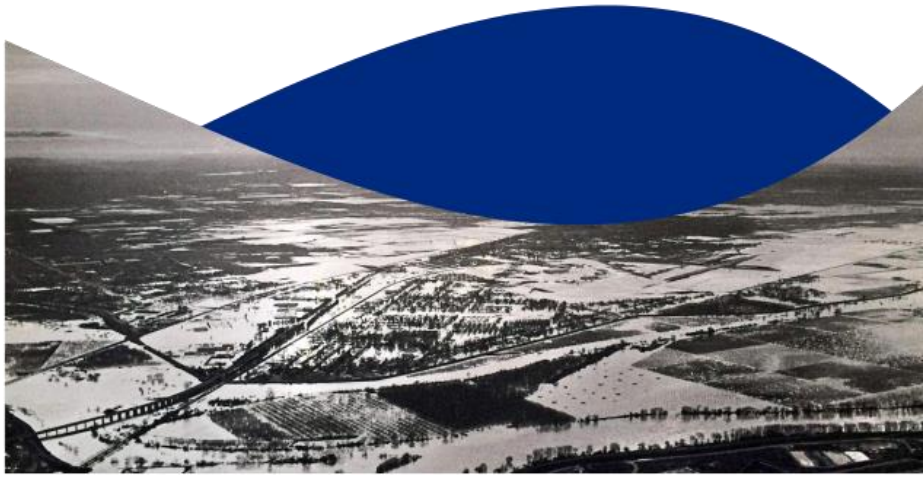
Sutter County
2021 Local Hazard Mitigation Plan Update
April 2021 Public Review Draft



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Executive Summary

This 2021 Local Hazard Mitigation Plan (LHMP) Update serves to update the 2013 Federal Emergency Management Agency (FEMA) approved Sutter County LHMP. The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards. Sutter County, two incorporated communities, and seven special districts prepared this LHMP Update to the FEMA approved 2013 Sutter County LHMP, in order to make the County and its residents less vulnerable to future hazard events.

This LHMP Update demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This LHMP Update was also developed, among other things, to ensure Sutter County and participating jurisdictions' continued eligibility for certain federal disaster assistance: specifically, the FEMA Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation Program (PDM), and the Flood Mitigation Assistance Program (FMA).

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses to insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated. The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from hazards.

LHMP Plan Development Process

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. This LHMP Update documents the hazard mitigation planning process and identifies relevant hazards and vulnerabilities and strategies the County will use to decrease vulnerability and increase resiliency and sustainability in the community.

This is a multi-jurisdictional plan with the following seeking approval of the plan by FEMA:

- Sutter County*
- City of Live Oak *
- City of Yuba City*
- Levee District 1*
- Levee District 9
- Reclamation District 70*
- Reclamation District 1001*
- Reclamation District 1500*
- Reclamation District 1660*
- Sutter Butte Flood Control Agency

* Participated in 2013 Sutter County LHMP

This LHMP Update was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. The County and all participating jurisdictions followed a planning process prescribed by FEMA as detailed in Table ES-1.

Table ES-1 Local Hazard Mitigation Planning Process

DMA Process	Modified CRS Process
1) Organize Resources	
201.6(c)(1)	1) Organize the Planning Effort
201.6(b)(1)	2) Involve the Public
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies
2) Assess Risks	
201.6(c)(2)(i)	4) Identify the Hazards
201.6(c)(2)(ii)	5) Assess the Risks
3) Develop the Mitigation Plan	
201.6(c)(3)(i)	6) Set Goals
201.6(c)(3)(ii)	7) Review Possible Activities
201.6(c)(3)(iii)	8) Draft an Action Plan
4) Implement the Plan and Monitor Progress	
201.6(c)(5)	9) Adopt the Plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan

The planning process began with the organizational phase to establish the Hazard Mitigation Planning Committee (HMPC) comprised of key County representatives, and other local and regional stakeholders; to involve the public; and to coordinate with other departments and agencies. A detailed risk assessment was then conducted followed by the development of a focused mitigation strategy by all participating jurisdictions or the Sutter County Planning Area. Once approved by Cal OES and FEMA, this LHMP Update will be adopted and implemented by the County and all participating jurisdictions over the next five years.

Risk Assessment

The HMPC conducted a risk assessment that identified and profiled hazards that pose a risk to the County and participating jurisdictions, assessed the vulnerability of the Sutter County Planning Area to these hazards, and examined the existing capabilities to mitigate them.

The Sutter County Planning Area is vulnerable to numerous hazards that are identified, profiled, and analyzed in this Plan. Floods, earthquakes, drought, levee failures, landslides, wildfires, and other severe weather events are among the hazards that can have a significant impact on the County. Table ES-2 details the hazards identified for this Sutter County LHMP Update.

Table ES-2 Sutter County Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Highly Likely	Limited	Low	–
Climate Change	Extensive	Likely	Limited	Medium	
Dam Failure	Extensive	Occasional	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Limited	High	High
Earthquake	Extensive	Unlikely	Catastrophic	Medium	Low
Floods: 1%/0.5%/0.2% annual chance	Extensive	Likely	Critical	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Limited	Medium	Medium
Levee Failure	Significant	Occasional	Catastrophic	High	Medium
Pandemic	Extensive	Likely	Critical	High	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Limited	Medium	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Medium	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Limited	Medium	Medium
Wildfire	Significant	Highly Likely	Limited	Medium	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Mitigation Strategy

Based on the results of the risk assessment, the participating jurisdictions and the HMPC developed a mitigation strategy for reducing the County's and all participating jurisdictions' risk and vulnerability to hazards. The resulting Mitigation Strategy for the Sutter County Planning Area is comprised of LHMP goals and objectives and a mitigation action plan which includes a series of mitigation action projects and implementation measures. Based on the risk assessment, the HMPC identified goals and objectives for reducing the Sutter County Planning Area's vulnerability to hazards. The goals and objectives of this multi-hazard mitigation plan are:

Goal 1: Minimize risk and vulnerability of the community to hazards and reduce damages and protect lives, properties, public health, and the environment in Sutter County

- Minimize economic and resource impact
- Minimize impact to both existing and future development
- Prevent and reduce flood-related losses
- Continue to improve integrity of levees
- Consider and address Climate Change influence on all hazards

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts

- Update and maintain list of critical facilities: Essential Services, At-Risk Populations, Hazardous Materials Facilities
- Protect and maintain evacuation routes

Goal 3: Improve public awareness, education, and preparedness for hazards that threaten our communities

- Enhance public outreach, education and preparedness program to include all hazards of concern
- Increase public knowledge about the risk and vulnerability to identified hazards and recommended responses to disaster events
- Improve public awareness and education and better prepare citizens for both sheltering in place and evacuations during emergencies
- Improve awareness of available resources (e.g., shelter locations, equipment, personnel)
- Increase public's awareness and involvement in communities' mitigation projects

Goal 4: Increase Sutter County's ability to be prepared for, respond to, and recover from a disaster event

- Improve interagency (local, state, federal) emergency coordination and communications to ensure effective community preparedness, response and recovery
- Improve accessibility and coordination of plans associated with disaster preparedness and response with local, state, and federal agencies and private partners
- Identify and prioritize risks; draft policies and training that support successful outcomes

- Protect and maintain continuity of operations and services during disasters
- Enhance the use of shared resources/Develop a strong mutual aid support system
- Enhance abilities to communicate and exercise outcomes with neighboring agencies in actual scenario-based training
- Effectively incorporate lessons learned in previous disaster response into future disaster planning
- Create (or expand) Levee Improvement Agency(ies) to plan for the future levee system improvements necessary to address risk reduction, FEMA accreditation, climate change resiliency, and other challenges

Goal 5: Maintain FEMA Eligibility/Position the communities for grant funding.

- Promote levee project partnerships between local agencies and state agencies (e.g., DWRs Maintenance Yards) to seek grants as some state agencies are ineligible to pursue state grants

Actions to support these goals are shown on Table ES-3.

Table ES-3 Sutter County Planning Area Mitigation Actions

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Sutter County						
Multi-Hazard Actions						
Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	Sutter County	2013 Action	X	X		Prevention
Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness	Sutter County and all jurisdictions	2013 Action	X	X	X	Public Information
Action 3. Digitize vulnerable and irreplaceable county records currently located in Sutter County Museum storage building	Sutter County and all jurisdictions	New Action	X	X	X	Prevention Property Protection Public Information
Action 4.						
Action 5.						
Action 6.						
Action 7.						
Action 8.						
Action 9.						
Action 10.						
Action 11.						
Climate Change Actions NEED ACTIONS						
Action 12.						
Dam Failure, Flood: 1%, 0.5%, 0.2% annual chance, Flood: Localized Flood, Levee Failure, and Severe Weather: Heavy Rains and Storms Actions NEED ACTIONS						
Action 13.						
Action 14.						
Action 15.						
Drought & Water Shortage, Severe Weather: Extreme Heat, and Wildfire Actions NEED ACTIONS						

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 16.						
Earthquake Actions NEED ACTIONS						
Action 17.						
Pandemic Actions NEED ACTIONS						
Action 18.						
Severe Weather: Extreme Cold Actions NEED ACTIONS						
Action 19.						
Action 20.						
City of Live Oak						
Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	City of Live Oak	2013 Action	X	X		Prevention
Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness	City of Live Oak	2013 Action	X	X	X	Public Information
NEED ACTIONS						
City of Yuba City						
Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	City of Yuba City	2013 Action	X	X		Prevention
Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness	City of Yuba City	2013 Action	X	X	X	Public Information
Action 3. Hazard Preparedness Public Outreach for Yuba City	City of Yuba City	New Action	X	X	X	Public Information
Action 4. Establish Backup Power Sources for Critical Facilities within Yuba City	City of Yuba City	2013 Action	X	X	X	Prevention Property Protection Emergency Services
Action 5. Emergency Operations Plan (EOP) for the City of Yuba City	City of Yuba City	New Action	X	X		Prevention Emergency Services

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 6. Enhance Infrastructure to Mitigate Against Climate-Driven Failures	City of Yuba City	New Action	X	X	X	Property Protection Structural Projects
Action 7. Geographic Information Systems (GIS) Update Project	City of Yuba City	New Action				Prevention
Action 8.Prepare a Study to Evaluate Climate-Driven Impacts on Infrastructure	City of Yuba City	New Action			X	Prevention
Action 9. Implementation of CRS Activities	City of Yuba City	New Action	X	X	X	Prevention Property Protection Structural Projects Natural Resource Protection Public Information Emergency Services
Action 10. 200-Year Flood Protection for Sphere of Influence Area	City of Yuba City	2013 Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 11. Alternative Methods to Dispose of Treated Wastewater	City of Yuba City	2013 Action	X	X	X	Property Protection Natural Resource Protection
Action 12. Relocation of Treated Wastewater Effluent Diffuser Line	City of Yuba City	2013 Action	X	X	X	Property Protection Natural Resource Protection
Action 13. Water Treatment Plant Intake Access Road and Intake Structure	City of Yuba City	New Action	X	X	X	Structural Projects
Action 14. Project Improvements to Decrease Localized Flooding	City of Yuba City	New Action	X	X	X	Prevention Property Protection Structural Projects Natural Resource Protection
Action 15. Feather River Habitat Restoration	City of Yuba City	2013 Action	X	X	X	Natural Resource Protection
Action 16. Levee Pipe Crossing Inspection and Reinforcement	City of Yuba City	New Action	X	X	X	Prevention Property Protection Structural Projects
Action 17. Aquifer Storage and Recovery Well Development	City of Yuba City	New Action	X	X		Property Protection Structural Projects

