures which do not modify or improve the existing levee/flood control system. As a result, MAs 6a and 6b do not result in a net reduction in the probability of levee failure.

While DWR has not categorized the segment of levee in RD 563 along the right bank of Snodgrass Slough due to insufficient data, this segment of levee is documented as one of the weakest links in the RD 563 levee system. Consequently, MA 7 results in a high reduction in the probability of levee failure through the repair and improvement of the levee along the right bank of Snodgrass Slough in RD 563.

MA 8 repairs and strengthens the portion of RD 563 levee along the right bank of the Mokelumne River from the confluence with Snodgrass Slough to approximately 625 feet downstream of the Walnut Grove-Thornton Road bridge. This segment of levee is documented to

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have a high likelihood of levee failure or the need to flood fight due to vulnerabilities to underseepage and stability. As a result, MA 8 results in a high reduction in the probability of levee failure.

MA 9 repairs and strengthens the portion of levee in RD 563 along the left bank of Georgiana Slough in the southerly portion of the study area. This segment of levee is documented to have a high likelihood of levee failure or the need to flood fight due to vulnerabilities to underseepage and erosion. As a result, MA 9 results in a high reduction in the probability of levee failure.

MA 10 constructs a cross levee in RD 563 and does not include any perimeter levee improvements. As a result, MA 10 results in a low reduction in the probability of levee failure.

MA 11 constructs a cross levee in RD 563 and repairs and improves the RD 563 perimeter levees north of said cross levee along the left bank of Georgiana Slough and the right bank of the Mokelumne River and Snodgrass Slough. The levee segments along Georgiana Slough and the Mokelumne River are documented by DWR to have a high likelihood of levee failure or the need to flood fight, and as a result, strengthening and improving these levees as part of MA 10 would result in a high reduction in the probability of levee failure.

MA 12 repairs and strengthens the entire study area perimeter levee systems within RD 554 and 563 adjacent to the community and certifies said levee system(s) to FEMA accreditation standards. As noted above, select reaches in the study area perimeter levee system have a moderate to high likelihood of levee failure or the need to flood fight as documented by DWR. MA 12 would effectively eliminate the probability of levee failure in the study area, and as a result, results in the highest reduction in the probability of levee failure of all management actions under consideration.

6.3.1.4 Reduction of High Insurance Premiums

Those management actions which result in 100-year FEMA certification could result in a net reduction in NFIP insurance premiums. MAs 5, 11, and 12 are the only solutions which result in 100-year FEMA certification. However, implementation of the structural elements and non-structural measures as part of MAs 1 through 4, 6a, 6b, (inclusive of a flood fight berm and improving Walnut Grove-Thornton Road in RD 563), 7, 8, 9, and 11 in concert with a community- or risk-based insurance program, could also result in a net reduction in flood insurance premiums for the community.

6.3.1.5 Enhancing Resiliency and Reliability of Through-Delta Water Conveyance

MA 12 would provide the greatest multi-benefit enhancement of the resiliency and reliability of through-Delta water conveyance by collectively improving 1.6 miles of SPFC levee along the Sacramento River and Georgiana Slough. Improving said segments of SPFC levee along the Sacramento River and Georgiana Slough would equate to improving 2.5 percent of the total SPFC levees along the freshwater corridor in the Delta (a total of 62 miles). MAs 1, 5, and 9

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would improve enhance the resiliency and reliability of through-Delta water conveyance to a lesser degree. MAs 4, 6, and 10 associated with improving or constructing a new cross levee and/or an all-weather access road/flood fight berm will not necessarily improve through-Delta water conveyance but will improve flood fighting capabilities in the immediate vicinity of the DCC and the important freshwater conveyance channels within 2.0 miles downstream of the DCC.

6.3.1.5.1 Environmental Stewardship and Multi-Benefits

Since the entire suite of Management Actions involve improvements to perimeter levees or the creation of a new cross levees, all of the enhancement concepts would be feasible to implement in whole, or part, during levee repair work, including: 1) rehabilitation of the community's defunct sewage ponds, which could support seasonal wetland or managed freshwater marsh which would be unaffected by levee repairs, 2) enhancing the combination of wildlife habitat and recreation opportunities within the Delta Meadows State Park adjacent to the communities of Locke and East Walnut Grove, and 3) SRA habitat creation or enhancement.

Under all management actions, a recreation component could be implemented in whole, or in part, with the construction of either cross levee or in connection with improvements to any perimeter levee, particularly if improvements to the levee crowns can facilitate multi-use trails. Trail usage along a small (dry cross levee along Old Walnut Grove-Thornton Road) or large (RD 563 cross levee) loop could include signage and interpretive information for users regarding the rich history of the area and could also connect through EWG, and continue across the DCC, linking the East Walnut Grove and Locke historic districts. However, a loop trail is most likely if Management Actions 2 through 4 and 6 through 11 are implemented, since these are the only options that include improved perimeter levee systems and/or cross levees to create a complete loop.

A perimeter trail could offer a connection to other Delta Legacy Communities, north to Stone Lakes National Wildlife Refuge, through Delta Meadows State Park (with facility improvements in partnership with State Parks), and to points farther north and east, to connect with other recreational areas with existing parking and trailheads such as the Cosumnes River Preserve. This concept could also be combined with improvements proposed for the adjacent communities.

Improvements to recreational access in the East Walnut Grove study area would also complement the Delta Protection Commission's Vision for East Walnut Grove, as detailed in their Economic Sustainability Plan. These elements are currently developed only to a conceptual level, but support development of a Delta Meadows River trail (which would connect via the DCC rail bridge), a connection of the trail to the historic district (with public parking planned at the north end of downtown), restoration of downtown historic structures, development of agritourism for open space in the southeast portion of East Walnut Grove, development of additional commercial, mixed-use, and overnight amenity uses, in areas that do not include historic structures, and a connection to the West Walnut Grove business district/waterfront

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across the Sacramento River via improved public access. Visitors can also access East Walnut Grove via the existing Walnut Grove Marina or the public dock on the Sacramento River which was recently improved.

6.3.2 Other Considerations

6.3.2.1 Agricultural Sustainability

Under Management Action 6a or 6b, a small amount of agricultural land and open space would be affected by construction of the all-weather access road/flood fight berm to accommodate the road footprint (up to 20-ft.-wide), any necessary roadway prism widening improvements along Walnut Grove-Thornton Road, and easements adjacent to the access roads.

Under MAs 2 through 4, 6 through 9, 11, and 12, agricultural sustainability is likely to be affected along those segments of levee where seepage, stability, or combination berms could be deployed, since the berms could be as much as 126-foot-wide, resulting in displacement of productive permanent crops (orchards and vineyards) and seasonal row or field crops. To minimize displacement of valuable agricultural land adjoining the community, it may be advantageous to install vertical cutoff walls in place of landward stability/seepage berms. A new cross levee system in RD 563 (MA 10) would result in the greatest reduction of permanent orchards/vineyards and seasonal field/row crops of all management actions.

6.3.2.2 Local Support

Those management actions which result in the least impacts to agricultural sustainability garner the most local support. Consequently, with respect to all management actions under consideration, with the exception of MAs 6a, 6b, and 10, local support is given to vertical remediations (cutoff walls) over horizontal remediations (seepage, stability or combination berms), since a cutoff wall would be installed entirely within the existing levee prism and would not result in a net reduction in agricultural land.

The greatest support exists for levee improvements within RD 554 that do not disturb and greatly impact the landside levee slopes and landward properties where there are existing structures and/or highly productive agricultural lands.

Between Managements Actions 6a, 6b, and 10 within RD 563 local support is greatest for the flood fight berm (MA 6b); whereas there is very little, if any, local support in pursuing the large cut-off levee at the lower downstream end of the study area within RD 563.

6.3.2.3 Cost

MA 4 (RD 554 dry cross levee improvements) is the lowest cost solution to reducing flood risk in the study area at $864,000, followed by MA 6a (all-weather access road/flood fight berm) and MA 6b (all-weather access road/flood fight berm and road widening) at $2.9M and $3.9M,

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respectively. MA 8 (repairing and strengthening the 950-foot portion of levee along the right bank of the Mokelumne River in RD 563) is the next lowest cost solution at $4.9M. MAs 3, 1, 7, and 9 are the next lowest cost solutions ranging between $6.3M (MA 3, repairing and strengthening the levee along the right bank of the DCC in RD 554) and $9.2M (MA 9, repairing and strengthening the 0.7 miles of levee along the left bank of Georgiana Slough in RD 563). MA 2, which repairs and strengthens the 1.2-mile segment of levee along the right bank of Snodgrass Slough in RD 554 is estimated at nearly $11.5M. The remaining MAs 5, 10, 11, and 12 are the highest cost solutions to reducing flood risk to the East Walnut Grove study area. These solutions range in cost between nearly $14M (MA 10, RD 563 cross levee) and $68M (MA 12, FEMA certification for the entire study area).

6.3.2.4 Cultural Resource Considerations

Under all of the MAs, cultural resources could be affected, since installation of a cutoff wall and/or placement of riprap can disturb previously unknown archeological resources and repair/strengthen-in-place remediations (including a seepage, stability, or combination berm up to 126-ft.-wide) may require grading or foundational work. However, built-environmental resources, such as historic buildings, on adjacent land would not be permanently affected. Additionally, under MAs 6a, 6b, 10, and 11, cultural resources could be affected by construction of the foundation of either the all-weather access road/flood fight berm or cross levee.

6.3.2.5 Ecosystem Considerations

Under MAs 1 through 4 within RD 554, disturbances to biological resources could be reduced or minimized if levee remedial actions were limited to landside improvements, and if cutoff walls were pursed over the landside berms. MAs 2 and 3 within RD 554 will likely require landside slope and toe improvements that will likely displace habitat in landside agricultural ditches, but not displace any vegetation on the waterside slopes below the ordinary high-water line.

MAs 7 through 9 in RD 563 entail remediation of the perimeter less within RD 563 that could be implemented with or without MA 10, a RD 563 cross levee. Remediation of said levees can likely be conducted without disturbing much of the waterward habitat (with the exception of possibly tree trimming near the waterside hinge-point to accommodate levee raises/cut-off wall degrades, etc.). Most disturbance will likely be on the landward side of the RD 563 levees.

Under MAs 6, 10, and 11, small amounts of linear open space would be affected by construction of the flood fight access road/Walnut Grove-Thornton Road improvements, as well as along the footprint of the identified cross levee, including easement areas (up to 20-ft.-wide) for any clearing or maintenance activities.

Any work along Georgiana Slough or the left bank of the Sacramento River during perimeter levee improvements could result in some impacts, due to slightly more SRA habitat along this reach but it is likely these repairs could be implemented if appropriate work window restrictions, monitoring, and species and habitat avoidance and mitigation measures are in place. Biological

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resources in this area could be affected if any sensitive habitat along the alignment cannot be avoided. The erosion site remediation efforts identified along the left bank of the Sacramento River, immediately downstream of the DCC (at the upstream end of NULE Segment 128) in connection with MA 2 provides an opportunity to enhance or add SRA as indicated on the erosion site plans developed by DCC Engineering on behalf of RD 554 (*see* Appendix A-4).

The restoration activities possible in the study area would be consistent with Delta Plan Strategy 4.2 "Restore Habitat," Strategy 4.4 "Prevent Introduction of and Management of nonnative Species Impacts," and Strategy 5.2 "Plan to Protect the Delta's Lands and Communities." These actions would provide benefits to the following species: Sacramento splittail and Delta smelt, western pond turtle, multiple waterbird guilds (waders, dabblers, and divers), tricolored blackbird, other songbird species. The actions described at a conceptual level above, would also provide critical regional habitat connectivity between Cosumnes River Preserve, Delta Meadows, McCormack Williamson Tract restoration, Staten Island, and Stone Lakes National Wildlife Refuge.