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 18. Develop additional water supplies	City of Yuba City	New Action	X	X		Property Protection Natural Resource Protection
Action 19. Project to Reduce Localized Vulnerability to Sewer System Overflows	City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 20. Fuels Mitigation for High-Risk Wildland Urban Interface (WUI) Areas	City of Yuba City	New Action	X	X		Property Protection Natural Resource Protection
Levee District 1						
Action 1. Access Control	LD 1, unincorporated Sutter County	New Action	X	X	X	Prevention Property Protection Natural Resource Protection Emergency Services
Action 2. Erosion Mitigation at Levee District 1 – Sutter (LD1S) (Various sites; including those near Morse Road, Sullivan Pump, Singh Ranch Bend, and location where river takes an abrupt turn or bend)	LD 1, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection
Reclamation District 70						
Action 1. Water Hyacinth in West Burrow Canal Sutter Bypass	RD 70, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection
Action 2. Prepare for Higher Precipitation	RD 70, unincorporated Sutter County	New Action	X	X	X	Prevention Property Protection Natural Resource Protection
Action 3. Complete Projects from the CVFPP 2022 Update	RD 70, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Reclamation District 1001						
Action 1. Flood Potential from Overgrowth River Bottoms, River Fronts and Levee Sides	RD 1001, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 2. Drainage Canal Cleaning (Sediment and Aquatic Plant Life)	RD 1001, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection
Action 3. Feather River: Seepage, Stability, and Erosion	RD 1001, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 4. Public Signage	RD 1001, unincorporated Sutter County	New Action	X	X		Prevention
Action 5. Controlled Burn or Physical (mechanical) Maintenance of Overgrown (Vegetation) Areas	RD 1001, unincorporated Sutter County	New Action	X	X		Prevention Property Protection
Action 6. Levee access (Maintenance, Monitoring and Emergency)	RD 1001, unincorporated Sutter County	New Action	X	X		Prevention Property Protection Emergency Services
Reclamation District 1500						
Action 1. Karnak Pump Station Rehabilitation	RD 1500, unincorporated Sutter County	New Action	X	X	X	Structural Projects
Action 2. Sacramento River East Levee Improvements	RD 1500, unincorporated Sutter County	New Action	X	X	X	Structural Projects
Action 3. Sediment and Invasive Species Removal	RD 1500, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection
Action 4. Levee Penetration and Encroachments Improvements	RD 1500, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects
Action 5. Sutter Bypass West Levee Improvements	RD 1500, unincorporated Sutter County	New Action	X	X	X	Structural Projects

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 6. Complete Projects from the CVFPP 2022 Update	RD 1500, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Reclamation District 1660						
Action 1. Complete Projects from the CVFPP 2022 Update	RD 1500, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
NEED ACTIONS						
SBFCA						
Action 1. Sutter Bypass Multi-Benefit Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 2. Feather River and Sutter Bypass Erosion Repairs	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 3. Levee Penetration and Encroachments Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 4. Lower Feather River West Levee Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 5. Sutter Bypass East Levee Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 6. Oroville Wildlife Area Multi-Benefit Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 7. Sediment and Invasive Species Removal	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Natural Resource Protection
Action 8. Dam Failure Risk Reduction	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 9. Earthquake Risk Reduction	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects
Action 10. Levee Penetration and Encroachments Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 11. Lower Feather River West Levee Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 12. Sutter Bypass East Levee Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Levee District 9						
Action 1. Access Control	LD 1, unincorporated Sutter County	New Action	X	X	X	Prevention Property Protection Emergency Services
Action 2. Erosion Mitigation at Levee District 9	LD 1, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection

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Annex H: Sutter Butte Flood Control Agency

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Appendices

Appendix A: Planning Process

Appendix B: References

Appendix C: Mitigation Strategy

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Appendix F: Critical Facilities

Abbreviations and Acronyms

Acronym	Definition
AB	Assembly Bill
ACS	American Community Survey
APG	Adaptation Planning Guide
APN	Assessor Parcel Numbers
AQI	Air Quality Index
BAM	Best Available Map
BCEGS	Building Code Effectiveness Grading Schedule
BLM	Bureau of Land Management
BRACE	Building Resilience Against Climate Effects
BRIC	Building Resilient Infrastructure and Communities
CAC	Community Assistance Contact
CAISO	California Independent System Operator
CBC	California Building Code
Cal DWR	California Department of Water Resources
Cal OES	California Office of Emergency Services
CAS	Climate Adaptation Strategy
CAV	Community Assistance Visit
CCHPR	Climate Change and Health Profile Report
CCSM3	Community Climate System Model Version 3
CDAA	California Disaster Assistance Act
CDC SVI	Center for Disease Control Social Vulnerability Index
CDFA	California Department of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Health
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CGS	California Geological Survey
CNNDB	California Natural Diversity Database
CNPS	California Native Plant Society
CNRA	California Natural Resource Agency
CPUC	California Public Utilities Commission
CRS	Community Rating System
CRV	Contents Replacement Values
CVP	Central Valley Project

Acronym	Definition
DAC	Disadvantaged Community Status
DFIRM	Digital Flood Insurance Rate Map
DMA	Disaster Mitigation Act
DSOD	Division of Safety of Dams
EF	Enhanced Fujita
EOP	Emergency Operations Plan
ESF	Emergency Support Function
F	Fujita
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHSZ	Fire Hazard Severity Zones
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FMMP	Farmland Mapping and Monitoring Program
FRA	Federal Responsibility Area
FRAP	Fire and Resource Assessment Program
GFDL	Geophysical Fluid Dynamics Laboratory
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GRASP	Geospatial Research, Analysis & Services Program
HMGP	Hazard Mitigation Grant Program
HMPC	Hazard Mitigation Planning Committee
IBC	International Building Code
ICC	Increased Cost of Compliance
IPCC	Intergovernmental Panel on Climate Change
IRC	International Residential Code
IRWM	Integrated Regional Water Management
LAFCO	Local Agency Formation Commission
LOMA	Letter of Map Amendment
LOMR	Letter of Map Revision
LHMP	Local Hazard Mitigation Plan
LRA	Local Responsibility Area
MERS	Middle East Respiratory Syndrome
MHDP	Multi-Hazards Demonstration Project
MHI	Median Household Income
MMI	Modified Mercalli Intensity

Acronym	Definition
MPH	Miles Per Hour
MSL	Mean Sea Level
MW	Megawatts
NBHCP	Natomas Basin Habitat Conservation Plan
NCDC	National Climactic Data Center
NDMC	National Drought Mitigation Center
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NIDIS	National Integrated Drought Information System
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NWS	National Weather Service
OES	Sutter County Office of Emergency Services
OHP	Office of Historic Preservation
PA	Public Assistance
PDM	Pre-Disaster Mitigation
PG&E	Pacific Gas and Electric
PM	Particulate Matter
PNAS	Proceedings of the National Academy of Sciences
PSPS	Public Safety Power Shutoff
RCP	Representative Concentration Pathways
RL	Repetitive Loss
SAC-SJ	Sacramento-San Joaquin
SB	Senate Bill
SBA	Small Business Administration
SDAC	Severely Disadvantaged Community
SFHA	Special Flood Hazard Area
SGMA	Sustainable Groundwater Management Act
SH	State Highway
SR	State Route
SRA	State Responsibility Area
SRL	Severe Repetitive Loss
SWP	State Water Project
UBC	Uniform Building Code
UCERF	Uniform California Earthquake Rupture Forecast
ULOP	Urban Level of Flood Protection
URM	Unreinforced masonry

Acronym	Definition
USACE	US Army Corps of Engineers
USDA	US Department of Agriculture
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WHO	World Health Organization
WSOC	Wildfire Safety Operations Center
WRCC	Western Regional Climate Center
WUI	Wildland Urban Interface

Chapter 1 Introduction

1.1 Purpose

Sutter County, two incorporated communities, and seven special districts prepared this Local Hazard Mitigation Plan (LHMP) Update to the Federal Emergency Management Agency (FEMA) approved 2013 Sutter County LHMP. The purpose of this LHMP Update is to guide hazard mitigation planning to better protect the people and property of the County from the effects of hazard events. This LHMP Update demonstrates the community's commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources. This LHMP Update was also developed, among other things, to ensure Sutter County and participating jurisdictions' continued eligibility for certain federal disaster assistance: specifically, the FEMA Building Resilient Infrastructure and Communities (BRIC), Hazard Mitigation Grant Program (HMGP), and the Flood Mitigation Assistance Program (FMA).

1.2 Background and Scope

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially reflect the true cost of disasters, because additional expenses incurred by insurance companies and nongovernmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be reduced or even eliminated.

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $6 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2019 Report).

Hazard mitigation planning is the process through which hazards are identified, likely impacts determined, mitigation goals set, and appropriate mitigation strategies determined, prioritized, and implemented. This plan documents Sutter County's hazard mitigation planning process and identifies relevant hazards and vulnerabilities and strategies the County and participating jurisdictions will use to decrease vulnerability and increase resiliency and sustainability in the community.

This Sutter County 2021 LHMP Update is a multi-jurisdictional plan that geographically covers the entire area within Sutter County's jurisdictional boundaries (hereinafter referred to as the Planning Area). The following jurisdictions participated in the planning process and are seeking FEMA approval of the LHMP Update:

- Sutter County*

- City of Live Oak *
- City of Yuba City*
- Levee District 1*
- Levee District 9
- Reclamation District 70*
- Reclamation District 1001*
- Reclamation District 1500*
- Reclamation District 1660*
- Sutter Butte Flood Control Agency

* Participated in 2013 Sutter County LHMP

All plan participants from the 2013 Sutter County Plan are participating in this LHMP Update, save Gilsizer Drainage District which was absorbed into the County.

This LHMP Update was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act (DMA) or DMA 2000.) While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). This planning effort also follows FEMA's 2013 Plan Preparation Guidance. Because the Sutter County Planning Area is subject to many kinds of hazards, access to FEMA grant programs is vital.

Information in this LHMP Update will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community impacts and disruptions. The Sutter County Planning Area has been affected by hazards in the past and is thus committed to reducing future impacts from hazard events and maintaining eligibility for mitigation-related federal funding.

1.3 Community Profile

Sutter County lies in a portion of north central California known as the Sacramento Valley, approximately 40 miles north of Sacramento. Sutter County's boundaries are generally defined by Yolo and Colusa Counties to the west with the Sacramento River and Butte Slough forming the western boundary; Butte County to the north; Yuba and Placer Counties to the east with the Feather and Bear Rivers forming the eastern boundary; and Sacramento County to the south. The County encompasses approximately 607 square miles.

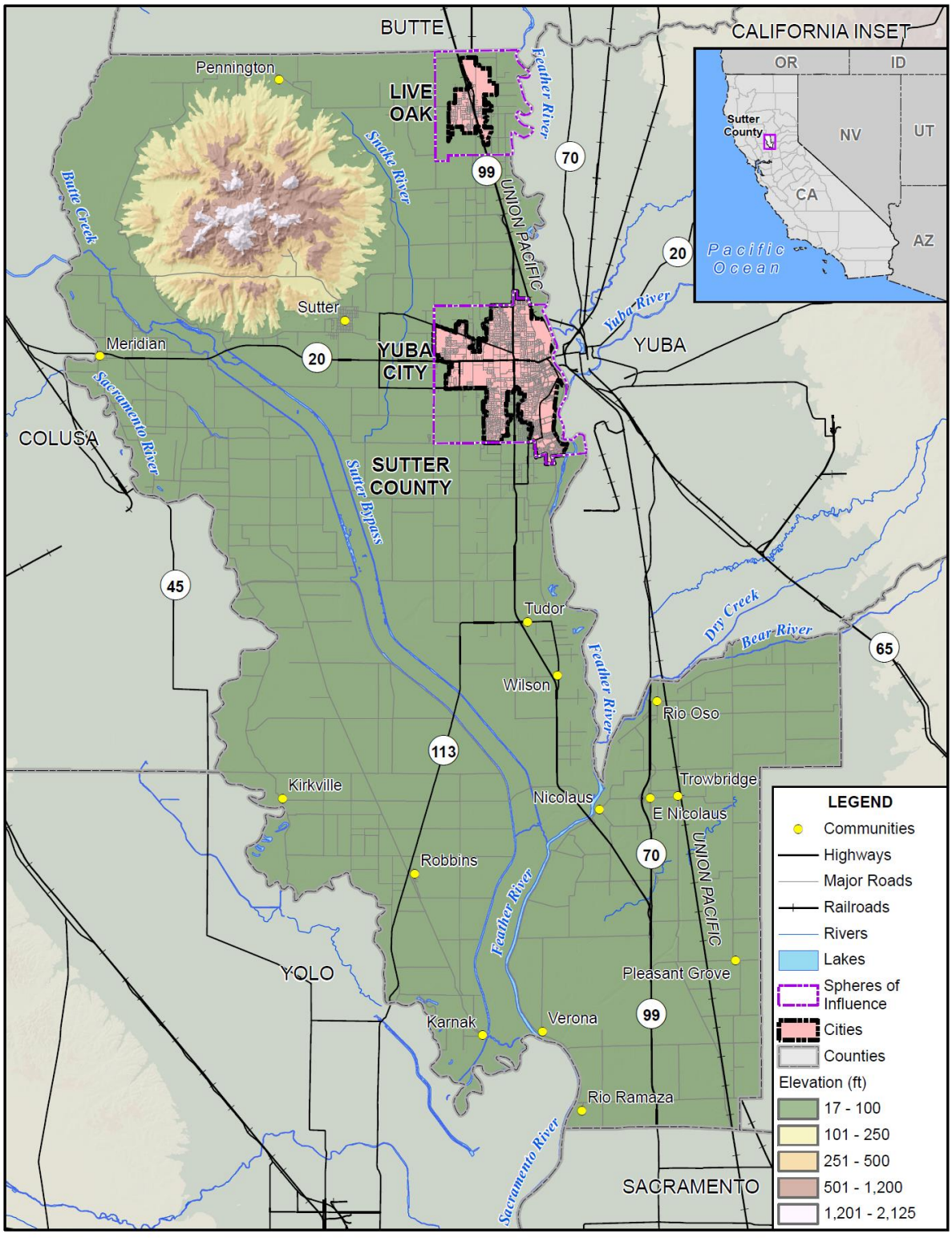
Sutter County includes two incorporated cities (the City of Yuba City and the City of Live Oak) and several unincorporated rural communities. A distinct "Yuba City Urban Area" exists which includes incorporated Yuba City, the unincorporated land area immediately surrounding the incorporated city limits (the urban

fringe), and Tierra Buena. 15 separate rural communities are also located within the unincorporated area of the County.

State Highway 99, which extends in a north-south direction through the County, defines the principal transportation corridor connecting the County to the region. State Route 20 is the principal east-west corridor between Highway 99 and Interstate 5.

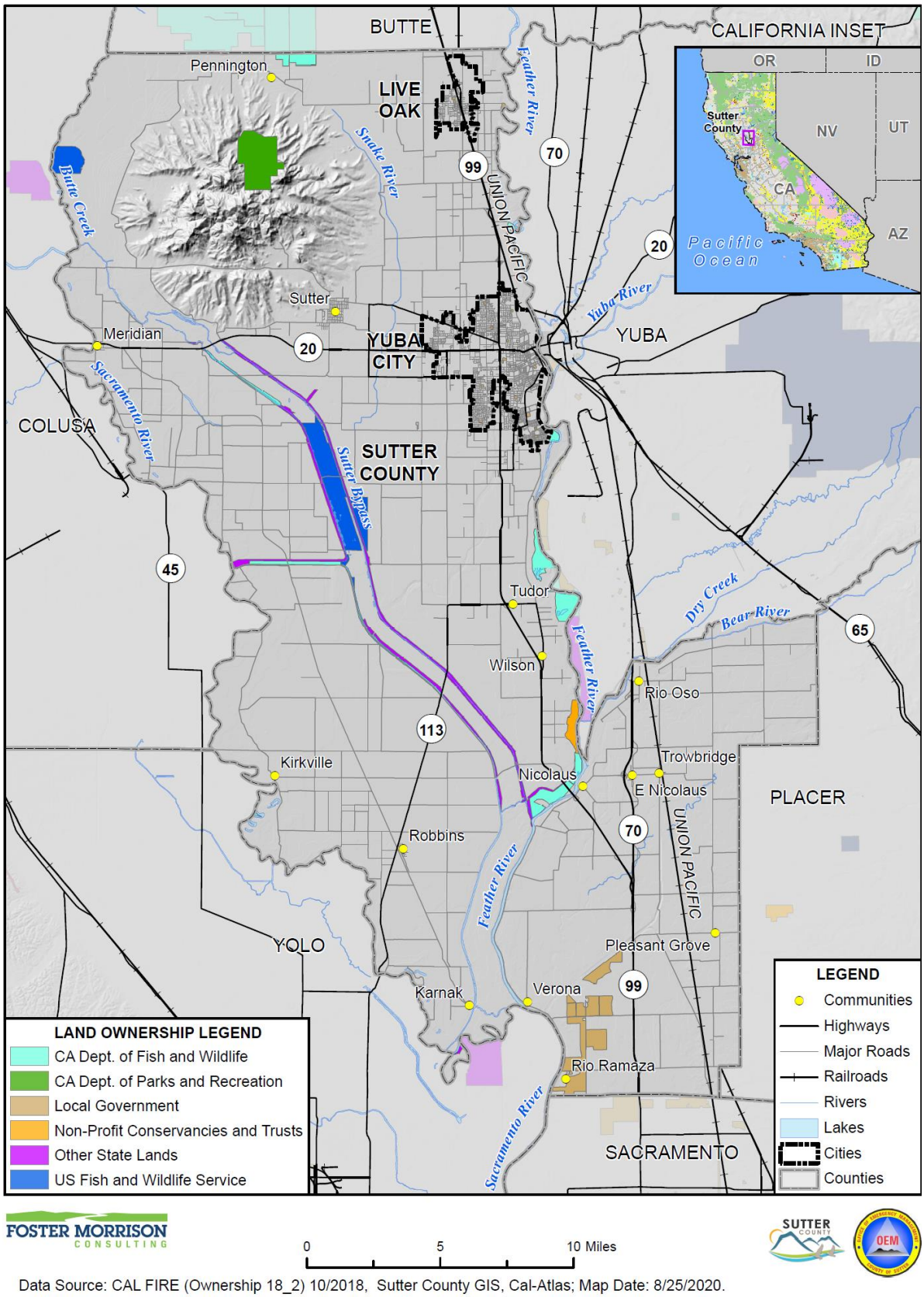
A map of the County is shown in Figure 1-1. Multiple entities own land in Sutter County. A land ownership map can be seen on Figure 1-2 and is detailed in Table 1-1.

Figure 1-1 Sutter County



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure 1-2 Sutter County – Land Ownership (non-private)



Data Source: CAL FIRE (Ownership 18_2) 10/2018, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table 1-1 Sutter County Planning Area – Land Ownership

Land Ownership / Jurisdiction	Total Acres	% of Total Acres
City of Live Oak		
Local Government	19	0.00%
Data Not Included	1,974	0.51%
City of Live Oak Total	**1,993**	**0.51%**
City of Yuba City		
CA Dept. of Fish and Wildlife	9	0.00%
Local Government	94	0.02%
Non-Profit Conservancies and Trusts	3	0.00%
Data Not Included	9,489	2.44%
City of Yuba City Total	**9,595**	**2.46%**
Unincorporated Sutter County		
CA Dept. of Fish and Wildlife	3,053	0.78%
CA Dept. of Parks and Recreation	1,769	0.45%
Local Government	2,344	0.60%
Non-Profit Conservancies and Trusts	358	0.09%
Other State Lands	2,675	0.69%
US Fish and Wildlife Service	3,273	0.84%
Data Not Included	364,485	93.57%
Unincorporated Sutter County Total	**377,958**	**97.03%**
Grand Total	**389,545**	**100.00%**

Source: CAL FIRE (2018), Sutter County GIS

1.3.1. History

In the early 1800's, the area now known as Sutter County was inhabited by the native Maidu Indians. Members of various Spanish expeditions in search of mission sites, and fur trappers lured by the abundant wildlife, traveled through in 1841. The bulk of the territory was deeded by the Mexican Government to the County's namesake, John Sutter. Established in 1842, John Sutter's Hock Farm was the first large-scale agricultural settlement in Northern California, composed of grain, cattle, orchards and vineyards.

Sutter County was incorporated by the California State Legislature on February 18, 1850, as one of the state's original 27 counties. At that time it included the southwest portion of what is now Placer County and a piece of what now belongs to Colusa County. Boundaries were fixed in their present locations around 1856.

The first County Seat was proclaimed by Senator Thomas J. Green to be "a noble city of broad streets, imposing buildings, and splendid public squares." He convinced the state to declare the land he had bought

from John Sutter, which he called "Oro," as the County Seat. However, Senator Green neglected to mention that the grand town of Oro existed only on paper and, in fact, only consisted of one 20 x 20 foot zinc building. Wanting more substantive County Seat, the town of Nicolaus, a bustling trading post and ferry crossing, was selected. After several short-term changes in location, in 1856 the people of Sutter County voted to proclaim Yuba City as the permanent County Seat.

1.3.2. Geography and Climate

The topography of Sutter County is comprised primarily of the gentle flatlands of the Sacramento River Valley at a general elevation of 17 to 100 ft above mean sea level. The only prominent topographic feature within the County is the Sutter Buttes, a Pliocene volcanic plug which rises abruptly 2,000 feet above the surrounding valley floor. Geographic features within Sutter County include the Sutter Buttes; the Feather, Sacramento and Bear Rivers, and associated levee system; localized drainage courses; oxbow lakes; the Butte Sink; and the expansive valley floor. The County can be divided into two major geographic units: the valley and the uplands. Sutter County shares the mild climate of its San Joaquin and Sacramento Valley neighbors. Temperatures range from lows, around 36 degrees Fahrenheit in January, to summer month highs, around 96.4°F. The County receives an average annual rainfall of 30.0 inches.

1.3.3. Population and Demographics

The California Department of Finance 2020 estimates for population of the County and its jurisdictions are shown in Table 1-2.

Table 1-2 Sutter County Population by Jurisdiction, 2020

Jurisdiction	Total Population
City of Live Oak	9,200
City of Yuba City	70,458
Unincorporated County	21,092
Total	**100,750**

Source: California Department of Finance, 2020 E-1 Report

Select social and economic information for the County and participating jurisdictions are shown in Table 1-3.

Table 1-3 Sutter County – Select Social and Economic Statistics

Statistic	Number
Populations	
Population under 5	6.9%
Population over 65	14.8%
Median Age	35.7
Racial Makeup	
White	69.6%

Statistic	Number
Black or African American	2.1%
American Indian or Alaska Native	1.0%
Asian	15.3%
Native Hawaiian or Pacific Islander	0.6%
Some Other Race	4.6%
Two or more races	6.8%
Income	
Median income	$56.955
Mean Income	$75.716
Poverty rate	
All families	13.3%
All people	16.0%

Source: 2010 US Census, 2017 US Census Bureau American Community Survey, California Employment Development Department

1.3.4. Economy and Tax Base

Sutter County has a diverse economy. US Census estimate show economic characteristics for the County. These are shown in Table 1-4.