6.3.2.6 Consistency with Existing Delta Regulations and Policies

As mentioned previously, there are several agencies with regulatory, flood management, and/or land use authority over projects in the Delta, inclusive of the subject Sacramento County Delta Legacy Community of East Walnut Grove that is located in the Primary Zone of the Delta. Due to the large number of broad policies and goals contained in the many DPC, DSC, and Conservancy planning documents applicable to the study area, an exhaustive matrix comparing the various proposed flood management elements against the many broad goals and policies of Delta agencies is contained in Appendix G.

Generally, all of the proposed management actions indirectly support the various Delta agencies plans and policies regarding sustainability and viability of the Delta agricultural economy, preservation of the Legacy Community's unique history and sense of place, and opportunities for public recreation and ecosystem enhancement (where feasible). The only management action components that could conflict with existing regulations could be those that propose seepage/stability berms and possibly the access road/flood fight berm, if their final configuration would affect a substantial acreage of important farmland of regional and statewide significance within the study area. Although most restrictions regarding agricultural land conversion address conversion to urban uses, the concept of taking agricultural land out of production due to flood management facilities would need to be explored further before implementation of any management action.

Historically, levee repairs can induce population growth and encourage development within the floodplain. Although levee repairs are proposed under all of the various management actions, development within the Delta is constrained by the Delta Plan and SPA ordinances which limit new residential, commercial, and industrial development within the Primary Zone of the Delta. As such, future floodplain development within the study area is not expected to be substantial.

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By protecting East Walnut Grove and adjacent working agricultural lands with better flood protection, and providing multi-benefit opportunities when possible, East Walnut Grove can reasonably thrive as a community within the confines of existing regulations.

6.3.3 Trade-Off Analysis Summary

A summary of the trade-off analysis is provided in Table 6-7 below.

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Table 6-7. Trade-Off Analysis Summary Table

Management Action	Flood Risk Reduction				Limitation of High Insurance Premiums	Enhancing Resiliency and Reliability of through-Delta Water Conveyance	Local Support	Multi-Benefit, Eco-System or Recreation Enhancements	Cost
	Reducing Risk to Life	Reducing Risk to Property Damage	Reduced Probability of Levee Failure	Net Reduction in EAD to East Walnut Grove Study Area (Existing Conditions/Future Conditions) ($)					
1	High	High	Moderate	N/A	No	Yes	Moderate - High	High	High
2	High	High	Low to High	N/A	No	Yes	Moderate - High	Medium	High
3	High	High	Moderate	N/A	No	Yes	Moderate - High	Medium	High
4	Low	Moderate	Low	N/A	No	No	High	High	Low
5	High	High	High	$3,474,000 - $16,851,000	Yes	Yes	High	Low	High
6a	Low	Moderate	Low	$3,724,000-$11,589,000	Possibly	No	Moderate	Medium	Low
6b	Low	High	Low	$3,724,000-$11,589,000	Possibly	No	High	Medium	Low
7	Low	Moderate	High	N/A	No	Yes	moderate	Medium	High
8	Low	Moderate	High	N/A	No	Yes	moderate	Medium	High
9	Low	Moderate	High	N/A	No	Yes	moderate	Medium	High
10	Low	Moderate	Low	N/A	Possibly	No	Low	Low	High
11	Low	High	High	$3,838,000-$12,663,000	Yes	Yes	Low	Low	High
12	High	High	High	$7,313,000 -$29,514,000	Yes	Yes	Low	Low	High

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7. Recommendations

This section details the suite of management actions recommended for implementation. Other non-structural measures that are recommended for implementation are also identified. Following these recommendations, right-of-way and easements considerations, as well as considerations for operation, maintenance, repair, replacement and rehabilitation (OMRR&R) are discussed, as well as regulatory requirements, financial feasibility, and stakeholder support.

7.1 Recommended Suite of Structural-Related Management Actions

Of the 12 management actions previously identified, MAs 1 through 3 and 6b are recommended for timely, near-term implementation. This includes:

- **Management Action 1:** Repair and Strengthen-in-Place Sacramento River and Georgiana Slough Left Bank SPFC Left Bank Levees in RD 554 (NULE Segment 128)
- **Management Action 2:** Repair and Strengthen-in-Place Snodgrass Slough Right Bank Non-SPFC Levee (NULE Segment 1051) in RD 554
- **Management Action 3:** Repair and Strengthen-in-Place DCC Right Bank Non-SPFC Levee (NULE Segment 1052) in RD 554
- **Management Action 6b:** All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut Grove-Thornton Road in RD 563

Additional management actions for long-term consideration include:

- **Management Action 4:** Repair and Strengthen-in-Place Non-SPFC Dry Cross Levee Adjoining RD 563 along Old Walnut Grove-Thornton Road in RD 554
- **Management Action 5:** Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554 south of the DCC
- Portions of **Management Actions 7-9**
    - Improving any freeboard/geometry deficiencies in the RD 563 perimeter levee system upstream and north of the cross levee identified in RD 563 in connection with MA 11

Long-term management actions include the long-term goal of securing a 100-year level of flood protection for RD 554 south of the cross levee by repairing and improving the SPFC levees in RD 554 along the Sacramento River/Georgiana Slough and the non-SPFC levees in RD 554 along the DCC and Snodgrass Slough, as well as the RD 554 dry cross levee adjoining RD 563 along Old Walnut Grove-Thornton Road.

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As previously discussed, repairing and strengthening the SPFC levees along the left, east bank of the Lower Sacramento River and Georgiana Slough, and the non-SPFC levees along the DCC and immediately downstream thereof, would also improve the resiliency and reliability of the through-Delta water conveyance system. Provided the community can also garner support from in-Delta and South of Delta water export interested parties, including but not limited to, the DCA, DWR, CVP, Metropolitan Water, and State Water Contractors, it is recommended that MA Items 1 through 3 and 7 through 9 be implemented over time to improve and modernize the perimeter levee systems that also serve to improve the resiliency and reliability of the through-Delta conveyance system as it currently exists today and into the future. It should be noted that MA 3 includes strengthening-in-place the entire 0.80-mile non-SPFC right bank levee of the Delta Cross Channel. See Appendix K for further details in support of the multi-benefit opportunities associated with MAs 1-3 as well as MAs 7-9 identified by the Sacramento County Delta Legacy Communities associated with reducing flood risks combined with improving SWP water conveyance through the Delta.

It is also recommended that all of the above recommended structural-related management actions be coupled with the noted suite of non-structural measures identified and prioritized in 7.3 below. A summary of the proposed remediations for each management action recommended for timely, near-term implementation is summarized in Table 7-1 below. These remediations were largely developed by DWR based on the assessment performed as documented in the NULE GAR and as provided in the 2011 RACER for the North NULE study area and are detailed in Table 7-2.

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Table 7-1. Summary of Proposed Remediations for Management Actions 1-12 (Items 2-3 and 7-10 URS, 2011b)

Management Action	Proposed Remediations
1: Repair and Strengthen-in-Place Sacramento River and Georgiana Slough SPFC Left Bank Levees in RD 554 (NULE Segment 128)	• 1,850-ft.-long cutoff wall along the most southerly portion of NULE Segment 128 from station 0+00 to 18+50 • Approximately 750 ft. of rock slope protection along the most northerly portion of NULE Segment 128 from station 39+00 to 46+50
2: Repair and Strengthen-in-Place Snodgrass Slough Right Bank Non-SPFC Levee (NULE Segment 1051) in RD 554	• 100-ft.-wide combination seepage/stability berm along the entire 1.2-mile-long segment of levee or a portion thereof to address through seepage, underseepage, and stability vulnerabilities • Improve and flatten landside slopes to address geometry deficiencies
3: Repair and Strengthen-in-Place DCC Right Bank Non-SPFC Levee (portions of NULE Segment 1052) in RD 554	• Fill-in land side toe and/or agricultural drainage ditch • 80- to 95-ft.-wide seepage berm along the portion of the levee to address underseepage vulnerabilities • 95-ft.-wide combination seepage/stability berm along the portion of the levee to address underseepage and stability vulnerabilities
4: Repair and Strengthen-in-Place Non-SPFC Dry Cross Levee Adjoining RD 563 along Old Walnut Grove-Thornton Road	• Fill in landward borrow ditch along landward toe of RD 554 cross levee and any additional improvements that may be required to secure 100-year FEMA accreditation to fend off RD 563 flood waters that may originate in RD 563- Tyler Island, as most recently occurred in 1986
5: Secure 100-Year FEMA Certification for Community of East Walnut Grove/RD 554	• Levee improvements as described in MAs 1-4 along with addressing all FEMA design criteria and O&M and documentation requirements pursuant to 44 CFR §65.10
6a: All-Weather Access Road/Flood Fight Berm	• 0.8-mile-long all-weather access road and flood fight berm with an 8- to16-ft.-wide crown width, 3H:1V landside and waterside slopes, and maximum road crown elevation of 12 ft., assuming design WSEL of 10 ft. NAVD 88 and 3 ft. of freeboard
6b: All-Weather Access Road/Flood Fight Berm and Road Raising/Widening along Walnut Grove-Thornton Road in RD 563	• 0.8-mile-long all-weather access road and flood fight berm with an 8- to 16-ft.-wide crown width, 3H:1V landside and waterside slopes, and maximum road crown elevation of 12 ft., assuming design WSEL of 10 ft. NAVD 88 and 3 ft. of freeboard • Raising the underlying roadway bed and widen shoulders of Walnut Grove-Thornton Road for approximate distance of 0.3 miles and improve said road to serve as flood evacuation route between Delta Legacy Communities and Interstate 5

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Management Action	Proposed Remediations
7: Repair and Strengthen-in-Place Snodgrass Slough Right Bank non-SPFC Levee (portion of NULE Segment 1051 in RD 563) from RD 554 to the North Fork of the Mokelumne River	• 100-ft.-wide combination seepage/stability berm along the entire 1.2-mile-long segment of levee or a portion thereof to address through seepage, underseepage, and stability vulnerabilities • Levee raise to 19-20 ft. NAVD 88 primarily to address freeboard geometry deficiencies
8: Repair and Strengthen-in-Place Mokelumne River Right Bank Non-SPFC Levee (portion of NULE Segment 1043 in RD 563)	• 126-ft.-wide combination seepage/stability berm along a portion of the levee to address through seepage, underseepage, and stability vulnerabilities • 126-ft.-wide seepage berm along a portion of the levee to address underseepage vulnerabilities • Levee raise to 20-21 ft. NAVD 88 primarily to address freeboard and geometry deficiencies
9: Repair and Strengthen-in-Place Georgiana Slough Left Bank Non-SPFC Levee (portion of NULE Segment 130 in RD 563)	• 12-ft.-high stability berm along a portion of levee located on the left bank of Georgiana Slough in RD 563 (NULE Segment 130) to address through seepage and stability vulnerabilities • 70- to 75-ft.-wide combination seepage/stability berm along a portion of levee located on the left bank of Georgiana Slough in RD 563 (NULE Segment 130) to address through seepage and underseepage vulnerabilities • Levee raise along a portion of levee located on the left bank of Georgiana Slough in RD 563 (NULE Segment 130) primarily to address freeboard and geometry deficiencies
10: Cross Levee in RD 563 Previously Identified by DWR	• A new 5,600-ft.-long cross levee in RD 563 previously identified by DWR constructed with a 20-ft. minimum crown width, 3H:1V landside and waterside slopes, and levee crest elevation of 13 ft., assuming an upstream design water surface elevation of 10 and 3 ft. of freeboard
11: Secure 100-Year FEMA Certification for the RD 563 Portion of the Study Area with Previously Identified Cross Levee in RD 563	• Levee improvements as described in MAs 7-10 along with addressing all FEMA design criteria and O&M and documentation requirements pursuant to 44 CFR §65.10.
12: Secure 100-Year FEMA Certification for the Entire Study Area of East Walnut Grove	• Levee improvements as described in MAs 1-4 and 7-10 along with addressing all FEMA design criteria and O&M and documentation requirements pursuant to 44 CFR §65.10. FEMA certification will likely be required in the upstream basin of RD 554 south of the DCC prior to acquiring certification for the downstream basin portion within RD 563 incorporating the downstream cross levee in RD 563.