Table 1-4 Sutter County Civilian Employed Population 16 years and Over

Industry	Estimated Employment	Percent
Agriculture, forestry, fishing and hunting, and mining	4,230	10.9%
Construction	2,868	7.4%
Manufacturing	2,877	7.4%
Wholesale trade	1,272	3.3%
Retail trade	4,771	12.3%
Transportation and warehousing, and utilities	2,157	5.6%
Information	346	0.9%
Finance and insurance, and real estate and rental and leasing	1,490	3.9%
Professional, scientific, and management, and administrative and waste management services	2,931	7.6%
Educational services, and health care and social assistance	8,413	21.8%
Arts, entertainment, and recreation, and accommodation and food services	3,431	8.9%
Other services, except public administration	1,537	4.0%
Public administration	2,341	6.1%

Source: US Census Bureau American Community Survey 2018 Estimates

Major employers in the County are shown in Table 1-5.

Table 1-5 Major Employers in Sutter County

Employer Name	Location	Industry
Applebee's	Yuba City	Full-Service Restaurant
Fountains Managed by Rideout	Yuba City	Convalescent Homes
Geweke Ford	Yuba City	Automobile Dealers-New Cars
Holt of California	Pleasant Grove	Contractors-Equip/Supls-Dlrs/Svc (whls)
Home Depot	Yuba City	Home Centers
Homeward Bound Golden	Elverta	Animal Shelters
Legend Transportation	Yuba City	Trucking-Liquid & Dry Bulk
Lowe's Home Improvement	Yuba City	Home Centers
River Valley High School	Yuba City	Schools
Sam's Club	Yuba City	Wholesale Clubs
Sierra Central Credit Union	Yuba City	Credit Unions
Sierra Gold Nurseries	Yuba City	Nurserymen
Siller Bros Aviation Div	Yuba City	Helicopter-Charter & Rental Service
Sunsweet Growers Inc	Yuba City	Fruits-Dried (whls)
Sutter County Jail	Yuba City	Government Offices-County
Sutter County Sheriff	Yuba City	Sheriff
Sutter-Yuba Behavioral Health	Yuba City	Hospitals
Sysco Sacramento Inc	Pleasant Grove	Food Products (whls)
Trees Inc	Yuba City	Tree Service
Valley Truck & Tractor Co	Yuba City	Lawn Mowers
Walmart Supercenter	Yuba City	Department Stores
Winco Foods	Yuba City	Grocers-Retail
Yuba City Care & Rehab Ctr	Yuba City	Convalescent Homes
Yuba City High School	Yuba City	Schools
Yuba Skilled Nursing Ctr	Yuba City	Convalescent

Source: Economic Development Department 2021

The County has a wide and varied tax base. Tax base information is tracked and maintained by the Sutter County Assessor's Office. Table 1-6 shows the tax base for the County as well as for the incorporated jurisdictions.

*Table 1-6 Unincorporated Sutter County – Distribution of Value by Property Use**

Property Use	2020 Value ($)	Percent of Current Roll
Agricultural	$2,415,540,183	63.88%
Commercial	$131,236,012	3.47%
Industrial	$192,907,593	5.10%
Institutional	$87,350,051	2.31%
Miscellaneous	$0	0.00%
Residential	$941,571,402	24.90%
Vacant	$12,657,182	0.33%
Total	**$3,781,262,423**	**100.0%**

Source: Sutter County 2020 Assessor's Office data
*includes land and structure values

1.4 Plan Organization

This Sutter County LHMP Update is a multi-jurisdictional plan that geographically covers the entire area within Sutter County's jurisdictional boundaries (i.e., the Planning Area). The Sutter County Local Hazard Mitigation Plan update is organized as follows:

Base Plan

- Chapter 1: Introduction
- Chapter 2: What's New
- Chapter 3: Planning Process
- Chapter 4: Risk Assessment
- Chapter 5: Mitigation Strategy
- Chapter 6: Plan Adoption
- Chapter 7: Plan Implementation and Maintenance

Annexes

- Annex A: City of Live Oak *
- Annex B: City of Yuba City*
- Annex C: Levee District 1*
- Annex D: Reclamation District 70*
- Annex E: Reclamation District 1001*
- Annex F: Reclamation District 1500*
- Annex G: Reclamation District 1660*
- Annex H: Sutter Butte Flood Control Agency
- Annex I: Levee District 9

Appendices

- Appendix A: Planning Process
- Appendix B: References
- Appendix C: Mitigation Strategy

- Appendix D: Adoption Resolution
- Appendix E: Threatened and Endangered Species
- Appendix F: Critical Facilities

The **Base Plan** provides the overall framework for this multi-jurisdictional LHMP. It is the umbrella document that includes the planning process, methodologies, and procedural requirements for all participating jurisdictions (i.e., unincorporated County and all Jurisdictional Annexes). As such, Chapters 1-7 of the Base Plan apply to the unincorporated County, the five incorporated communities, and the seven special Districts as participants to this LHMP Update seeking FEMA approval of the Plan. Because this is a multi-jurisdictional plan, the Base Plan addresses the LHMP hazard mitigation planning elements specific to the Sutter County Planning Area which includes data, information and analysis specific to all participating jurisdictions and also includes data, information, and analysis specific to unincorporated Sutter County.

The **Jurisdictional Annexes** detail the hazard mitigation planning elements specific to each additional participating jurisdiction to this Sutter County LHMP Update. Each annex is not intended to be a standalone document, but appends to, supplements, and incorporates by reference the information contained in the Base Plan document. As such, all Chapters 1-7 of the Base Plan, including the planning process and other procedural requirements and planning elements apply to and were met by each participating jurisdiction. The annexes provide additional information specific to each participating jurisdiction, with a focus on providing additional details on the risk assessment and mitigation strategy.

The **Appendices** provide additional information, data, and planning process documentation that applies to all participating jurisdictions (i.e., unincorporated County and all jurisdictional annexes) to this Sutter County LHMP Update.

Chapter 2 What's New

Requirements §201.6(d)(3) and §201.7(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within 5 years in order to continue to be eligible for mitigation project grant funding.

The 2013 Sutter County Local Hazard Mitigation Plan (LHMP) contained descriptions of their planning processes, the risk assessments of identified hazards for the Sutter County Planning Area and mitigation strategies for reducing the risk and vulnerability from these hazards. Since approval of this plan by FEMA, progress has been made by the County, the two incorporated communities, and seven special Districts on implementation of the 2013 mitigation strategies. As part of this LHMP Update, a thorough review and update of the 2013 County LHMP was conducted to ensure that this Update reflects current community conditions and priorities in order to realign the updated mitigation strategy for the next five-year planning period. This section of this LHMP Update includes the following:

- **What's New in the Plan Update**. Section 2.1 provides an overview of the approach to updating the Plan and identifies new analyses, data and information included in this LHMP Update to reflect current community conditions. This includes a summary of new hazard and risk assessment data as it relates to the Sutter County Planning Area as well as information on current and future development trends affecting community vulnerability and related issues. The actual updated data, discussions, and associated analyses are contained in their respected sections within this LHMP Update.
- **Summary of Significant Changes to Current Conditions and Hazard Mitigation Program Priorities**. Section 2.2 provides a summary of significant changes in current conditions, changes in vulnerability, and any resulting modifications to the community's mitigation program priorities.
- **2013 Mitigation Strategy Status and Successes**. Section 2.3.2 provides a description of the status of mitigation actions from the 2013 LHMP and also indicates whether a project is no longer relevant or is recommended for inclusion in the updated 2021 mitigation strategy. This section also highlights key mitigation success stories of the County and other participating jurisdictions since the 2013 LHMP.

This What's New section provides documentation of Sutter County Planning Area's progress or changes in their risk and vulnerability to hazards and their overall hazard mitigation program. Completion of this LHMP Update further provides documentation of the Sutter County communities' continued commitment and engagement in the mitigation planning process.

2.1 What's New in the Plan Update

This LHMP Update involved a comprehensive review and update of each section of the 2013 Plan and includes an assessment of the success of the participating communities in evaluating, monitoring, and implementing the mitigation strategy outlined in the 2013 LHMP. Only the information and data still valid from the 2013 LHMP was carried forward as applicable into this LHMP Update.

Also to be noted, Chapter 7 Implementation and Maintenance of this LHMP Update identifies key requirements for updating future plans:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to inventories; and
- Incorporate new action recommendations or changes in action prioritization.

These requirements and others as detailed throughout this Plan were addressed during this LHMP Update process.

As part of its comprehensive review and update of each section of the Plan, Sutter County and participating jurisdictions recognized that updated data, if available, would enhance the analysis presented in the risk assessment and utilized in the development of the updated mitigation strategy. Highlights of new data used for this LHMP Update is identified below in this section and is also sourced in context within Chapter 4, Risk Assessment. Specific data used is sourced throughout this LHMP Update. This new data and associated analysis provided valuable input for the development of the updated mitigation strategy presented in Chapter 5 of this LHMP Update.

Highlights of new information and analyses contained in this combined LHMP Update includes the following:

- TO BE ADDED LATER IN PROCESS

2.2 Summary of Significant Changes to Current Conditions, Planning Area Vulnerability, and Hazard Mitigation Priorities

INSERT AFTER FINAL MEETING

2.3 2013 LHMP Mitigation Strategy Successes and Status

Sutter County and participating jurisdictions have been successful in implementing actions identified in the 2013 Sutter County LHMP Mitigation Strategies, thus, working diligently towards meeting their 2013 goals and objectives of:

Goal 1: Minimize risk and vulnerability of the community to hazards and reduce damages and protect lives, properties, and public health in Sutter County

- Minimize economic and resource impact
- Minimize impact to both existing and future development
- Prevent and reduce flood-related losses

- Improve integrity of levees
- Prevent and reduce agricultural losses

Goal 2: Provide protection for critical facilities, infrastructure, utilities and services from hazard impacts.

- Update and maintain list of critical facilities: Essential Services, At-Risk Populations, Hazardous Materials Facilities
- Protect evacuation routes

Goal 3: Improve community awareness, education, and preparedness for hazards that threaten our communities

- Enhance public outreach, education and preparedness program to include all hazards of concern
- Increase public knowledge about the risk and vulnerability to identified hazards and recommended responses to disaster events
- Increase public communications to keep the public well informed prior to, during and after a disaster event, including information regarding evacuation and sheltering options
- Provide planning and coordination for "At-Risk" populations
- Increase public's awareness and involvement in communities' mitigation projects

Goal 4: Increase communities' ability to be prepared for, respond to, and recover from a disaster event

- Improve interagency (local, state, federal) emergency coordination and communication to ensure effective community preparedness, response and recovery
- Enhance the use of shared resources/Develop a strong mutual aid support system
- Create and maintain a fully functional, interoperable radio and communication system

- Improve interoperable communication with non-public safety and private partners

Goal 5: Enhance collaboration and coordination of disaster-related plans with local, state, and federal agencies and private partners

- Protect and maintain continuity of operations

Goal 6: Maintain FEMA Eligibility/Position the communities for grant funding.

Where possible, Sutter County and participating jurisdictions used existing plans and programs to implement the 2013 mitigation strategies.

2.3.1. Success Stories

Fifth Street Bridge Replacement Project

The 2013 LHMP mitigation strategies included replacement of the Fifth Street Bridge, a deteriorating two-lane arterial connecting Yuba City and Marysville. In 2008, a seismic vulnerability report concluded the bridge was vulnerable to soil liquefaction in an earthquake. Subsequently, Caltrans found the bridge to be functionally obsolete.

The $73 million project involved the Federal Highway Administration, California Department of Transportation, Sacramento Area Council of Governments, Sutter County, Yuba County, Yuba City and Marysville, among others.

Construction began in January 2018. The bridge was completed in August 2020. The new structurally-sound four-lane bridge now provides critical access to the only hospital in the two cities, and serves as a key evacuation route in the event of disaster.

ALL - PLEASE PROVIDE INFORMATION ON OTHER MITIGATION SUCCESS STORIES SINCE 2013?

2.3.2. 2013 Mitigation Strategy Update

The 2013 Sutter County LHMP mitigation strategy contained 57 separate mitigation actions for the County and participating jurisdictions. Of the 57 actions, X have been completed, X are ongoing, and X have not been started. X 2013 Sutter County actions have been identified for inclusion in this LHMP Update, and are carried forward in Chapter 5 in Table 5-4. Table 2-1 provides a status summary of the mitigation action projects from the 2013 Sutter County LHMP. Following the table is a description of the status of each project.

All the Multi-Jurisdictional Action statuses here are from Yuba City and County. Need Action Status from:

- Sutter County
- Live Oak (partially provided)
- Gilsizer Drainage District
- RD 1001
- RD 1500

Table 2-1 Sutter County's 2013 LHMP Update: Mitigation Action Status Summary

Mitigation Action	Complete	Ongoing	Not Started	Project in Plan Update
Multi-Jurisdictional Actions				
Enhance Public Awareness of the Effects of Natural Hazards and Public Understanding of Disaster Preparedness		X		Y
Planned Multi-Hazard CRS Outreach Projects		X		Y

Mitigation Action	Complete	Ongoing	Not Started	Project in Plan Update
Implementation of CRS Activities		X		Y
Review and Amend Flood Damage Prevention Ordinance, as Appropriate		X		
Evaluate the Development and Implementation of County-Wide Stormwater Management Ordinance		X		
Prepare Post-Disaster Guidance Materials		X		Y
Feather River Regional Flood Management Plan	X			
Feather River West Levee Rehabilitation Project	X			
River Level Gauge System		X		
Sutter Basin Feasibility Study		X		
Sutter County Actions				
Flood System Repair Program				
Robbins Wastewater Plant - Backup Power Source				
Live Oak Canal - Improvement Project				
Gilsizer Slough - Master Drainage Study				
Robbins Wastewater Plant - Water Meters & Mains				
NIXLE Text Notification System	X			
Robbins Wastewater Plant - Water Treatment Plant				
City of Live Oak Actions				
Eliminate Local Flooding Areas at the Six Locations Identified in the Master Drainage Study	X	X		?
Hwy 99 Improvements		X		?
EOC Equipment and Supplies		X		?
Blackboard Connect Upgrades and Maintenance	X			?
Backup Power to Critical Facilities	X			?
Well, Holding Tank, Water Treatment Equipment with Associated Water lines and Water Main Upgrade	X	X		?
City of Yuba City Actions				
Project Improvements to Decrease Localized Flooding		X		Yes
Enhance Current Rapid Notify System to Include Cell Phone Enhancements	X			No
Feather River Habitat Restoration		X		Yes
Fifth Street Bridge Replacement	X			No
Gilsizer Slough Weir at Bogue Road			X	No
Interactive Critical Facility Data Management		X		No
Low Lift Pump Station Security Improvements	X			No
Hazard Preparedness Public Outreach			X	No

Mitigation Action	Complete	Ongoing	Not Started	Project in Plan Update
Relocation of Treated Wastewater Effluent Diffuser Line		X		Yes
Response Logistics Planning		X		No
200-Year Flood Protection for Sphere of Influence Area		X		Yes
Alternative Methods to Dispose of Treated Wastewater Effluent		X		Yes
Establish Backup Power Sources for Critical Facilities within Yuba City		X		Yes
Yuba City Urban Area Emergency Operations Center			X	No
Gilsizer Drainage District Actions				
Master Drainage Study and Improvements to Meet 200-YR Flood Protection				
Revetment of Slough Channel				
Levee District 1 Actions				
Bank Erosion Repairs	X			N
Reclamation District 70 Actions				
Alternative Power Source at Pumping Station			X	N
Levee/Erosion Repair			X	N
Coordination with State DWR Flood Emergency Response Project	X			N
Reclamation District 1001 Actions				
Flood System Repair Project #1				
Flood System Repair Project #2				
Flood System Repair Project #3				
Flood System Repair Project #4				
Flood System Repair Project #5				
Flood System Repair Project #6				
Flood System Repair Project #7				
Flood System Repair Project #8				
Alternative Power Source at Pump House				
Flood Emergency Response Project				
Reclamation District 1500 Actions				
Alternative Power Source at Karnak Pump Station				
Reclamation District 1660 Actions				
Levee Repair			X	N
Alternative Power Source at Pump Station			X	N
Coordination with State DWR Flood Emergency Response Project	X			N

Multi-Jurisdictional Actions

Enhance Public Awareness of the Effects of Natural Hazards and Public Understanding of Disaster Preparedness

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County – Ongoing, project has been partially implemented but needs more work completed in next planning cycle.

City of Live Oak – Ongoing.

City of Yuba City – Ongoing.

Planned Multi-Hazard CRS Outreach Projects

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County – Ongoing, project has been partially implemented but needs more work completed in next planning cycle.

City of Live Oak – Ongoing.

City of Yuba City – Ongoing.

Implementation of CRS Activities

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County – Ongoing, project has been partially implemented but needs more work completed in next planning cycle.

City of Live Oak –

City of Yuba City – Ongoing.

Review and Amend Flood Damage Prevention Ordinance, as Appropriate

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County –

City of Live Oak – Ongoing.

City of Yuba City – Ongoing.

Evaluate the Development and Implementation of County-Wide Stormwater Management Ordinance

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County –

City of Live Oak –

City of Yuba City – Not applicable due to the City having its own stormwater management ordinance.

Prepare Post-Disaster Guidance Materials

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County – Ongoing, project has been partially implemented but needs more work completed in next planning cycle.

City of Live Oak –

City of Yuba City – Ongoing. Disaster preparedness guide amongst other resource available under City's Flood Evacuation Management webpage.

Feather River Regional Flood Management Plan

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County – Completed. The Sutter Butte Flood Control Agency, Yuba Water Agency, Three Rivers Levee Improvement Authority, and the Marysville Levee Commission developed the 2014 Feather River Regional Flood Management Plan.

City of Live Oak – Completed. The Sutter Butte Flood Control Agency, Yuba Water Agency, Three Rivers Levee Improvement Authority, and the Marysville Levee Commission developed the 2014 Feather River Regional Flood Management Plan.

City of Yuba City – Completed. The Sutter Butte Flood Control Agency, Yuba Water Agency, Three Rivers Levee Improvement Authority, and the Marysville Levee Commission developed the 2014 Feather River Regional Flood Management Plan.

Feather River West Levee Rehabilitation Project

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County – Completed. Sutter Butte Flood Control Agency Project.

City of Live Oak – Completed. Sutter Butte Flood Control Agency Project.

City of Yuba City – Completed. Sutter Butte Flood Control Agency Project.

River Level Gauge System

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County – Completed.

City of Live Oak –

City of Yuba City – Ongoing. Website has a link to see water level system, but no info regarding CDEC station IDs for stations within or near City

Sutter Basin Feasibility Study

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Sutter County –

City of Live Oak –

City of Yuba City – Ongoing. 2013 plan link here.

Sutter County Actions

Flood System Repair Program

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Robbins Wastewater Plant - Backup Power Source

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Live Oak Canal - Improvement Project

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Gilsizer Slough - Master Drainage Study

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Robbins Wastewater Plant - Water Meters & Mains

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

NIXLE Text Notification System

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Completed – Implemented Code Red System

Robbins Wastewater Plant - Water Treatment Plant

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

City of Live Oak Actions

Eliminate Local Flooding Areas at the Six Locations Identified in the Master Drainage Study

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Completed soccer park retention basin; improved pumping station.

Hwy 99 Improvements

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing. Estimated time of completion 2022-2023

EOC Equipment and Supplies

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing. Some items were developed but this will remain as more work to be done.

Blackboard Connect Upgrades and Maintenance

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Completed. No longer needed as City was provided Code Red by Sutter County.

Backup Power to Critical Facilities

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Backup power completed – added generators to most critical facilities one well one seer location does not have back up but everything else does.

Well, Holding Tank, Water Treatment Equipment with Associated Water lines and Water Main Upgrade

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Well 7 completed and storage tank and booster tank is not built yet.

City of Yuba City Actions

Project Improvements to Decrease Localized Flooding

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing. Annual and public request small projects where Street Maintenance department performs various improvements such as replacing gutters, adding more aggregate to dirt shoulders, etc.

Enhance Current Rapid Notify System to Include Cell Phone Enhancements

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Completed. City has contract with CodeRed and is capable of rapid notification that includes cell phones.

Feather River Habitat Restoration

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing. Feather River Parkway project is latest phase of habitat restoration? Link for more details here

Fifth Street Bridge Replacement

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Completed Fifth Street Bridge Replacement

Gilsizer Slough Weir at Bogue Road

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Project was not implemented due to lack of funding. City has been awarded Prop 1 IRWM funding to construct a trash capture device in the bottom of the Gilsizer Slough channel. The proposed design would be a "rigid basket" design that would also act as a weir.

Interactive Critical Facility Data Management

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing.

Low Lift Pump Station Security Improvements

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Completed Low Lift Pump Station Security Improvements.

Hazard Preparedness Public Outreach

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was not completed from the 2013 LHMP. Some areas are addressed in the Yuba City Fire Department website; however, a full guide was not completed. This project does not need to carry over to the 2021 LHMP.

Relocation of Treated Wastewater Effluent Diffuser Line

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project is ongoing. Proceeding with planning, design and engineering for new Wastewater Effluent Outfall. This project needs to carry over to the 2021 LHMP.

Response Logistics Planning

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing. City employees are required to complete the FEMA ICS-100, ICS-200, and ICS 700 courses.

200-Year Flood Protection for Sphere of Influence Area

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was not completed due to a lack of funding. This project needs to carry over to the 2021 LHMP.

Alternative Methods to Dispose of Treated Wastewater Effluent

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing. City continues to evaluate possibility of enhanced wastewater treatment processes to allow effluent to be used for irrigation purposes. This project needs to carry over to the 2021 LHMP.

Establish Backup Power Sources for Critical Facilities within Yuba City

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Ongoing. City has established backup power sources at several City facilities. Most recently, the City has submitted a grant application for grant funds for another project that would construct backup power sources for additional City Facilities. This project needs to carry over to the 2021 LHMP.

Yuba City Urban Area Emergency Operations Center

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project did not occur since the 2013 LHMP.

Fire Station 4 satisfies the need of Yuba City as an EOC; however, it does not meet the needs of a multi-agency EOC. This project does not need to be carried over to the next LHMP.

Gilsizer Drainage District Actions

Master Drainage Study and Improvements to Meet 200-YR Flood Protection

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Revetment of Slough Channel

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Levee District 1 Actions

Bank Erosion Repairs

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): This project was completed.

Reclamation District 70 Actions

Alternative Power Source at Pumping Station

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not Implemented. The cost was greater than the benefit.

Levee/Erosion Repair

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Has not been implemented. Evaluating cost.

Coordination with State DWR Flood Emergency Response Project

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Complete. No evidence of loss avoidance can be provided. However, Emergency Response Project has given clearer direction on how to procced with flood fighting. See Emergency Operations Plan

Reclamation District 1001 Actions

Flood System Repair Project #1

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood System Repair Project #2

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood System Repair Project #3

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood System Repair Project #4

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood System Repair Project #5

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood System Repair Project #6

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood System Repair Project #7

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood System Repair Project #8

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Alternative Power Source at Pump House

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Flood Emergency Response Project

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

Reclamation District 1500 Actions

Alternative Power Source at Karnak Pump Station

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?):

IS THIS THE SAME AS THE NEW ACTION FOR KARNAK PUMP STATION REHABILITATION?