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Table 7-2. Detailed Remediations for Management Actions 1-3 and 7-9 by Existing Levee Reach (URS, 2011b)

Levee Segment Location	NULE Segment	Hazard Remediated	Extent (% of Total Segment Length)	Remedial Alternatives
Left Bank Sacramento River and Georgiana Slough – RD 554	128	T + S	100	35-ft.-deep cutoff wall
		E	15	750 ft. of RSP
Left Bank Georgiana Slough – RD 563	130	T + S	40	14-ft.-high levee 12ft.-high stability berm
		T + U	30	14-ft.-high levee 75-ft.-wide combo berm
		T + U	20	14-ft.-high levee 70-ft.-wide combo berm
		T	10	14-ft.-high levee 12-ft.-high stability berm
		E	30	14-ft.-high levee
		FG	41	31% freeboard deficiency; 14-ft.-high levee – 2.5 ft. Freeboard Deficiency (1%); 14-ft.-high levee – 0.5 ft. freeboard deficiency (30%); 14-ft.-high levee– geometry deficiency
Right Bank DCC – RD 554	1052	U + S	30	19-ft.-high levee 95-ft.-wide combo berm
		U	60	19-ft.-high levee 95-ft.-wide seepage berm
		U	10	16-ft.-high levee 80-ft.-wide seepage berm
		E	10	19-ft.-high levee
		FG	35	19-ft.-high levee Geometry deficiency only

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Levee Segment Location	NULE Segment	Hazard Remediated	Extent (% of Total Segment Length)	Remedial Alternatives
Right Bank Snodgrass Slough – RDs 554 & 563	1051	T + U + S	60	20-ft.-high levee 100-ft.-wide combo berm
		T + U	40	20-ft.-high levee 100'ft.-wide combo berm
		FG	75	19-ft.-high levee Geometry deficiency only
Right Bank Mokelumne River – RD 563	1043	T + U + S	50	21-ft.-high levee 126-ft.-wide combo berm
		U	50	126-ft.-wide seepage berm
		E	50	21-ft.-high levee
		FG	95	21-ft.-high levee Geometry deficiency only

Notes: E =Erosion; FG = Freeboard/Geometry; T= Through Seepage; U = Under Seepage; S = Stability

7.2 Stakeholder and Public Input on Structural-Based Management Actions and Non-Structural Flood Risk Reduction Measures

The recommended suite of four near-term management actions were informed by stakeholder and public feedback received following preparation of the draft feasibility study report in November 2020. Stakeholders and the public expressed the greatest support for repairing and strengthening the 0.9 miles of SPFC levees along the left bank of the Sacramento River and Georgiana Slough in RD 554 (MA 1) due to the multi-benefit component of improving both the water conveyance system and the flood control system. Public support was also expressed for repairing and strengthening the levees along the right bank of Snodgrass Slough in RD 554 (MA 2).

The all-weather access road/flood fight berm and road widening along Walnut Grove-Thornton Road in RD 563 (MA 6b) is favorable to most locals and stakeholders. This non-structural management action is also relatively low in cost ($3.9M) in comparison to other recommended management actions and would protect the community of East Walnut Grove from potential flood waters originating outside of the community in RD 563. As a result, this feasibility study recommends this management action for potential near-term implementation by the community of East Walnut Grove.

No formal input was provided for repairing and strengthening the right bank of the DCC in RD 554 (MA 3), though RD 554 has previously noted that this levee is believed to meet the

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FEMA urban levee geometry design standard with the exception of noted geometry deficiencies previously discussed.

See Appendix K for additional background information related to improving water conveyance through the Delta (including areas immediately adjacent to and adjoining the Cross Channel) in tandem with reducing flood risks to the Delta Legacy Communities within Sacramento County.

7.3 Non-Structural Measures Recommended for Implementation

Out of the full suite of 15 non-structural measures described in detail in Appendix H and further discussed in Section 5.2, an all-weather access road/flood fight berm is included as part of the recommended structural-related management actions discussed in the previous Section.

The following non-structural measures identified and numbered as follows in Appendix H are recommended to be carried forward to reduce flood risks within the East Walnut Grove study area include the following:

1. Flood Fight Berm or a Ring Levee System
2. Voluntary Elevation of Structures
3. Wet or Dry Floodproofing
4. Flood Emergency Safety Plans
5. Sacramento County OES Decision Support Tool
6. Local Hazard Mitigation Plan and Relief Cuts
7. Alternatives to FEMA's NFIP – Private, Community-Based Flood Insurance
8. NFIP Flood Insurance Enhancements *via* AFOTF
9. Mokelumne River Conveyance Improvements & Staten Island Overflow Area
10. Improve FEMA's CRS Score for Sacramento County/Isleton
11. Land Use Regulations and Limitations
12. Improved Governance Between Neighboring LMAs/RDs
13. SWIFs & Period Inspections with USACE
14. Public Education/Public Awareness

The only non-structural measure previously identified but not carried forward is Acquisitions and Relocations (Item No. 4 in Appendix H). This item was not carried forward at the request of key stakeholders. Relocating entire communities within the Delta, particularly Delta Legacy Communities such as East Walnut Grove, is inconsistent with the goals and objectives of both the Delta Plan and the Sacramento-San Joaquin Delta National Heritage Area designation.

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The recommended suite of non-structural measures and timeline status are summarized below. Of these, a portion are currently ongoing within the East Walnut Grove study area, with the remaining recommended for implementation in the near term and long-term as summarized in Table 7-3. Associated recommendations and costs, as applicable, are summarized below Table 7-3.

Table 7-3. Recommended Timeline for Implementation of Other Non-Structural Measures

Non-Structural Measure	Ongoing	Recommended: Near Term	Recommended: Long Term
Voluntary Structural Elevation		X	X
Wet or Dry Floodproofing		X	X
Flood Emergency Safety Plans	X	X	X
Sacramento County OES Decision Support Tool	X	X	X
Local Hazard Mitigation Plan and Relief Cuts		X	X
Alternatives to NFIP – Community and Flood-Risk Based Insurance Program	X	X	X
NFIP Flood Insurance Enhancements via AFOTF		X	X
Mokelumne River Conveyance Improvements/Flood Easements			X
Improve FEMA Community Rating System Score for Sacramento County	X	X	
Improved Governance between Neighboring LMAs/RDs & Community		X	X
SWIFs & Periodic Inspections with USACE		X	X
Public Education and Awareness	X	X	X

7.3.1 Voluntary Structural Elevation

It is recommended that voluntary raising of structures, on a case-by-case basis, be carried forward as a non-structural solution for reducing flood risks within the East Walnut Grove study area; however, voluntary structural elevation is not recommended for any structures located within any of the community's three historic districts, namely the Chinese-American, Japanese-American, and the Commercial Residential Historic Districts within RD 554 due to their historic nature. The county should also continue to encourage residential and business owners to participate in the voluntary raising of structures by offering potential cost-sharing incentives (50% or greater cost share reductions) available through federal and State cost-sharing programs.

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As described previously, there are a total of 249 structures in the community of East Walnut Grove within RDs 554 and 563. As previously presented in Table 5-6, this represents a cost of at least $42M to elevate all of the structures within the East Walnut Grove study area that is inclusive of all of East Walnut Grove within RDs 554 and 563 combined. Note that this cost could be greater when assuming commercial, industrial, and public buildings may be more costly to elevate than single family residential structures at $170,000 each.

The cost to raise all structures to these heights may be feasible with federal and State participation but may not be desirable for the entire community. However, elevating structures is encouraged on a case-by-case basis wherever feasible with federal and State assistance. This non-structural solution would need to be voluntary for residential structures as expressed during public outreach meetings, but it could be mandatory for essential, critical facilities in the event the preferred management actions are not fully implemented. This element is recommended for implementation, on a case-by-case basis, in the long term.

7.3.2 Wet or Dry Floodproofing

Please *refer to* Section 5.2.3 for a more detailed description of this non-structural measure that would be voluntary in nature by individual homeowners and business owners, similar to voluntary elevation of structures. Similar to elevating structures, wet or dry floodproofing would be done a case-by-case-basis and could be implemented during the short- and long-term.

7.3.3 Improved Emergency Response

RD 554 is currently utilizing the DWR Delta Flood Emergency Response Grant Round 2 funding to update its Delta Flood ESP. RD 3 is the grantee within the funding agreement which covers plan updates for several other RDs in Sacramento County.

The intent is for the ESP to be consistent with AB 156, FEMA's Comprehensive Preparedness Guide 101, and regional formatting standards. This includes the development of supporting annexes, namely a flood-specific annex that details the RD's field response operations. The written flood annex will be transferred to a Flood Contingency Map annex that is quick to access and easy to interpret during an emergency.

The ESP will also be reviewed for consistency with SEMS and National Incident Management System standards such as appointing an incident commander, assigning specific response actions to objective conditions, and emergency spending authorities. The Emergency Operation Plan's (EOP) format will also be updated to be consistent with regional standards (San Joaquin, Yolo, and Solano County Flood ESPs).

Additional district specific enhancement will include: identifying the gauges listed in the already-developed EOPs that need datum conversions to NAVD 88 (in order to meet grant requirements); identifying any other critical infrastructure and elevations (pump stations, etc.); and evaluating the feasibility of a relief cut(s) where appropriate, with a brief technical

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memorandum summarizing the conditions in which a relief cut may be a feasible option (*see* Section 7.3.4 below for more information).

Coordination on the plan update began in September 2020 and the final plan update is scheduled for completion before the end of 2021.

It is recommended that the Delta Flood ESP for East Walnut Grove be updated every 5 years and/or as needed.

7.3.4 Local Hazard Mitigation Plan and Relief Cuts

Sacramento County began public outreach to update the 2016 LHMP in 2020. The next 5-year update to the LHMP is planned to be complete by the end of 2021. As part of this update, Sacramento County has the opportunity to reevaluate the impacts of flooding and levee failure to the people and assets of the Sacramento County planning area, including RDs 554 and 563, and to establish updated goals and prioritize projects to reduce these impacts on people and property within RDs 554 and 563. It is recommended that Sacramento County continue to update the LHMP every 5years.

Relief cuts properly executed in the study area could result in potential reductions in flood depths in excess of 4 feet. If the RDs are willing, as previously noted, the updated LHMP may be a place to formalize relief cuts. As discussed above, Sacramento County RDs will be updating their ESPs and are looking at incorporating a relief cut if feasible. Preliminary relief cut evaluations for the RD 554 and 563 basins has shown that a relief cut would be of greatest value if deployed in the lower reaches of Tyler Island – RD 563, and along the RD 554 dry cross levee adjoining RD 563. However, a relief cut at or near this latter location in RD 554 would have to be carefully planned with water metered out at controlled rates to not adversely impact high stages that may co-exist in the Mokelumne River and Snodgrass Slough areas in concert with the DCC Gates being either closed or open. Any relief cut of the RD 554 dry cross levee adjoining RD 563 would also require approval and coordination with RD 563 as a relief cut at this location would impose flooding conditions onto RD 563.

7.3.5 Alternatives to NFIP – Community and Flood-Risk Based Insurance Program

Please *refer to* Section 5.2.7 for a more detailed description of this non-structural measure of a community-based flood insurance program that has been recommended for implementation for the short- and long-term as a viable supplement and/or alternative to FEMA's current NFIP.

East Walnut Grove and other Delta legacy Communities might choose to implement a community-based flood insurance program through the establishment of a Homeowners Association (HOA) or a GHAD. A GHAD is a State-level public agency for the purpose of providing prevention, rapid response, and funding to address hazardous geologic conditions. They were established in 1979 by the Beverly Act to allow local residents to develop self-

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funding mechanisms that address the long-term abatement and maintenance of structures that protect real property from geologic hazards.