Reclamation District 1660 Actions

Levee Repair

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not Implemented. The cost was greater than the benefit.

Alternative Power Source at Pump Station

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Not Implemented. The cost was greater than the benefit.

Coordination with State DWR Flood Emergency Response Project

Progress to Date (Consider: Was the project implemented – why or why not? Did the project reduce risks? Can you provide evidence of loss avoidance?): Complete. No evidence of loss avoidance can be provided. However, Emergency Response Project has given clearer direction on how to procced with flood fighting. See Emergency Operations Plan

Chapter 3 Planning Process

Requirements §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;

2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and

3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Sutter County recognized the need and importance of the update process for their 2013 Local Hazard Mitigation Plan (LHMP) and initiated its development. After receiving a grant from the Federal Emergency Management Agency (FEMA), which served as the primary funding source for this LHMP Update, the County contracted with Foster Morrison Consulting, Ltd. (Foster Morrison) to facilitate and develop the Plan. Jeanine Foster, a professional planner with Foster Morrison, was the project manager and Community Rating System (CRS) lead in charge of overseeing the planning process and the development of this LHMP update. Chris Morrison, also a professional planner with Foster Morrison, was the lead planner for the development of this LHMP Update. The Foster Morrison's team's role was to:

- Assist in establishing the Hazard Mitigation Planning Committee (HMPC) as defined by the Disaster Mitigation Act (DMA);
- Meet the DMA requirements as established by federal regulations and following FEMA's planning guidance;
- Support objectives under the National Flood Insurance Program's (NFIP) CRS and the Flood Mitigation Assistance (FMA) program;
- Facilitate the entire planning process;
- Identify the data requirements that HMPC participants could provide and conduct the research and documentation necessary to augment that data;
- Assist in facilitating the public input process;
- Produce the draft and final plan documents; and
- Coordinate with the California Office of Emergency Services (Cal OES) and FEMA Region IX plan reviews.

3.1 Local Government Participation

Sutter County and the City of Yuba City, as participating NFIP CRS communities, and all the other participating jurisdictions, made a commitment to this 2021 multi-jurisdictional LHMP Update. The DMA

planning regulations and guidance stress that each local government (participating jurisdiction) seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC;
- Detail where within the Planning Area the risk differs from that facing the entire area;
- Identify potential mitigation actions; and
- Formally adopt the plan.

For Sutter County and all participating jurisdictions, "participation" meant the following:

- Attending and participating in the HMPC meetings;
- Completing and returning the Data Collection Worksheets;
- Collecting and providing other requested data (as available);
- Coordinating information sharing between internal and external agencies;
- Managing administrative details;
- Making decisions on Plan process and content;
- Identifying mitigation actions for the Plan;
- Reviewing and providing comments on Plan drafts;
- Providing Draft documents of LHMP for public review;
- Informing the public, local officials, and other interested stakeholders about the planning process and providing opportunity for them to comment on the Plan;
- Coordinating, and participating in the public input process; and
- Coordinating the formal adoption of the Plan by the governing boards for each jurisdiction.

The County and all jurisdictions seeking FEMA approval of this LHMP Update met all of these participation requirements. Multiple representatives from the County and all jurisdictions attended the HMPC meetings described in Table 3-4 and also brought together an internal planning team to help collect data, identify mitigation actions and implementation strategies, and review and provide data on Plan drafts. Appendix A provides additional information and documentation of the planning process.

In order to promote the integration of CRS into this planning process, the HMPC representatives from the County and City of Yuba City, as the two CRS communities, were selected based on their areas of expertise relative to the CRS mitigation categories as detailed in Table 3-1. In addition, the Sutter County and City of Yuba City staff responsible for community land use and comprehensive planning for the County were active participants on the HMPC and provided data and information to support development of the Plan. Specifically, the Sutter County Development Services Department (Neal Hay, Development Services Director and Doug Libby, Principal Planner) and City of Yuba City Planning Department (Ben Moody, Development Services Director, and Jaspreet Kaur, Assistant Planner), in association with Foster Morrison Planners were involved in the development of this LHMP Update through attendance at meetings, providing data, future land use planning support, and help with all LHMP planning elements. In addition to attending meetings, providing draft text for inclusion in the plan, and reviewing plan documents, Sutter County and City of Yuba City planners, in addition to planners from other participating jurisdictions, also provided information on development since the 2013 LHMP, mapping, text, and details on future development areas, input on current mitigation capabilities, and a variety of documents and information specific to their jurisdictions.

Table 3-1 Sutter County LHMP Staff Capability with Six Mitigation Categories

Jurisdiction/Departments	Prevention	Property Protection	Natural Resource Protection	Emergency Services	Structural Flood Control Projects	Public Information	Other
Sutter County							
Emergency Services, Zach Hamill, Emergency Operations Manager	X	X	X	X	X	X	X
Development Services Department/Planning, Neal Hay, Director	X	X	X		X	X	X
Development Services Department/Flood Management/NFIP/CRS, Nick Ramos, Civil Engineer	X	X	X		X	X	X
City of Yuba City							
Fire Chief/City OES, Jesse Alexander	X	X	X	X	X	X	X
Development Services Department/Planning Ben Moody, Director	X	X	X		X	X	X
Development Services/Regulatory Compliance, Kathy Willis	X	X	X		X	X	X

Specific individuals representing Sutter County and City of Yuba City departments, and representatives from other participating jurisdictions, participating in this LHMP Update were actively involved throughout the Plan Update process as identified in Appendix A in the sign-in sheets for the meetings and as evident through the data, information and input provided by HMPC representatives to the development of this LHMP Update. This Chapter 3 and Appendix A provides additional information and documentation of the planning process and participants to this Plan Update, including members of the HMPC.

3.2 The 10-Step Planning Process

Foster Morrison established the planning process for updating the Sutter County LHMP using the DMA planning requirements and FEMA's associated guidance. This guidance is structured around a four-phase process:

1. Organize Resources;
2. Assess Risks;
3. Develop the Mitigation Plan; and
4. Implement the Plan and Monitor Progress.

Into this process, Foster Morrison integrated a more detailed 10-step planning process used for FEMA's CRS and FMA programs. Thus, the modified 10-step process used for this plan meets the requirements of six major programs: FEMA's Hazard Mitigation Grant Program (HMGP); Pre-Disaster Mitigation (PDM)

program; CRS program; FMA Program; Severe Repetitive Loss (SRL) program; and new flood control projects authorized by the U.S. Army Corps of Engineers (USACE).

Table 3-2 shows how the modified 10-step process fits into FEMA's four-phase process. The sections that follow describe each planning step in more detail.

Table 3-2 Mitigation Planning Processes Used to Develop the Sutter County Local Hazard Mitigation Plan

DMA Process	Modified CRS Process
1) Organize Resources	
201.6(c)(1)	1) Organize the Planning Effort
201.6(b)(1)	2) Involve the Public
201.6(b)(2) and (3)	3) Coordinate with Other Departments and Agencies
2) Assess Risks	
201.6(c)(2)(i)	4) Identify the Hazards
201.6(c)(2)(ii)	5) Assess the Risks
3) Develop the Mitigation Plan	
201.6(c)(3)(i)	6) Set Goals
201.6(c)(3)(ii)	7) Review Possible Activities
201.6(c)(3)(iii)	8) Draft an Action Plan
4) Implement the Plan and Monitor Progress	
201.6(c)(5)	9) Adopt the Plan
201.6(c)(4)	10) Implement, Evaluate, and Revise the Plan

This LHMP Update involved a comprehensive review and update of each section of the 2013 Plan and includes an assessment of the success of the County in evaluating, monitoring and implementing the mitigation strategy outlined in the initial Plan, as previously described in more detail in Chapter 2 and throughout Chapter 4 and Chapter 5.

The process followed to update the LHMP is detailed in the above table and the sections that follow and is in conformance with the latest DMA planning guidance and the CRS 2017 Coordinator's Manual. As part of this LHMP Update, all sections of the Plan were reviewed and updated to reflect new data, processes, and resulting mitigation strategies. Only the information and data still valid from the 2013 LHMP was carried forward as applicable into this LHMP Update.

3.2.1. Phase 1: Organize Resources

Planning Step 1: Organize the Planning Effort

With Sutter County's commitment to participate in the DMA planning process and the CRS program, Foster Morrison worked with the County's Office of Emergency Services (County OES), as overall project lead,

to establish the framework and organization for development of the plan. An initial meeting was held with key community representatives to discuss the organizational and process aspects of this LHMP Update process.

The initial kick-off meeting was held on September 9, 2020. Invitations to these kickoff meetings were extended to key County departments, the two incorporated communities, special districts located within the planning area, tribal governments, as well as to other federal, state, and local stakeholders, including representatives from the public, that might have an interest in participating in the planning process. Representatives from the HMPC members to the 2013 Plan, key County departments, and other identified stakeholders were used as a starting point for the invite list, with additional invitations extended as appropriate throughout the planning process. The list of initial invitees is included in Appendix A.

Hazard Mitigation Planning Committee (HMPC)

The HMPC was established as a result of these initial meetings, as well as through interest generated through the initial public meeting and outreach conducted for this project as detailed later in this section. The HMPC, comprising key county, city, special district, and other government and stakeholder representatives and the public, developed the plan with leadership from the County OES and facilitation by Foster Morrison. This list includes all HMPC members that attended one or more HMPC meetings, as well as those who provided key input into the Plan development process. The following participated on the HMPC:

INSERT HMPC AT END OF PROCESS

Steering Committee

In addition to the HMPC, a Steering Committee to the HMPC was established to help guide LHMP development, including the CRS components of floodplain management planning and the overall development of the LHMP. The Steering Committee is comprised of key representatives from the County and the City of Yuba City as the two CRS communities and includes non-local government and public representatives. The non-local government members of the Steering Committee (citizens and other outside stakeholders) represent more than 50% representation of the committee for the Steering Committee. See Table 3-3 and Appendix A for details on the makeup of the Steering Committee.

Table 3-3 Sutter County LHMP Steering Committee to the Hazard Mitigation Planning Committee

Community/ Representative	Department/Organization	County/ City	Public/ Resident	Stakeholder	# Meetings
Sutter County					
Zach Hamill,	Sutter County OES, Emergency Operations Manager	X			4
Nick Ramos	Development Services Department, Flood Management	X			4
Takira Shalowitz	County Resident		X		4

Community/ Representative	Department/Organization	County/ City	Public/ Resident	Stakeholder	# Meetings
Sukh Purwal	County Resident	X	X		4
City of Yuba City					
Ben Moody	Directory - Development Services Department/Planning	X			4
Kathy Willis	Development Services Department/ Regulatory Compliance	X			4
Jennifer Chaplin	City Resident		X		3
Zac Repka	City Resident		X		3
Lucy Cardenas			X		3

Meetings

The planning process officially began with a kick-off meeting held on September 9, 2020, followed by public kick-off meeting held the same day at 5:30 pm. The meetings covered the scope of work and an introduction to the DMA, CRS, and FMA requirements. During the HMPC meetings, participants were provided with data collection worksheets to facilitate the collection of information necessary to support development of the plan. Using FEMA guidance, these worksheets were designed to capture information on past hazard events, identify hazards of concern to each of the participating jurisdictions, quantify values at risk to identified hazards, inventory existing capabilities, record possible mitigation actions, and to capture information on the status of mitigation action items from the 2013 Plan. A copy of the worksheets for this project are included in Appendix A. Each participating jurisdiction seeking FEMA approval of this LHMP Update completed and returned the worksheets to Foster Morrison for incorporation into this LHMP Update.

During the planning process, the HMPC communicated through virtual Zoom meetings, email, telephone conversations, Dropbox websites, and through a County developed webpage dedicated to the plan development process. This later website was developed to provide information to the HMPC, the public and all other stakeholders on the LHMP process. Draft documents were also posted on these websites so that the HMPC members and the public could easily access and review them.

The Sutter County LHMP website (as shown on Figure 3-1) can be accessed online at: https://www.suttercounty.org/doc/government/depts/cao/em/hazard_mitigation

Figure 3-1 Sutter County Hazard Mitigation Plan Update Website

Source: Sutter County

The HMPC met formally five times during the planning period (September 2020 – May 2021) which adequately covers the four phases of DMA and the 10-Step CRS planning process. The formal meetings held and topics discussed are described in Table 3-4. Agendas and sign-in sheets for each of the meetings are included in Appendix A.

Table 3-4 HMPC Meetings

Meeting Type	Meeting Topic	Meeting Date(s)	Meeting Location(s)
HMPC #1 Kick-off Meeting	1) Introduction to DMA and the planning process 2) Overview of current LHMP; 3) Organize Resources (CRS Steps 1,2&3): the role of the HMPC, planning for public involvement, coordinating with other agencies/stakeholders 4) Introduction to Hazard Identification	September 9, 2020	Zoom Meeting
HMPC #2	1) Risk assessment overview and work session -CRS Step 4: Assess the Hazard -CRS Step 5: Assess the Problem	December 9, 2020	Zoom Meeting
HMPC #3	1) Review of risk assessment summary 2) Review and update of mitigation goals 3) Intro to Mitigation Action Strategy -CRS Step 6: Set Goals -CRS Step 7: Review possible activities	January 13, 2021	Zoom Meeting
HMPC #4	1) Review of mitigation alternatives 2) Review and update of mitigation actions from the 2012 plan 3) Identify updated list of mitigation actions by hazard 4) Review of mitigation selection criteria 5) Update and prioritize mitigation actions 6) Mitigation Action Strategy Implementation and Draft Action Development -CRS Step 7: Review possible activities -CRS Step 8: Draft an Action Plan	January 20, 2021	Zoom Meeting
HMPC #5	1) Review of final HMPC, jurisdictional and public comments and input to plan 2) Review and documentation of changed conditions, vulnerabilities and mitigation priorities 3) CRS Step 8: Draft an Action Plan 4) CRS Step 9 & 10: Plan Maintenance and Implementation Procedures	May 6, 2021	Zoom Meeting

Zoom Meetings

As a result of the Covid-19 Pandemic, all of the HMPC and public meetings were conducted virtually via the online Zoom format. While these Zoom meetings presented a few challenges from a collaboration standpoint, holding these meetings online also had its advantages. First, it was observed that more people were available to attend an online meeting, including those out of area agencies where travel to Sutter for a meeting was difficult due to the time involved. Another benefit was the use of the Chat function in the Zoom format. This allowed those individuals not likely to speak up in a face-to-face meeting to provide input via Chat. Further, these Chat transcripts were recorded in a written retrievable format that allowed Foster Morrison to develop comprehensive notes detailing HMPC and public input.

Planning Step 2: Involve the Public

Public stakeholders are defined as any stakeholders not attached to local government in the Sutter County Planning Area. Up-front coordination discussions with Sutter County OES, the County floodplain managers and CRS coordinators for the City of Yuba City established the initial plan for public involvement. Public involvement activities for this LHMP Update included press releases, social media communications, stakeholder and public meetings, development of an LHMP webpage and associated website postings, the collection of public and stakeholder comments on the draft plan through a variety of mechanisms, and other public outreach activities as further described below, as well as specific targeted outreach to different groups of people and other agencies throughout the plan development process. Information provided to the public included an overview of the mitigation status and successes resulting from implementation of the 2013 Plan as well as information on the processes, new risk assessment data, and proposed mitigation strategies for this 2021 LHMP Update. As part of the plan development process, a Public Involvement Strategy was also developed to ensure a meaningful public process and to focus efforts on maximizing CRS credits for public outreach.

Early Public Meeting

Public outreach for this Plan Update began at the beginning of the plan development process with an advertisement placed in the local newspaper, social media, and other local outreach methods (like the flyer shown in Figure 3-2) announcing the public meeting and to inform the public of the purpose of DMA, CRS, and the hazard mitigation planning process for the Sutter County Planning Area. Members of the public were invited to join the HMPC meetings.

Figure 3-2 Public Invitation Flyer

TO BE PLACED

Final Public Meeting

The first draft of the plan was provided to the HMPC in March of 2021, with a public review draft provided in April 2021. A public meeting was held on May 5, 2021 to present the draft LHMP and to collect public comments on the Plan prior to finalization and submittal to Cal OES/FEMA. The public meeting was advertised in a variety of ways to maximize outreach efforts to both targeted groups and to the public at large and included an advertisement in local newspapers inviting the public to attend either the formal public meeting or the planning team meeting at their convenience. The advertisement in the local newspapers included information on the date, location and time of the meeting, where the draft Plan could be accessed in the community, and how to provide comments on the draft LHMP Update. In addition to a copy of the draft plan being placed on the County website in advance of these meetings, hard copies of the draft of the plan were made available to interested parties at two Sutter County Public Libraries:

Figure 3-3 Public Outreach at Main Sutter County Library

TO BE PLACED

Source: Sutter County

Documentation to support the final public meeting can be found in Appendix A. In addition to advertisement for public participation, notices of meetings were sent directly to all persons on the HMPC contact list and also to other agency and key stakeholders with an interest in the Sutter County Planning Area. The majority of these people reside in Sutter County or in surrounding communities. Because this is a multi-jurisdictional planning effort, all public outreach activities for this LHMP Update were conducted in cooperation with and on behalf of Sutter County and City of Yuba City, as the two CRS communities, as well as for all participating jurisdictions.

The formal public meetings for this project are summarized in Table 3-5.

Table 3-5 Schedule of Public and Stakeholder Meetings

Meeting Type	Meeting Topic	Meeting Date	Meeting Locations
Early Public Meeting	1) Intro to DMA, CRS and mitigation planning 2) 2021 LHMP Update Process	September 9, 2020	Zoom Meeting
Final Public Meeting	1)Presentation of Draft LHMP and solicitation of public and stakeholder comments	May 5, 2021	Zoom Meeting

Where appropriate, stakeholder and public comments and recommendations were incorporated into the final plan throughout the plan development process, including the sections that address mitigation goals and strategies. Various public comments were obtained throughout the planning process and prior to plan submittal to Cal OES and FEMA. A table summarizing the formal public comments received and how they were addressed is included in Appendix A. All press releases, newspaper advertisements and articles, website postings, and public outreach efforts are on file with Sutter County OES and are included in Appendix A.

The draft plan is currently available online on the Sutter County website at: https://www.suttercounty.org/doc/government/depts/cao/em/hazard_mitigation

Other Public Outreach Efforts

Beyond these more formal public involvement activities, the update process also included the following public outreach activities included in Table 3-6 which are further documented and described in Appendix A. The public outreach activities described here were conducted with participation from and on behalf of all jurisdictions participating in this Plan, including the CRS communities of Sutter County and the City of Yuba City.

Table 3-6 Other Public Outreach Efforts

Effort	Description
Public Outreach Flyer for Kickoff Meeting	An initial public outreach flyer was developed for the initial public and planning team kick off meetings.

Effort	Description
Survey	A public survey was posted on the County's website inviting the public to comment on how prepared both the County and individuals are for a possible natural disaster, including flood events.
Sutter County LHMP Update Website	Information on the Plan update process and location of documents, and final HMPC and public meeting locations were posted on the County website. This website also included a link to the Survey.
Public Outreach at Sutter County Public Library, ???Location	The County placed the draft plan in the reference section at the Sutter County Public Library, ????location. Invitations were placed on social media, the County website, and as part of the advertisements for public meetings to let the public know that the documents were there for review and input.

Public Outreach Survey

An integral element in hazard mitigation planning is broad public participation. Information provided by residents fosters a better understanding of local hazard concerns and can spawn innovative ideas to reduce impacts of future hazard events. A public opinion survey was accomplished to gather information from Sutter County Planning Area residents concerning local hazards. The survey was located on the County's LHMP website and survey participation was promoted through public meetings, program websites, press releases, social media, and other public outreach events as previously described. Following is a summary of survey results.

- 85 individuals took the survey.
- 53 out of the 80 people who responded were extremely concerned about the possibility of the community being affected by a disaster.
- Wildfire, drought, and earthquake were hazards of greatest concern.
- 14 out of 84 respondents noted that their house was in a floodplain, 26 out of 84 didn't know if their home was in a floodplain.
- 58 out of 84 respondents had experienced a natural disaster.
- Email, radio, and the County website were the best choices to reach the public regarding disaster information and making homes more disaster resistant.

The full survey and survey results are included in Appendix H.

Planning Step 3: Coordinate with Other Departments and Agencies

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and Plan approval would be greatly enhanced by inviting other local, state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the County, and/or their interest as a neighboring jurisdiction, representatives from the following agencies were invited to participate on the HMPC:

- TO BE INSERTED AT END OF PROCESS

Coordination with key agencies, organizations, and advisory groups throughout the planning process allowed the HMPC to review common problems, development policies, and mitigation strategies as well as identifying any conflicts or inconsistencies with regional mitigation policies, plans, programs and

regulations. Coordination involved contacting these agencies through a variety of mechanisms and informing them on how to participate in the LHMP Update process and if they had any expertise or assistance they could lend to the planning process or specific mitigation strategies. Coordination with these groups included, holding face-to-face meetings, sending outreach e-mails, some with follow up phone calls; and making phone calls alone to out of area agencies. All of these groups and agencies were solicited asking for their assistance and input, telling them how to become involved in the LHMP Update process, and inviting them to HMPC meetings. This coordination with other agencies is documented in Appendix A and includes a summary table of who was contacted, the method of contact, and the purpose. Supporting documentation such as emails and meeting logs are also included.

In addition, as part of the overall stakeholder and agency coordination effort, the HMPC coordinated with and utilized input to the LHMP update from the following agencies:

- TO BE INSERTED AT END OF PROCESS

Several opportunities were provided for the groups listed above to participate in the planning process. At the beginning of the planning process, invitations were extended to many of these groups to actively participate on the HMPC. Specific participants from these groups are detailed in Appendix A. Others assisted in the process by providing data directly as requested in the Data Worksheets or through data contained on their websites or as maintained by their offices. Further as part of the public outreach process, all groups were invited to attend the public and HMPC meetings and to review and comment on the Plan prior to submittal to CAL OES and FEMA. In addition, as part of the review of the draft plan, key agency stakeholders were contacted and their comments specifically solicited as described further in this Section and included in Appendix A.

Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is also paramount to the success of this plan. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community's risk and vulnerability to hazards. Sutter County uses a variety of comprehensive planning mechanisms, such as general plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this LHMP Update establishes a credible and comprehensive Plan that ties into and supports other community programs. The development of this LHMP Update incorporated information from the following existing plans, studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions.

- TO BE INSERTED AT END OF PROCESS

Specific source documents are referenced at the beginning of each section of Chapter 4 and in Appendix B. These and other documents were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment. Data from these plans and documents were incorporated into the risk assessment and hazard vulnerability sections of the Plan. Where the data from the existing studies and reports is used in this LHMP Update, the source document is referenced throughout this Plan. The data was also used in determining the capability of the community in being able to implement certain mitigation strategies. Appendix B, References, provides a detailed list of references used in the preparation of this LHMP Update.