The city of Isleton has already taken the initial steps in June-July of 2021 to formalize a path for property owners within its city limits to aggregate their resources and establish a community-based flood insurance program that can be used to augment and/or replace the current set of NFIP policies held within the city of Isleton. The county is also encouraging the unincorporated Delta Legacy Community of Walnut Grove to consider alternatives to the current NFIP, including a community-based flood insurance program that could be administered with or without developing a GHAD (for further details *see* Appendix J, prepared by Kathleen Schaefer, P.E., CFM, former FEMA regional administrator of NFIP).

7.3.6 NFIP Flood Insurance Enhancements via AFOTF

Please *refer to* Section 5.2.8 for a more detailed description of this non-structural measure that is an ongoing, long-term non-structural measure that could be beneficial to all unincorporated, agriculturally-based areas within Sacramento County including the community of East Walnut Grove.

This non-structural measure developed by the AFOTF via its Technical Memorandum of December 28, 2016, has recommended as many as seven administrative refinements of the NFIP to sustain agriculture as a wise use of the floodplain in leveed SFHAs. The seven administrative refinements listed below are consistent with other non-structural measures that have been recommended for implementation. The key elements include the following, of which are applicable to the agricultural-based community of East Walnut Grove and the surrounding study area within RDs 554 and 563:

a) Levee relief cuts with emergency operation plans and floodplain management ordinance
b) Zone X for certified levee reaches: The partial accreditation of a basin or levee reach could potentially lead to lower NFIP insurance rates as portions of levee systems are approved.
c) Wet floodproofing rules for agricultural structures
d) Insurance rates for nonaccredited levees: The AFOTF recommends that FEMA use sound actuarial science to amend its insurance rates to reflect flood protection provided by a non-accredited levee as documented by a civil engineer.
e) Insurance rates for agricultural structures
f) Insurance rates for wet floodproofed structures
g) Add levee risk management activities to FEMA CRS

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7.3.7 Mokelumne River Conveyance Improvements & Staten Island Overflow Area

Please *refer to* Section 5.2.9 for a more detailed description of this non-structural measure that is a long-term non-structural measure that may have flood stage reduction benefits to the community of East Walnut Grove by potentially lowering flood stage levels along Snodgrass Slough located northeasterly of East Walnut Grove.

The documents referenced in Item 9 of Appendix H strongly suggest improving channel capacity in the Mokelumne River on either side of Staten Island and/or securing flood easements on Staten Island to accept excess flood waters. Implementation of these measures could significantly reduce flood stages upstream in Snodgrass Sough for the nearby communities of East Walnut Grove, Locke and possibly as far upstream as Courtland and Hood.

A regional solution for reducing flood stages in the North and South Forks of the Mokelumne River would be beneficial to lower flood stages in nearby Snodgrass Slough and the Franklin Pond, Point Pleasant area and the Cosumnes River, all of which are impacted by high flood stages downstream on the Mokelumne River on either side of Staten Island.

7.3.8 Improve FEMA Community Rating System Score for Sacramento County

Please *refer to* Section 5.2.10 for a more detailed description of this non-structural measure that is an ongoing, long-term non-structural measure that has been beneficial to all unincorporated areas within Sacramento County including the community of East Walnut Grove.

Sacramento County, via its floodplain administrator program, is a very active participant of the NFIP, and through its county-wide Flood Protection Ordinance the county strives to reduce flood risks throughout the unincorporated areas of Sacramento County while also attempting to reduce NFIP premium policy rates. Through different flood mitigation activities outlined within the NFIP, Sacramento County has been able to reduce flood insurance through the FEMA CRS. The county currently has the opportunity to improve their CRS score to achieve the highest possible Class 1 designation by implementing and participating in Emergency Action Plans and associated Table Top Exercises for nearby, upstream dams/reservoirs (namely Folsom Reservoir, and possibly others) that could have a sizeable impact on flooding portions of Sacramento County if said reservoir(s) were to fail and cause flooding. This last jump from a CRS Class 2 to Class l designation would result in the last available 5 percent decrease (from 40 to 45%) in NFIP premiums and would place Sacramento County as the 2nd highest ranked CRS community in the entire Country behind Placer County.

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7.3.9 Improved Governance between Neighboring LMAs/RDs and Community

Please *refer to* Section 5.2.11 for a more detailed description of this non-structural measure that is a long-term non-structural measure that could be beneficial to the communities of East Walnut Grove and Locke if not only RDs 554 and 563 join forces, but possibly RD 369 located just north of the nearby Delta Cross Channel.

7.3.10 Public Education and Awareness

Please *refer to* Section 5.2.12 for a more detailed description of this non-structural measure that includes three ongoing public education and awareness programs for the Delta Legacy Communities. The noted public education/awareness programs are administered by: (1) the DPC via their Delta Flood Preparedness Week hosted each fall season prior to the beginning of each flood season; (2) the Sacramento County Program for Public Information increases flood awareness through informational materials (such as the Storm Ready Booklets) and multiple levels of outreach, ranging from radio spots to specific stakeholder engagement; and (3) the DWR Flood Risk Notification Program that includes sending annual notices in advance of the flood season to every property owner who is located behind a SPFC levee within the Delta. The individual notices include the property owner's address and informs the owners their property may be exposed to potential flood risk from the failure of the levee system. The DWR also suggests each property owner visit DWR's Flood Risk Notification and enter their address to get the most up-to-date information on State-federal levees in their area.[1]

These programs all act as an ongoing, long-term conduit of flood risk information and coordination directly with the community members of East Walnut Grove and other nearby Delta Legacy Communities protected by a combination of SPFC and non-SPFC levees.

7.4 Right-of-Way and Easement Considerations/Recommendations

Local preference and planning guidelines in the Delta encourage retention of agricultural lands as much as possible; and the Delta Plan encourages preservation of agricultural land and uses *versus* displacement for commercial or residential uses. The structural-based management action components that could conflict with existing, regional regulations of preserving agricultural lands in the Delta could be those that include seepage/stability berms and possibly the access road/flood-fight berm as noted above in Section 6.3.2.1: Agricultural Sustainability.

If the final configuration of structural-based management actions would displace or affect a substantial acreage of important farmland of regional and statewide significance within the study area it may be deemed inconsistent with the Delta Plan and policies as administered by the DSC and DPC. It should be noted any major construction activity within the Delta would be

[1] http://water.ca.gov/myfloodrisk

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considered a "Covered Action" under the Delta Reform Act of 2009 within Delta and the CEQA lead agency would be required to submit a written certification of consistency with detailed findings as to whether the covered action is consistent with the Delta Plan. Any person who claims that a proposed "Covered Action" is inconsistent with the Delta Plan may appeal a certification of consistency to the Council. (Calif. Water Code, § 85225.10).

It should be noted that most landowners in the study area adjoining the existing SPFC and non-SPFC levee systems actually own fee-title land under the levee prism and up to the ordinary highwater mark on the water-side of the levee to maintain their riparian water rights to the Sacramento River and adjoining sloughs. The State and the Sacramento-San Joaquin drainage district retain easements for the SPFC levees; and Caltrans and Sacramento County retain easements in most locations (*vs.* fee title) where highways and or roadways are overlain on the top of the levee crowns.

Right-of-way (ROW) acquisition quantities were estimated for a portion of the structural-based management actions (*see* Appendix F). In addition to determining costs for acquiring fee title or dedicated easements for various management actions, estimates were also developed for any temporary roadways to divert traffic. ROW was estimated based on review of aerial photography of existing land use and visual ground-truthing to confirm some of the different agricultural uses. ROW acquisition costs as summarized below in Table 7-24 only accounts for the required alignment and doesn't include purchase of full parcels.

The impact of known utilities to be relocated is considered minimal to the larger scope of the project. Unidentified utility relocations are assumed part of the allowance for unlisted items costs. Costs do not include removal and relocation of any existing structure on the landside of the levee, including but not limited to pump stations, residences, etc. The impact of utility crossings on the stability of the levee foundation, embankments and refinements to associated costs for mitigation and / or relocation of these crossings will need to be considered during the project design phase.

Table 7-4: Permanent Right-of-Way Cost Estimates per Acre and Structure

Right-of-Way (fee title) & Structures	Unit	Cost
Permanent Right-of Way (fee title) - Seasonal Agricultural Field/ Row Crops	AC	$25,000
Permanent Right-of Way (fee title) - Orchard/ Vineyard	AC	$40,000
Permanent Right-of Way (fee title) - Commercial/ Industrial	AC	$240,000
Permanent Right-of Way (fee title) - Residential	AC	$180,000
Residential structures	Ea	$250,000
Other structures	Ea	$75,000

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7.5 OMRR&R Considerations

O&M is the traditional term used to describe the routine activities necessary for a functioning flood management system. OMRR&R is a more recently developed term used to describe and include the comprehensive set of non-routine activities that realistically need to occur for the system, and also includes rehabilitation, repair, and replacement.

LMA activities are guided, in part, by O&M manuals developed by the USACE in the mid-1950s and associated hydraulic design criteria. The original project assurances provided to the federal government in the 1950s make no mention of repair, rehabilitation, and replacement (RR&R). The term was first introduced in the Water Resources Development Act of 1986. Responsibility for the RR&R of SPFC facilities is not widely agreed upon across agencies. As the responsibility for portions of OMRR&R has shifted, funding issues have become more pronounced, requiring additional interpretation of SPFC assurance agreements, O&M manuals, and governing codes and regulations. Accordingly, interpretations of responsibility and necessary funding can differ.

LMAs are not only faced with insufficient funding to conduct the activities needed to maintain and operate SPFC facilities, but they are also working under conditions, design standards, and environmental regulations that have changed since the flood infrastructure was constructed. These changes have complicated OMRR&R and affected the ability to perform necessary activities needed to ensure a fully functioning flood system. Historically, this was not a major issue because federal programs, including PL 84-99 administered by USACE were relied on to fund necessary repairs associated with damages from significant flood events. However, federal funding is becoming more difficult to obtain and eligibility requirements for post-event assistance through PL 84-994 are becoming increasingly more difficult to meet.

As part of the 2017 CVFPP Update, DWR prepared an OMRR&R cost estimate to account for more stringent USACE O&M standards, additional USACE RR&R responsibilities, increasing mitigation costs, and correcting original system design deficiencies. In the technical memorandum, the State communicates that although the State may provide investment in levees, the responsibility for maintenance lies with LMAs. To support the continued increase in O&M and additional burden of RR&R responsibilities, an assessment will likely be necessary.

OMRR&R costs in the East Walnut Grove study area will increase in connection with the implementation and OMRR&R of an all-weather access road/flood-fight berm (MA 6b). RD 563 and the community will not likely pursue this management action unless there is large support and financial assistance from the community beneficiaries, namely the business owners of the East Walnut Grove community within RD 563. The community will need to conduct a benefit assessment for not only securing local cost-share components for the repair and improvement of the existing levee system(s) or for a new flood-fight berm, but also for the long-term OMRR&R of said perimeter flood defense system. The community beneficiaries of said perimeter levee system improvements may not be the likely candidate to perform the OMRR&R, but they need to be prepared to compensate RDs 554/563 (or another applicable O&M entity) for any

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incremental cost of OMRR&R over and above what the RDs may currently incur without the added presence of either new levee improvements or an all-weather access road/flood-fight berm.

No new substantial OMRR&R costs are anticipated by RD 554 with the implementation of MAs 1 through 3 associated with repairing and strengthening-in-place the existing levee system immediately adjacent to the community.

7.6 Regulatory Requirements

Environmental requirements associated with implementation of the preferred management action would include preparation of a CEQA/NEPA document, permits, endangered species consultations, Tribal consultation, and cultural resource assessments and consultations.

The level of CEQA/NEPA documentation required for the preferred structural-based management actions is dependent on many factors, including the project extent and severity of associated environmental impacts including biological and cultural resources, and air quality and greenhouse gas emissions. Under CEQA, if all impacts can be avoided or mitigated for, then a Mitigated Negative Declaration would suffice for the project. However, in areas where extensive habitat or air quality impacts are unavoidable, then an EIR would need to be prepared. More extensive CEQA documentation would result in a higher cost for analysis and preparation. The required level of NEPA documentation generally follows CEQA, but in certain instances, a less extensive analysis may be appropriate, depending on the lead federal agency.

Permits such as Clean Water Act Section 404 and 401 permits, approvals under the federal Endangered Species Act and California Endangered Species Act, and a Streambed Alteration Agreement from the CDFW (Section 1600 permit) will be needed, depending on what levee elevation is affected (is work below Mean High Water or Ordinary High Water) and if upland work is conducted in sensitive areas. Prior to beginning the regulatory process for implementation of a proposed element, the following studies would be needed: a wetland delineation of the study area in accordance with the 1987 USACE Wetland Delineation Manual and Sacramento District standards, and focused habitat classification and assessments to determine the potential impacts of the project on special-status species. Conducting the delineation and focused surveys incurs a cost as may any avoidance or minimization measures that may need to be incorporated into project design. Additionally, mitigation for unavoidable effects to sensitive vegetation and wildlife would likely incur a cost associated with on-site or off-site mitigation.

RDs 554 and 563 currently conduct some maintenance activities (repairs affecting up to 100 feet of levee) under a Routine Maintenance Agreement (RMA) with CDFW. The RMA covers maintenance activities for 5 years from the date of issuance, but can often be extended indefinitely, with periodic “touch-up” biological surveys. Depending on project activities, this agreement may be used or a separate 1600 may be required from CDFW. The are several CDFW

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staff familiar with project activities common to Delta levees maintenance and repairs covered under the Subventions program, and this helps with timely project permitting and implementation. Due to the presence of several threatened and endangered aquatic species in the Delta it should be noted that most all waterside work on the levees in the Delta is largely limited to the short 90-day disturbance period of August 1 through October 31.

As described in previous chapters, a total of 17 resources were identified during the records search and from information provided by the county of Sacramento. The majority of these have not been formally evaluated for their eligibility for listing in either the NRHP or CRHR. Many of the identified resources are within the community of East Walnut Grove, and therefore near to elements of the potential management actions, including remediation of levees along the Sacramento River. Further evaluation of these resources, including cultural and historic resources, would need to be conducted to inform final project design and implementation. *See* Appendix C for additional information on cultural resources within the study area.

In addition to complying with environmental regulations, any geotechnical investigations, and subsequent modifications on or within 15 feet landward of any SPFC levee system will require a USACE Section 408 permit approval initiated by the local sponsor through the CVFPB. The sponsor's application, must be developed by the local LMA or RD prior to submittal to the CVFPB. Upon receipt by the CVFPB it can take 90 to 120 days to receive approval and a mandatory endorsement by the CVFPB prior to their submittal to the USACE. Upon receipt of the 408 application by the USACE it can take at times up to 18 months or more to issue the Section 408 approval. Thus, it may take up to two years for the local sponsor to gain Section 408 approval after submitting an application to the CVFPB.

7.7 Federal, State and Local Funding Sources and Financial Strategies

The potential federal, state, and local funding sources for the flood risk reduction MAs and non-structural measures identified for the Delta Legacy Community of East Walnut Grove identified below in Sections 7.7.1 through 7.7.3 are largely excerpted and updated from the suite of funding sources previously identified in the 2014 Lower Sacramento/Delta North RFMP and the 2017 CVFPP Update. One new additional key federal funding source is FEMA's Building Resilient Infrastructure and Communities (BRIC) program that can channel competitive funds to the small Delta Legacy Communities through Cal OES for both structural and non-structural flood risk reduction measures.

7.7.1 Federal Funding Sources

The process for garnering federal funding for flood risk reduction projects requires that a federal interest in the project be identified. Federal interest has generally been identified and evaluated within feasibility studies prepared by the USACE, which evaluate various criteria and generally emphasize the flood damage-reduction benefits typically associated with larger urban area

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projects. Unfortunately, the small communities and rural areas generally lack the necessary flood risk reduction benefits alone to justify a significant federal interest, unless there are sizeable multi-objectives/benefits that can also be attached to the smaller benefits normally associated with small, rural communities that exist in the North Delta. One sizeable multi-benefit component that has been identified in most all of the Sacramento County Delta Legacy communities is repairing and strengthening-in-place the SPFC levee system along the Sacramento River for the entirety of the community's study area (East Walnut Grove's structural-based Management Actions 1 and 9) will also improve the reliability and resiliency of the through-Delta conveyance of SWP and CVP water through the Delta. Given the constrains of the current approach for evaluating and garnering federal investment for stand-alone flood risk reduction projects, coupled with constrained federal budgets, it may be difficult to secure significant federal investment in the region through the USACE. Furthermore, the evaluation, project identification and appropriation process for USACE projects can be protracted, expensive and can lead to higher project costs that may, in some cases, not be in the best economic interest of local project proponents.

Greater opportunities for federal funding may exist via FEMA's emerging BRIC program that can channel competitive funds to small communities through Cal OES. FEMA's BRIC program supports flood risk reduction programs and projects for small, rural communities with smaller, local cost-sharing requirements, particularly for disadvantaged communities. It also enables large multi-benefit infrastructure projects that could possibly be combined with reducing flood risks in the noted North Delta Legacy Communities, including the benefit of improving the long-term reliability and resiliency of through-Delta conveyance of SWP and CVP water through the Delta adjoining the communities. This is particularly applicable for the federal- and state-authorized SPFC levee system in the North Delta adjoining the chain of six Delta Communities, namely Hood, Courtland, Locke, Walnut Grove (East and West) directly adjacent to the Sacramento River SPFC levee system, and the City of Isleton adjacent to the Georgiana Slough SPFC levee system.

Table 7-5 provides a summary of potential federal funding sources to fund both structural-based management improvements and non-structural flood risk reduction measures. The table outlines the general uses of the funding source and the attributes and applicability of the mechanism for flood management.

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Table 7-5: Potential Federal Funding Programs

Agency	Program Name (Acronym)	Program Summary	Status	Who is Eligible to Apply	Cost Share Range
FEMA	Building Resilient Infrastructure and Communities (BRIC)	The BRIC program supports hazard mitigation projects, reducing the risks faced from disasters and natural hazards. (Approximately $919M available for local projects spread across entire nation for fiscal year 2021)	Relatively New	Federally Recognized Native American Tribes, State governments; City or township governments, County governments via Cal OES	Varies 75%-90% Highest for small disadvantaged communities (DACs)
FEMA	Flood Mitigation Assistance (FMA)	The FMA grant program provides funding to reduce or eliminate the risk of repetitive flood damage to buildings and structures insurable under the National Flood Insurance Program (NFIP).	Ongoing	Federally Recognized Native American Tribes, State governments; City or township governments, County governments via Cal OES	Varies 75%-100%
FEMA	Pre-Disaster Mitigation (PDM)	The PDM Grant Program is designed to implement a sustained pre-disaster natural hazard mitigation program to reduce overall risk from future hazard events, while also reducing reliance on Federal funding from future disasters.	Ongoing	Federally Recognized Native American Tribes, State governments; City or township governments, County governments via Cal OES	75% 90% for small disadvantaged communities (DACs)
USACE/State	USACE/CVFPB Feasibility Studies (USACE FS)	A feasibility report is developed to identify the recommended plan: project scope, economic benefit, and an accurate cost and schedule baseline identified with potential project risks.	Ongoing	CVFPB with a local Sponsor	50% USACE, 50% State and Locals Split
USACE/State	USACE/CVFPB Civil Works Projects (USACE CW)	Upon completion of a USACE feasibility study a Chief's Report is provided to congress. If the Chief's Report is authorized by Congress a local agency can advance a project with the USACE upon securing federal appropriations.	Ongoing	CVFPB with a local Sponsor, 25%	35% Split between CVFPB and local Sponsor
USACE	Sacramento River Bank Protection Project (SRBPP)	The Sacramento River Bank Protection Project is a long-term flood risk management project designed to enhance public safety and help protect property along the Sacramento River and its tributaries.	Phasing Out	Project Levees authorized in the SRFCP	0%

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7.7.2 State Funding Sources

In the near term, the State plans to utilize the remaining Proposition 1E bonds authorized to fund projects consistent with the CVFPP last adopted in July 2017 and being updated at 5-year intervals with the next update scheduled for 2022. Within the latest 2017 CVFPP updates, the State identified remaining Proposition 1E and 84 bond funds were not sufficient to meet all of the flood protection goals and identified an ongoing need for flood risk reduction within the Central Valley. Additional bond authorizations and greater utilization of State general funds will be needed to meet the goals identified in the CVFPP, particularly for the SCFRRP flood risk reduction components. The SCFFRP component measures for the entire CVFPP study area were estimated between $1.5B to $1.9B in the 2017 CVFPP update for the Sacramento Basin alone compared to only $310M to $370M for the San Joaquin Basin. The State Legislature will need to play a significant role, with respect to how State and local funding can be generated particularly within the Delta region, as it considers legislation associated with planned updates to the CVFPP and the associated financing/funding plan recommendations.

Below is an abbreviated excerpt from Section 3.13.1 of California's Flood Future Report of November 2013 that suggests levee improvements in the Delta should be orchestrated with improving the conveyance of SWP and CVP water through the Delta to areas south of the Delta where water demands are significantly greater than available water supplies south of the Delta.

> "The Sacramento-San Joaquin Delta provides a major source of water supply to more than 60 percent of California residents and is a vital source of water supply for agriculture. The Delta is a unique place defined by its ecological value as the transitional ecosystem from fresh to salt water and by its extensive levee system *(including SPFC levees in the north Delta and several non-SPFC levees in the central and south Delta that convey water to the SWP and CVP pumps in the south Delta)*. The Delta consists of approximately 70 major islands and tracts encompassing approximately 700,000 acres located behind levees. Virtually all assets and attributes of the Delta are dependent upon this large levee system. The levees reduce flood risk to land areas near and below sea level and provide for a network of channels that direct movement of *(SWP and CVP)* water across the Delta. The State of California has significant interest in the benefits provided by Delta levees, which have been legislated in the California Water Code (§ 12981, for example).
>
> The Delta is unique, not only as a levee system but also as an influence on existing DWR flood management programs within the Delta. The Delta is a prime example of why Integrated Water Management (IWM) is important in California. Due to its location, importance for much of California's water supply, deteriorating ecosystem conditions, questions about levee integrity and feasibility for improvements, and other issues, flood management cannot be considered in isolation of other resource needs. The importance of the Delta and its levees to the State has been included many times in legislation and codes. In addition, multiple Federal and State processes are underway to solve a variety of resource management problems in the Delta, and several include consideration of levee improvements or other flood management actions. These plans, *including the DCA's current efforts that consider a single-purpose isolated conveyance facility* and the Delta Stewardship Council (DSC) Delta Plan, *may* alter Delta conditions and will influence the future of IWM in the Delta. Implementation of these programs would alter ecosystem conditions and water

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infrastructure, which would influence Delta flood risk; therefore, flood management in the Delta needs to be considered as part of these larger planning efforts."

Given the above perspective within California's Flood Future Report there should be a larger financial interest in reducing flood risks in Delta by the USACE, USBR, FEMA, DWR, CVFPB, and Delta water users south of the Delta. This holds true particularly for improving the SPFC levees in the subject north Delta Legacy Community study areas adjoining the SWP and CVP freshwater conveyance corridor along the Sacramento River upstream of the Delta Cross channel, and portions of both Snodgrass and Georgiana Sloughs immediately downstream of the Delta Cross Channel.

Other policy efforts that could potentially generate future State funding include the recommendations presented within the current Governor's Water Resiliency Portfolio Water Action Plan. These recommendations include providing support and expanding funding for Integrated Water Management Planning and Projects, creating incentives for multi-benefit projects, providing assistance to disadvantaged communities, and prioritizing funding to reduce flood risk and improve flood response. In addition to recommendations that could direct State funding to the region, the former Governor's Water Action Plan also identified recommendations that could make it easier to generate local funding including removing barriers to local and regional funding for water projects. One of the key concepts in the Water Action Plan called for the development of a water financing strategy that leverages various sources of water-related project funding and proposes options for eliminating funding barriers, including barriers to co-funding multi-benefit projects.

Table 7-6 provides a summary of potential State funding sources applicable to Delta Legacy Communities protected by SPFC levees. The State funding programs can fund both structural-based management improvements and non-structural flood risk reduction measures. The table outlines the general uses of the funding source and the attributes and applicability of the mechanism for flood management.

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Table 7-6: Potential State Funding Programs

Agency	Program Name (Acronym)	Program Summary	Status	Who is Eligible to Apply	Cost Share Range
State DWR	Delta Special Projects	Cost share grant program for levee maintaining agencies in the Delta to rehabilitate non-SPFC and eligible SPFC levees.	Ongoing	LMA's within the Primary and Secondary Zones of the Legal Delta and limited areas within the Suisun Marsh.	75 to 95% Up to 100% for Habitat Projects
State DWR	Delta Levees Subventions	Cost share program for the maintenance and rehabilitation of non-SPFC and eligible SPFC levees in the Delta.	Ongoing	LMA's within the Primary and Secondary Zones of the Legal Delta.	Up to 75%
State DWR	Flood System Repair Projects (FSRP)	Evaluate (feasibility), design, and construct repairs of non-urban SPFC Facility (levees, channels, structures, etc.) deficiencies	Phasing Out	Eligible applications are local public agencies or Joint Powers Authority	50 to 90%
State DWR	Small Community Flood Risk Reduction Program (SCFRRP)	Projects to reduce flood risk in small, rural, and agricultural communities in the Central Valley. Funds support non-routine O&M, O&M plan updates, evaluations, feasibility studies, design, and construction of proactive repairs to flood control facilities of the SPFC and appurtenant non-SPFC levees.	Current	Local agencies: evaluate SPFC facilities must protect small and rural communities in the Central Valley designated by the CVFPP to have a High or Moderate-High Flood Threat Level.	50 to 90%
State-California Natural Resource Agency	California River Parkways Program	The Proposition 50 California River Parkways Grant Program in the Resources Agency is a competitive grant program for river parkways projects.	Ongoing	Public Agencies and California Nonprofit Organizations	50 to 90%
State DWR	Proposition 68	Proposition 68 authorizes $4.1 billion for state and local parks, natural resources protection, climate adaptation, water quality, and flood protection.	Ongoing	Public agencies, non-profit organizations, public utilities, Native American Tribes, and mutual water companies	50% Up to 100% for DACs
State DWR	Flood Maintenance Assistance Program	Program that provides State funds for eligible maintenance activities to Local Maintaining Agencies and Maintenance Areas.	Ongoing	Local Maintaining Agencies	50 to 75%

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Agency	Program Name (Acronym)	Program Summary	Status	Who is Eligible to Apply	Cost Share Range
State IRWM	Integrated Regional Water Management (IRWM)	Grant funds for development and revisions of IRWM Plans, and implementation of projects in IRWM Plans. Goals of Projects: to assist local public agencies to meet long- term water management needs of the State.	Ongoing	Applicant must be a local public agency or nonprofit representing an accepted IRWM Region. Other IRWM partners may access funds if their projects are identified in the Applicable IRWM Plan	Up to 75%

7.7.3 Local Cost Share Financing and Assessment Strategies

The cities, counties, LMAs and the regional flood management agencies have played a significant part in funding the local share of flood management improvements and operations and maintenance. Funding by local agencies within the region is largely limited due to constitutional and statutory constraints to the way local governments can fund and finance capital improvements and services. As noted previously, Attachment I to California's Flood Future Report provides a detailed description of funding mechanisms available to local agencies to fund flood management improvements. In general, revenues for flood management within the North Delta are generated mostly by RDs or LMAs from property-based taxes, fees and assessments. In California, a local agency's ability to provide ongoing services and invest in its infrastructure is limited by voter-approved initiatives, such as Proposition 13 (1978) (limiting property tax increases) and Proposition 218 (1996) (requiring voter approval for new assessments) as previously discussed above in Constraints Sections 3.3.1 and 3.3.2.

Limited Availability of Local Funding Sources

Presently the RDs and LMAs in the North Delta largely assess O&M and repair of the levee systems on an agricultural acreage basis, and do not necessarily assess on a land improvement basis that accounts for residential, commercial, or industrial structures. The acreage-based only assessment approach is in large part due to the assessment constrictions presented by Proposition 218 as further discussed above in Section 3.3.2. An exception to the acreage-only assessment in the North Delta is RD 563 - Tyler Island who experienced flooding in 1986 and has had subsequent flood fights in 2007 and 2017. RD 563 (encompassing a portion of the East Walnut Grove study area) successfully executed a Proposition 218 benefit assessment in the early 2010's. Following their detailed Proposition 218 benefit assessment study RD 563 now assesses anywhere from $45 to $65/year for agricultural acreage, $550 to $600/year for residential structures, and anywhere from $1,000 to $1,500/year for commercial/industrial groupings of multiple structures, all dependent upon the benefit received from maintenance, repair and improving the levee system designed to eliminate or reduce variable flood depths

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within RD 563. To improve the local cost-sharing participation by the Delta Legacy Communities for smaller community-specific flood risk reduction measures such as a flood fight berm, a ring levee, or a cutoff levee system for the community of East Walnut Grove within the larger combined basin of RDs 554 and 563, it is recommended that the community of East Walnut Grove assess themselves on a combined acreage- and structural-benefit basis, similar to RD 563. A benefit assessment study to support improvements that only benefit the community and not the balance of the larger study area (RDs 554 and 563) will be likely be required; and it may be advisable for the community to consider the development of a GHAD that could also incorporate a community-based flood insurance program. The community-based flood insurance program coupled with the suggested structural-improvement assessment approach can further enhance the community's ability to buy-down known flood risks (*see* Appendix J regarding a community-based flood insurance program for the Delta Legacy Communities in Sacramento County coupled with a community benefit assessment to generate local cost-share funds and assist with financing flood risk reduction measures).

Table 7-7 provides a summary of the local funding methods used by many agencies in California and the region to fund flood management improvements and services. The table describes the general uses of the funding source and the attributes and applicability of the mechanism for flood management. Included within these sources, many LMAs and RDs within the Delta, such as RDs 554 and 563 where the community of East Walnut Grove is located, fund ongoing O&M and repairs of levees via the Delta Levee Subventions program and/or the Delta Levees Special Projects, both of which are administered by DWR. These programs are reimbursement based administered by DWR and have minimum deductible cost per levee mile, and can include substantial local, up-front cost-share cashflow requirements. Thus, it is important to the communities within the existing RDs to know that they may need to assist with said RD levee improvements that provide direct and/or indirect flood risk reduction benefits to the community.

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Table 7-7: Potential Local Funding Programs and Assessment Strategies

Potential Local Funding Programs and Assessment Strategies						Pros, Cons, and Notes		
Item	**Use**	**Voter Approval**	**Bonds Allowed**	**Long/ Short Term**	**Entity**	**Pro**	**Con**	**Notes**
Geological Hazard Abatement Districts (GHAD)	O&M/ Capital Improvements	50% of Property Assessed	Yes	Long-Term	Independent District / Community	Broad scope of works, locally autonomous, Simple Majority Approval, Ongoing Funding Source. Some CEQA exemptions	Must prepare Plan of Control. Creates new responsible independent entity (similar to JPA), Prop 218 applies with respect to assessments levied.	Alternative to RD. Can fund reserves & Community-Based Insurance Program
Various Water Code Sections	O&M/ Capital Improvements	50% by Property Assessed	No	Long-Term	RDs & Community	Simple Majority Approval, Ongoing Funding Source	Applicability of Prop 218 - Must Show Benefit	Can fund maintenance or capital works. Can be used to finance improvements.
Benefit Assessment District Act of 1982	O&M/ Capital Improvements	50% of Property Assessed	No	Long-Term	Flexible	Simple Majority Approval, Ongoing Funding Source	Must Show Benefit Improvements/Services must be within the Boundary	Could provide some reimb. of Advance Funding
Municipal Imprvmt. District Act of 1913/1915	Capital Improvements	50% of Property Assessed	Yes	Long-Term	Flexible	Simple Majority Approval, Ongoing Funding Source	Must Show Benefit Improvements/Services must be within the Boundary	Could provide some reimb. of Advance Funding
Community Facilities Districts	O&M/ Capital Improvements	2/3's (See Note)	Yes	Long-Term	Flexible	Benefit not Needed, Flexible in Forming District, Improvements located anywhere	2/3 Approval Difficult to Obtain	Voting requirements change depending on presence of registered voters within boundary.
Advance Funding	Planning & Capital Improvements	NA	NA	Short-Term	N/A	Can cover upfront planning and operations costs	Limited/Uncertain Availability	Could be subject to reimb. from various sources over time.

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7.8 Financial Feasibility and Local Cost Share Requirements for Key Management Actions

7.8.1 Financial Feasibility Summary Utilizing EAD Evaluations

The net reductions in EAD and financial feasibility values (in pay-back periods) for most of the key recommended short-term and long-term structural-based management actions are described above in Section 6.3.1.2. The evaluations, inventory values, and methodology are presented in Appendix E.

The summary of the EAD results indicating net reductions in EAD values and the return period(s) of investment (in years) for various structural based management actions are summarized in Table 6-5 for existing conditions without climate change adjustments, and Table 6-6 for future conditions that include adjustments for climate change.

The EAD values in Table 6-5 under existing conditions indicates there is a great net reduction in EAD values in the amount of $3.7M that could result from Management Actions 6A or 6B (all-weather access road/flood fight berm in RD 563 with and without road widening along Walnut Grove-Thornton Road). At an estimated cost of $2.8M-$5.3M, the payback period ranges between nine months and nearly one-and-a-half years. The challenge with implementing Management Actions 5, 11, or 12, with longer payback periods is the benefit area(s) coming up with the local cost-share components from not only the combined RDs, but also from the limited amount of citizens and businesses residing in the community of East Walnut Grove who will benefit from said repairs or improvements.

Long-term Management Action 5 (securing 100-year FEMA certification the portion of East Walnut Grove within RD 554), Management Action 11 (securing 100-year FEMA certification the portion of East Walnut Grove within RD 563), and Management Action 12 (FEMA certification of the entire East Walnut Grove study area) are estimated at up to $29M, $39M, and $67M, respectively, with payback periods ranging between eight to 10 years.

7.8.2 Local Cost Share Financing and Assessment Strategies

Implementing any of the above management actions, including the flood risk reduction measure of implementing a simple access road/flood fight berm around the community (Management Actions 6A or 6B) with a payback period estimated between nine months and one-and-a-half years, will still require a local cost share of at least 5 to 10 percent. This could be a large challenge, particularly if said management actions do not provide a direct benefit to the balance of the larger 740-acre study area beyond just the immediate, developed community area of East Walnut Grove. Assessments can only be levied where there is direct benefit received from any one of the proposed management actions.

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For management actions benefiting the entirety of the study area totaling approximately 740 acres there still is a challenge with developing the required local cost-share to participate in the noted federal and State grant programs identified above in Sections 7.7.1 and 7.7.2. Assuming that 80 percent of a local cost-share could be financed with the other 20 percent acquired in accumulated proceeds from an assessment, only one to two percent of the total cost of each management action will be required from the community of East Walnut Grove to potentially secure long-term financing for each said management actions. As described above in Section 7.7.3, this local cost share could be generated through a conventional acreage-based assessment commonly deployed by RDs 554 and 563, as well as a structural benefit basis within RD 554, similar to what RD 563 accomplished on Tyler Island in the early 2010's with their Proposition 218 benefit assessment to fund substantial levee repairs/improvements.

The local cost share for the all-weather access road/flood fight-berm in RD 563 (Management Actions 6A and 6B) could be generated through an acreage assessment paired with a structural benefit assessment for the limited portion of East Walnut Grove located within RD 563. By assessing the total acreage of East Walnut Grove located within RD 563 (290 acres) at $15 per acre, an estimated $4,350 per year could be generated. Similarly assessing residential, commercial, and industrial structures within the community of East Walnut Grove in RD 563, at $300 per residential structure and $400 per commercial or industrial structure (to be refined in more detailed during a benefit assessment study), an assessment of $10,300 per year could be generated. With these assessments totaling $14,650 per year, it would take 2 years to acquire cash to secure local cost share financing for the all-weather access road/flood fight berm, and another 8 years to pay back the financed amount. These payback periods could be doubled if a 10 percent cost share requirement is needed instead of the nominal 5 percent local cost-share scenario that is presented in Table 7-8.

Similarly, the local cost share for securing 100-year FEMA certification for just the portion of East Walnut Grove within RD 554 (Management Action 5, inclusive of MAs 1-4) could also be generated through a combined acreage-based assessment and a structural benefit assessment. By assessing the total acreage of East Walnut Grove located within RD 554 (450 acres) at $20 per acre, an estimated $9,000 per year could be generated. Assessing structures within the community of East Walnut Grove in RD 554, at $400 per residential structure and $600 per commercial or industrial structure (to be refined in more detailed during a benefit assessment study), an assessment of up to $105,000 per year could be generated. With these assessments totaling $114,000 per year, it would take 2.5 years to acquire enough cash to secure local cost share financing to secure 100-year FEMA accreditation for the RD 554 portion of East Walnut Grove, and another 10-plus years to pay back the financed amount. These payback periods could be doubled if a 10 percent cost share requirement is needed instead of the nominal 5 percent local cost-share scenario that is presented in Table 7-8.

East Walnut Grove, similar to nearby Locke, are both considered Disadvantage Communities (DACs) with their median household incomes below 80% of California's median household income value. With their DAC status, and with the introduction of multi-benefits associated with

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select management actions, the community's cost share requirements could quite possibly drop to only 5% as presented in the Table 7-8. Unfortunately even at a low cost-share requirement of just 5% it appears as if it could be very challenging to finance the local portion of a cross levee system within RD 563 (MA 11) with the local cost-share payback periods exceeding 100-years as noted in Table 7-8. Thus, there needs to be a long-range financial plan developed by the community of East Walnut Grove and the greater North Delta interests on how they can seek additional funds to partner with other benefiting agencies, but also for improving the collective study area SPFC and non-SPFC levee segments if it is ultimately desired to have most or all of the study area meet FEMA's current 100-year levee accreditation standards.

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Table 7-8: Conceptual Financial Analysis of East Walnut Grove Local Cost-Share Assessments and Local Pay-Back Periods for Select Management Actions

		Management Action (MA)				
		Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554 (**MA 5, inclusive of MA 1-4**)	All-Weather Access Road/Flood Fight Berm in RD 563-URB (**MA 6A**)	All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut-Grove Thornton Road in RD 563-URB (**MA 6B**)	Secure 100-Year FEMA Certification for the RD 563-URB Portion of the Study Area with Cross Levee System (**MA 11, inclusive of MA 7-10**)	Secure 100-Year FEMA Certification for the Entire East Walnut Grove Study Area (**MA 12, inclusive of MA 1-5 & MA 7-11**)
Estimated Cost (Low)		$29,063,000	$2,898,000	$5,338,000	$38,956,000	$67,112,000
Estimated Cost (High)		$29,063,000	$2,898,000	$5,338,000	$38,956,000	$67,112,000
Net Reduction in EAD to East Walnut Grove Study Area, Existing Conditions		$3,474,000	$3,724,000	$3,724,000	$3,838,000	$7,313,000
Net Reduction in EAD to East Walnut Grove Study Area, Future Conditions		$16,851,000	$11,589,000	$11,589,000	$12,663,000	$29,514,000
Flood Risk Reduction Payback Period (in Years: Future – Existing Conditions)		1.7 to 8.4 years	0.3 to 0.8 years	0.5 to 1.4 years	3.1 to 10.1 years	2.3 to 9.2 years
Local Responsibility (Lead **Assessed**/Support)		**RD 554, Community of East Walnut Grove**	**Community of East Walnut Grove in RD 563-URB**	**Community of East Walnut Grove in RD 563-URB**	**Community of East Walnut Grove in RD 563-URB**	**RDs 554/563-URB, Community of East Walnut Grove**
5% Local Cost Share Scenario	5% of Total Cost	$1,453,000	$145,000	$267,000	$1,948,000	$3,356,000
	80% Local Financed (4% Total Cost of MA)	$1,162,400	$116,000	$213,600	$1,558,400	$2,684,800
	20% Local Cash Needed (1% Total Cost of MA)	$290,600	$29,000	$53,400	$389,600	$671,200

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	Management Action (MA)				
	Secure 100-Year FEMA Certification for Portion of East Walnut Grove within RD 554 (**MA 5, inclusive of MA 1-4**)	All-Weather Access Road/Flood Fight Berm in RD 563-URB (**MA 6A**)	All-Weather Access Road/Flood Fight Berm and Road Widening along Walnut-Grove Thornton Road in RD 563-URB (**MA 6B**)	Secure 100-Year FEMA Certification for the RD 563-URB Portion of the Study Area with Cross Levee System (**MA 11, inclusive of MA 7-10**)	Secure 100-Year FEMA Certification for the Entire East Walnut Grove Study Area (**MA 12, inclusive of MA 1-5 & MA 7-11**)
Acreage Assessment[1]	$9,000	$4,350	$4,350	$4,350	$13,350
Residential Assessment[2]	$56,400	$1,500	$1,500	$1,500	$56,400 (RD 554) $1,500 (RD 563)
Commercial/Industrial Assessment[3]	$48,600	$8,800	$8,800	$8,800	$48,600 (RD 554) $8,800 (RD 563)
Total Annual Assessments	$114,000	$14,650	$14,650	$14,650	$128,650
Number of Years to Acquire Cash to Secure 5% local Cost-Share Financing	2.5 years	2.0 years	3.6 years	26.6 years	5.2 years
Number of Years to Pay Back Financed Amount	10.2 years	7.9 years	14.6 years	106.4 years	20.9 years
Total Payback Years	12.7 years	9.9. years	18.2 years	133.0 years	26.1 years

Notes: The assessed values indicated below are very preliminary in nature per acre and/or per the various structures. A full benefit assessment study will be needed to determine actual assessment values. Changing the acre-assessed values and and/or the structure benefit-assessed values will obviously impact the estimated pay back periods presented herein.

[1] Acreage assessment assessed at $20/acre for RD 554 (450 acres – RD 554); and $15/acre for RD 563-URB (290 acres - RD 563-URB)

[2] Residential assessment utilizes the total number of residential structures located within the community of East Walnut Grove from the 2022 CVFPP Update, assessed at $400 per structure in RD 554 and $300 in RD 563-URB (per residential structures of 141 structures in RD 554, and 5 in RD 563-URB)

[3] Commercial/industrial assessment utilizes the inventory of structures from the 2022 CVFPP Update, assessed at $600 per 81 commercial/industrial/public structures in RD 554 and $400 per 22 non-residential structures in RD 563-URB (to be refined later based upon benefit values, that can be partially based upon sq. ft. and elevation of structures, and maximum potential depth of flooding)

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8. Implementation of Recommendations

8.1 Implementation Schedule including Roles and Responsibilities

The community of East Walnut Grove, acting through Sacramento County with support from RDs 554 and 563, has the opportunity to significantly reduce flood risks to East Walnut Grove. East Walnut Grove, Sacramento County, and the noted RDs intend to accomplish this by repairing and strengthening-in-place the greatest known and documented weaknesses in the perimeter SPFC and non-SPFC levee system protecting the East Walnut Grove study area and potentially constructing an access road/flood-fight berm in RD 563 to further protect the community in the event a levee breach were to occur in the study area but outside of the community.

As its highest priorities, the community of East Walnut Grove would prefer to see the 0.9-mile-long levee along the left bank of the Sacramento River and Georgiana Slough within RD 554 (MA 1) and the 1.2-mile-long portion of the non-SPFC levee along Snodgrass Slough in RD 554 (MA 2) repaired and strengthened within the next five years, by 2026. Estimated at a cost of $9M (MA 1) and $11M (MA 2), these actions alone would not represent a substantial, incremental reduction in EAD values within the study area, but they would substantially reduce the potential for life loss if a levee breach were to occur at these locations.

Following MAs 1 and 2, the community would prefer to see the 0.8-mile-long portion of the non-SPFC levee along the Delta Cross Channel in RD 554 fortified also within the next 5 years to meet current FEMA accreditation standards (MA 3) at a cost of approximately of $6M. This action alone also would not represent a substantial, incremental reduction in EAD, but it would substantially reduce the potential for life loss or property damage if a levee breach were to occur at this location.

To achieve the noted reductions in flood risk the following recommendations include full development of the structural-based management actions, including improving the SPFC levee system to meet current, FEMA 100-year accreditation standards, advancing non-structural measures, and developing multi-benefits that will improve the reliability and resiliency of conveying SWP and CVP water in the North Delta adjoining and within the Delta Cross Channel. They are outlined and planned to secure financial assistance and concurrence with DWR, the CVFPB, the USACE, and the Delta Conservancy and to also to show consistency with Delta Plans administered by the DPC and the DSC. The following recommendations can be sequenced or phased in the order as listed below or amended based upon variable funding sources. However, it is recommended recommendations 1 through 5 below take priority for initiating all short-term structural-based management actions, with all other recommendations not tied to any specific phasing or prioritization, with several non-structural measures already partially implemented.

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1. Timely financial assistance and participation from DWR is needed in connection with executing repairs and improvements to the SPFC levee along the left bank of the Sacramento River and Georgiana Slough in RD 554 (MA 1). Short of DWR providing assistance and funding for the full repairs, DWR should consider providing assistance to the RDs to fund the design and permitting of repairs and improvements, based upon the initial findings and proposed remediation measures as identified by both DCC Engineering and Backburn Consulting. With DWR funding most or all of the initial design, permitting, and CEQA/NEPA documentation it would allow more time for the RDs and the community of East Walnut Grove to develop its applicable cost-share funds that may be necessary to actually implement the needed repairs.
2. Consistent with the approach outlined above associated with MA 1, RD 554 should also earmark nominal funds, with possible assistance from Sacramento County and the community of East Walnut Grove, to address the extent of repairs on the non-SPFC levee system in RD 554 along the right bank of Snodgrass Slough and the Delta Cross Channel. Funds should also be earmarked by RD 554 to fund the design, permitting and CEQA/NEPA documentation for the applicable repairs so the repairs are more shovel-ready when larger funding sources become available either through Delta Levees Special Projects and/or Subventions in addition to other grant programs that may be available.
3. The community of East Walnut Grove, with support from Sacramento County and the RDs, should seek funds via community block grants funds or other sources to fund a Proposition 218 election that may be required to raise local cost-share funds for developing the applicable local cost share for flood risk reduction actions that have community-specific benefits over and above those that are more beneficial to the larger RD basins and the East Walnut Grove study area. The community-specific flood risk management actions that could significantly reduce life loss and potential damages in East Walnut Grove due to flooding in the community include strengthening-in-place the Sacramento River and Georgiana Slough SPFC levee immediately fronting the community (MA 1). These community-specific levee improvements could be paired, as recommended, with an accompanying all-weather access road/flood-fight berm in RD 563 (MA 6b), which would require planning and financing beyond the current responsibilities of RDs 554 and 563. The local cost share of said community-specific flood risk reduction measures could also be partially funded via a community-based flood insurance program as another relatively near-term non-structural measure, as noted further below.
4. To implement MAs 1-3, which repair and strengthen the SPFC and non-SPFC levee system in RD 554, geotechnical explorations will be required in advance of preparing preliminary designs and advancing permits and supporting CEQA/NEPA documentation. It is recommended that the community, with the support of Sacramento County and others, work with RD 554 to identify potential funding sources and advance said geotechnical explorations, remediation designs, and environmental documents so this

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management action is closer to shovel-ready when funds may become more readily available.

5. The community of East Walnut Grove should work closely in the near-term with other Delta Legacy Communities in Sacramento County, particularly other DWR SCFRRP participants, including the city of Isleton, to establish a GHAD or HOA to advance a private, community-based flood insurance program that would effectively provide relief from the ever-increasing high NFIP rates and possibly support the implementation of the all-weather access road/flood-fight berm (MA 6b). The city of Isleton has taken the initial steps in developing a community-based flood insurance program, and it will be more cost effective (resulting in significantly lower insurance premiums than offered by the NFIP) if there were more nearby communities pooling their resources together and aggregating or spreading their potential flood losses over a larger pool of insureds. The timely development of said GHAD or HOA would not only serve to substantially reduce flood insurance rates, but it could serve as a vehicle to generate local cost-share funds to buy-down flood risks within the community that is currently assessed by RD 554 on an acreage only basis, *versus* a flood risk value tied to structure improvements and content values. The private, community-based flood insurance program could also fund regional programs or local cost-share requirements to buy-down risks at the regional level, including larger, long-term multi-objective components such as improving the entire SPFC levee reaches not only in the East Walnut Grove study area but also in the greater North Delta (Multi-Benefit MAs 1 and 9).

6. In connection with implementing the multiple-benefit elements of improving as many as 1.6 miles of SPFC levees (MAs 1 and 9) as well as 2.5 miles of non-SPFC levees directly adjacent to the DCC it is recommended that community representatives pool their resources together with other participating Delta Legacy Communities in the North Delta. Improving the SPFC levees to current, modern FEMA standards to address seepage, under seepage, and stability will also serve to improve the reliability and resiliency of conveying SWP and CVP water through the North Delta with or without the DCA's current tunnel and intakes proposal. The noted communities and regional stakeholders have been approached by the DCA regarding their Communities Benefits Program (CBP), and the Delta Legacy Communities have suggested improving the SPFC levee system, particularly upstream and adjacent to the DCC is necessary with or without the proposed DCA improvements. It is suggested that the community of East Walnut Grove and its neighboring Delta Legacy Communities, particularly in Yolo and Sacramento Counties, work with RFMP representatives, including Sacramento Area Flood Control Agency, West Sacramento Flood Control Agency, the CVFPB and DWR MA 9 to share and ideally implement their preferred alternative of how improving the limited number of SPFC levee miles in the North Delta along the Sacramento River in the North Delta will also improve the reliability and resiliency of conveying SWP and CVP water through the entire Delta, with or without the DCA's independent, isolated conveyance facility. The multi-benefit attributes of improving and modernizing the SPFC levee system in tandem

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with improving water conveyance through the Delta should also be presented and shared with the Delta Protection Commission, Delta Stewardship Council and the Delta Conservancy. See Appendix K for additional background information related to improving water conveyance through the Delta (including areas immediately adjacent to and adjoining the Cross Channel) in tandem with reducing flood risks to the Delta Legacy Communities within Sacramento County.

7. Concurrently with implementing the near- and long-term structural-based management actions, the community of East Walnut Grove, with assistance from Sacramento County, the two RDs and others, can implement the following non-structural measures to further reduce residual flood in the East Walnut Grove study area. All of the non-structural measures for implementation are described in more detail in Sections 5.2 and 7.3, and in Appendix H. The following non-structural solutions are highly recommended for implementation, some of which are already in the early stages of implementation:
    1. Flood Fight Berm or a Ring Levee System
    2. Voluntary Elevations of Structures
    3. Wet or Dry Floodproofing
    4. Flood Emergency Safety Plans
    5. Sacramento County OES Decision Support Tool
    6. Local Hazard Mitigation Plan and Relief Cuts
    7. Alternatives to FEMA's NFIP – Private, Community-Based Flood Insurance
    8. NFIP Flood Insurance Enhancements *via* AFOTF
    9. Mokelumne River Conveyance Improvements & State Island Overflow Area
    10. Improve FEMA's CRS Score for Sacramento County/Isleton
    11. Land Use Regulations and Limitations
    12. Improved Governance Between Neighboring LMAs/RDs
    13. SWIFs & Period Inspections with USACE
    14. Public Education/Public Awareness

8.2 Delta Regulatory Compliance, Delta Investment Priorities, and Additional Studies & Plans

8.2.1 DSC Consistency Determination Required with Delta Plan and Qualifying Covered Actions

The Sacramento-San Joaquin Delta Reform Act of 2009 (Delta Reform Act) established a certification process for demonstrating consistency with the Delta Plan. The Delta Reform Act requires any State or local agency proposing to undertake a qualifying action (covered action)

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must submit to the Delta Stewardship Council (DSC) a written certification of consistency with detailed findings as to whether the covered action is consistent with the Delta Plan (Wat. Code, § 85225). ***The certification of consistency needs to demonstrate the project or covered action is consistent with the Delta Plan's co-equals goals of providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem. The coequal goals are to be achieved in a manner that protects and enhances the unique cultural, recreational, natural resources and agricultural values of the Delta as an evolving place.***

As a component of demonstrating consistency of covered actions with the Delta Plan all levee projects must evaluate and where feasible incorporate alternatives, including the use of setback levees, to increase floodplains and riparian habitats. ***Evaluation of setback levees in the Delta shall be required along the Sacramento River between Freeport and Walnut Grove and other locations as shown in Appendix 8 of the Delta Plan.*** This Delta Plan policy considers construction of new levees or substantially rehabilitate or reconstruction of existing levee systems as covered actions. This policy language relative to expanding floodplains and riparian habitats in levee projects within the Delta was last amended by the DSC and included in the California Code of Regulations in 2019. Thus, prior to undertaking any substantial levee rehabilitation projects located between Freeport and Walnut Grove the project proponent, whether it is a local community, RD, LMA, or any other local/state entity, it should consult early with the DSC regarding the applicability of evaluating setback levee alternatives in tandem with substantial levee rehabilitation efforts as considered in this Feasibility Study Report; and then the project proponent should be prepared to file a consistency determination upon completion and adoption of the applicable final CEQA/NEPA documents.

8.2.2 Alignment with DSC's 3x3 Prioritization of State Investments in Delta Levees and Flood Risk Reduction

As previously highlighted in Section 4.1, the Delta Legacy Communities and their cost-share partners investing in substantial levee repairs, improvements, and rehabilitation efforts, including increased OMRR&R expenditures, should be structured as outlined in this feasibility study report, to be most responsive to the DSC's 3x3 Prioritization of State Investments in Delta Levees and Risk Reduction. The 3x3 prioritization table for levee investments is presented in Section 4 and is highlighted below in Table 8-1. The 3x3 table is highlighted below in five of the nine cells indicating that most structural-based management actions and non-structural measures proposed for implementation for the community of East walnut Grove are most responsive to the DSC's Prioritization of State Investments in Delta levees and risk reduction.

East Walnut Grove's Management Actions 1-3, consisting of the multi-benefit project of repairing and strengthening-in-place 0.9 miles of the SPFC levees along the Sacramento River and Georgiana Sloughs and 2.0 miles of non-SPFC levees within and directly adjacent to the Delta Cross Channel all within RD 554 also have the added benefit of improving the resiliency and reliability of the fresh water conveyance corridor aqueduct that conveys SWP and CVP water through the Delta. See Appendix K for additional background information related to improving water conveyance through the Delta (including areas immediately adjacent to and

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adjoining the Cross Channel) in tandem with reducing flood risks to the Delta Legacy Communities within Sacramento County.

Although not fully exhausted through this current feasibility study effort, it is recommended that East Walnut Grove and its cost-sharing partners further explore ecosystem conservation opportunities that may protect existing habitats and provide net enhancements to floodplain habitat in or nearby Snodgrass Slough or the Sacramento River.

Table 8-1: 3x3 Goals of the DSC for State Investment in Delta Integrated Flood Management.

Goals	Localized Network	Levee Network	Ecosystem Conservation
1	Protect existing urban and adjacent areas by providing 200-year flood protection.	Protect water quality and water supply conveyance in the Delta, especially levees that protect freshwater aqueducts and the primary channels that carry fresh water through the Delta.	Protect existing and provide for a net increase in channel-margin habitat.
2	Protect small communities and critical infrastructure of statewide importance (located outside of urban areas).	Protect floodwater conveyance in and through the Delta to a level consistent with the SPFC for project levees.	Protect existing and provide for net enhancement of the floodplain habitat.
3	Protect agriculture and local working landscapes.	Protect cultural, historic, aesthetic, and recreational resources (Delta as Place).	Protect existing and provide for net enhancement of wetlands.

8.2.3 Additional Ongoing Studies and Plans

CVFPP and Lower Sacramento-Delta North Regional Flood Management Plan (RFMP) Updates

Relief Cut Updates via Local Hazard Mitigation Plans (LHMP)

Great California Delta Trail Plan by DPC

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Appendix A-1: Existing Geotechnical Data of RD 554 SPFC and Non-SPFC Levee Segments – Blackburn Consulting, March 2020

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Appendix A-2: Preliminary Geotechnical Evaluation of RD 554 SPFC Levee Segment of Sacramento River and Georgiana Slough (Levee Segment 128) – Blackburn Consulting, August 2020

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Appendix A-3: Preliminary Geotechnical Mitigation Measures for RD 554 SPFC Levee Segment of Sacramento River and Georgiana Slough (Levee Segment 128) – Blackburn Consulting, September 2020

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Appendix A-4: RD 554 – East Walnut Grove Erosion Control and Riparian Bench Restoration Sacramento River Right Bank – DCC Engineering, October 19, 2020

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Appendix B: Biological Resources Constraints Assessment for the Community of East Walnut Grove

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Appendix C: Cultural Resources Records Search Results for East Walnut Grove, California

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Appendix D: Ecosystem Multi-Benefit Opportunities for the Sacramento County Delta Legacy Communities Small Communities Flood Risk Reduction Feasibility Studies

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Appendix E: Expected Annual Damages Technical Memorandum

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Appendix F: Cost Estimate Development for the Flood Risk Reduction Feasibility Study for Delta Legacy Community of East Walnut Grove, CA

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Appendix G: DPC, DSC and Delta Conservancy Master Comparison Matrix

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Appendix H: Identification of Non-Structural Elements for the Communities of Hood, Courtland, Locke, East Walnut Grove, and West Walnut Grove & Ryde Flood Risk Reduction Feasibility Studies

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Appendix I-1: Hydrology and Hydraulics Technical Memorandum for the North Delta Legacy Communities of Hood, Courtland, Locke, Walnut Grove (East), Ryde/Walnut Grove (West), and Isleton

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Appendix I-2: Technical Memo of WSEL Differences between 2016 FEMA BFE Values and CVFED Hydraulic Model Values with Delta Cross Channel Gates Opened or Closed for East Walnut Grove – GEI, August 2019

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Appendix J: Community-Based Flood Insurance Technical Memorandum

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Appendix K: Multi-Benefit Opportunities Identified to Reduce Flood Risks and Improve SWP Water Conveyance through the Delta by Sacramento County Delta Legacy Communities

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Appendix L: Reclamation District No. 563 Flood Fight Access Road and Cross Sections – KSN Engineers, July 2020

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Appendix M: Reclamation District No. 563 Walnut Grove Thornton Road Raising for Flood Fight Evacuation Route – KSN Engineers, November 2020

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