3.2.2. Phase 2: Assess Risks

Planning Steps 4 and 5: Identify the Hazards and Assess the Risks

Foster Morrison led the HMPC in a research effort to identify, document, and profile all the hazards that have, or could have, an impact the Sutter County Planning Area. Starting with the 2013 Plan, natural hazards of concern were added, deleted, and modified for this LHMP Update. Data collection worksheets were developed and used in this effort to aid in determining hazards and vulnerabilities and where the risk varies across the Planning Area. Geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities.

The HMPC also conducted a capability assessment to review and document the Planning Area's current capabilities to mitigate risk from and vulnerability to hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC could assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified.

Also addressed in the risk assessment of this 2020 LHMP is an assessment of the County's floodplain management program and participation in the National Flood Insurance Program (NFIP), including a discussion of their continued compliance with NFIP requirements and their CRS program.

A more detailed description of the risk assessment process, methodologies, and results are included in Chapter 4 Risk Assessment.

3.2.3. Phase 3: Develop the Mitigation Plan

Planning Steps 6 and 7: Set Goals and Review Possible Activities

Foster Morrison facilitated brainstorming and discussion sessions with the HMPC that described the purpose and process of developing planning goals and objectives, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This information is included in Chapter 5 Mitigation Strategy. Additional documentation on the process the HMPC used to develop the goals and mitigation strategy is in Appendix C.

Planning Step 8: Draft an Action Plan

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, a complete first draft of the LHMP Update was developed. This complete draft was provided for HMPC review and comment via a Dropbox web link. Other agencies and the Public HMPC and Steering Committee members were invited to comment on this draft as well. HMPC and agency comments were integrated into the second public review draft, which was advertised and distributed to collect public input and comments. The HMPC integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for CAL OES and FEMA Region IX to review and approve, contingent upon final adoption by governing boards of all participating jurisdictions.

3.2.4. Phase 4: Implement the Plan and Monitor Progress

Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the LHMP Update, the Plan was adopted by the governing boards of each participating jurisdiction using the sample resolution contained in Appendix D.

Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the planning process, all of the HMPC's efforts have been directed at researching data, coordinating input from participating entities, and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. An overall implementation strategy is described in Chapter 7 Plan Implementation and Maintenance.

Finally, there are numerous organizations within the Sutter County Planning Area whose goals and interests interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the implementation and ongoing success of this plan and mitigation in Sutter County and is addressed further in Chapter 7.

Implementation and Maintenance Process: 2013

The 2013 Sutter County, California Natural Hazard Mitigation Plan Update included a process for Plan maintenance and implementation of the mitigation strategy as well as formal updates to the Plan document. The 2013 process called for annual reviews with the status of mitigation strategy implementation documented in an annual report. In addition, the 2013 process called for a formal plan update as required by DMA regulations every 5 years. Due to the turnover of key staff responsible for the implementation of the 2013 LHMP and other key County departmental staff, it is unknown whether the 2013 LHMP underwent annual or other reviews. This 2021 LHMP Update, once approved and adopted, will meet the DMA formal 5-year update requirement.

In addition, the 2013 LHMP was relied on and integrated into other planning mechanisms in the County. Table 3-7 lists the planning mechanism the 2013 LHMP Update was integrated into by Sutter County.

Table 3-7 Incorporation of 2013 Sutter County LHMP Update into Other Planning Mechanisms

Planning Mechanism 2012 LHMP Was Incorporated or Implemented Through	Details
EOP, 2013, 2017 with current updates in process	The EOP used the risk assessment from the 2013 LHMP to inform the hazard descriptions in the EOP update and other LHMP areas were incorporated to the extent they aligned with the EOP.
Flood Plans	The 2013 LHMP was considered in the development of recent flood plans in Sutter County.

The plan implementation and maintenance process as set forth in the 2013 Plan has been updated for this LHMP Update. The revised update implementation and maintenance process for the Sutter County 2021 LHMP Update is set forth in Section 7 of this Plan document. A strategy for continued public involvement for this update process is also included in Chapter 7.

Chapter 4 Risk Assessment

Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

As defined by the Federal Emergency Management Agency (FEMA), risk is a combination of hazard, vulnerability, and exposure. "It is the impact that a hazard would have on people, services, facilities, and structures in a community and refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage."

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The process allows for a better understanding of a community's potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

This risk assessment followed the methodology described in the FEMA publication Understanding Your Risks—Identifying Hazards and Estimating Losses (FEMA 386-2, 2002), which breaks the assessment down to a four-step process:

1. Identify Hazards;
2. Profile Hazard Events;
3. Inventory Assets; and
4. Estimate Losses.

Data collected through this process has been incorporated into the following sections of this chapter:

- **Section 4.1: Hazard Identification** identifies the natural hazards that threaten the Sutter County Planning Area and describes why some hazards have been omitted from further consideration.
- **Section 4.2:**. **Sutter County Assets at Risk** identifies the property values; populations; critical facilities; and cultural, historical, and natural resources at risk. This information is not hazard specific and covers the entire Sutter County Planning Area.
- **Section 4.3: Hazard Profiles and Vulnerability Assessment** provides an overview of each hazard, its location and extent, and discusses the risk, vulnerability, and impacts of each natural hazard to the Planning Area. The hazard profile also describes previous occurrences of hazard events and the likelihood of future occurrences. The vulnerability assessment evaluates the Planning Area's and the unincorporated County's exposure to natural hazards; considering assets at risk, populations at risk, critical facilities, future development trends, and, where possible, estimates potential hazard losses.
- **Section 4.4: Capability Assessment** inventories existing local mitigation activities and policies, regulations, plans, and projects that pertain to mitigation and can affect net vulnerability.

This risk assessment covers the entire geographical extent of the Sutter County Planning Area, including the incorporated communities and other participating jurisdictions. In accordance with FEMA requirements, this risk assessment describes how the hazards and risks vary across the planning area and from jurisdiction to jurisdiction. While these differences are noted in this chapter, they are expanded upon in the annexes of the participating jurisdictions. If no additional data is provided in an annex, it should be assumed that the risk and potential impacts to the affected jurisdiction are similar to those described here for the entire Sutter County Planning Area.

This LHMP Update involved a comprehensive review and update of each section of the 2013 risk assessment. Information from the 2013 LHMP was used in this Update where valid and applicable. As part of the risk assessment update, new data was used, where available, and new analyses were conducted. Where data from existing studies and reports was used, the source is referenced throughout this risk assessment. Refinements, changes, and new methodologies used in the development of this risk assessment update are summarized in Chapter 2 What's New and are also detailed in this risk assessment portion of this Plan.

4.1 Hazard Identification

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all natural hazards that can affect the jurisdiction.

The Sutter County Hazard Mitigation Planning Committee (HMPC) conducted a hazard identification assessment to determine the hazards that threaten the Planning Area. This section details the methodology and results of this effort.

Data Sources

The following data sources were used for this Hazard Identification portion of this Plan:

- California Office of Emergency Services (CAL OES)
- HMPC input
- National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) Storm Events Database
- 2013 Sutter County LHMP
- 2018 State of California Hazard Mitigation Plan
- FEMA Disaster Declaration Database

4.1.1. Results and Methodology

Using existing hazards data and input gained through planning meetings, the HMPC agreed upon a list of hazards that could affect the Sutter County Planning Area. Hazards data from Cal OES, FEMA, the NOAA NCDC database, and many other sources were examined to assess the significance of these hazards to the Planning Area.

The following hazards in Table 4-1, listed alphabetically, were identified and investigated for this LHMP Update. As a starting point, the 2018 California State Hazard Mitigation Plan was consulted to evaluate

the applicability of hazards of concern to the State, to the Sutter County Planning Area. Building upon this effort, hazards from the 2013 Sutter County Local Hazard Mitigation Plan (LHMP) were also identified, and comments explain how hazards were updated from the 2013 Plan. Most hazards from the 2013 plan were profiled in this LHMP Update. Hazards dropped for this 2021 Plan Update include volcano, invasive pests/plants, tornado, and fog. The wind hazard and erosion hazard were incorporated into other hazards. New hazards include climate change and pandemic.

Table 4-1 Sutter County Hazard Identification and Comparison from 2013 LHMP

2021 Hazards	2013 Hazards	Comment
Aquatic Invasive Species	Marine Invasive Species	This hazard was renamed and similar analysis was performed.
Climate Change	–	New hazard
Dam Failure	Dam Failure	New inundation maps, especially from dams outside the County, were added and newer asset and critical facility data from the County and jurisdictions was analyzed. Future development analysis was also updated.
Drought & Water shortage	Drought & Water shortage	Similar analysis was performed.
Earthquake	Earthquakes	Additional Hazus runs were performed to show how risk varies based on which fault ruptures.
–	Earth Movements: Erosion	This hazard was removed as a stand alone hazard. Erosion is discussed in the flood and levee failure hazards.
–	Earth Movements: Landslide	Due to limited landslide areas in the County, this hazard was dropped from consideration.
Floods: 1%/0.2% annual chance	Floods: 100/500 year	Similar analysis was performed, but newer asset and critical facility data from the County and jurisdictions was analyzed. Future development analysis was also updated.
Floods: Localized Stormwater	Floods: Localized Stormwater	Similar analysis was performed.
–	Invasive Species: Pests/Plants	This hazard was dropped from consideration due to limited mitigation actions available to the County.
Levee Failure	Levee Failure	Additional analysis was performed based on data provided by the County and Sutter Butte Flood Control District. Newer asset and critical facility data from the County and jurisdictions was analyzed. Future development analysis was also updated. Wind impacts were also considered in this Hazard.
Pandemic	–	New hazard
Severe Weather: Extreme Cold and Freeze	Severe Weather: Extreme Cold/ Freeze	Similar analysis was performed.
Severe Weather: Extreme Heat	Severe Weather: Extreme Heat	Similar analysis was performed.

2021 Hazards	2013 Hazards	Comment
–	Severe Weather: Fog	Due to lack of available mitigation actions for this hazard, this was dropped from consideration.
Severe Weather: Heavy Rains and Storms	Severe Weather: Heavy rain, hailstorm, lightning, and Wind	Similar analysis was performed
–	Severe Weather: Tornado	Due to limited past occurrences of tornadoes, this hazard was dropped from consideration.
–	Volcanoes	Due to limited volcanic activity in the County, this hazard was dropped from consideration.
Wildfire	Wildfires	Similar analysis was performed, but newer asset and critical facility data from the County and jurisdictions was analyzed. Future development analysis was also updated.

Certain hazards were excluded from consideration for this LHMP Update. They are shown in Table 4-2.

Table 4-2 Sutter County – Excluded Hazards

Hazard Excluded	Why Excluded
Landslide	There are very few locations in the County at risk from landslide due to the relatively flat topography of the County. The areas at risk have little to no development in risk areas.
Volcanoes	Due to the distance from volcano, the likelihood of future occurrence, and the lack of mitigation actions from the County and participating jurisdictions, this hazard was excluded from consideration.
Tsunami	The County is not on the coast.
Air Pollution	The County did consider this a hazard for this Plan, it is dealt with in other planning mechanisms in the County. Smoke is discussed in the wildfire hazard.
Coastal Flooding, Erosion, and Sea Level Rise	The County is not on the coast.
Energy Shortage and Energy Resilience	The County did consider this a hazard, it is dealt with in other planning mechanisms in the County.
Natural Gas Pipeline Hazards	The County did not consider this a hazard due to the low number of gas pipelines traversing the County.
Oil Spills	The County did not consider this a hazard, as there are few pipelines or oil wells in the County.
Radiological Accidents	There are no areas in the County at risk to this hazard.
Subsidence	There are few areas of the County where subsidence is a risk. In addition, most subsidence is related to drought and water shortage, and will be discussed in that hazard profile and vulnerability assessment.
Cyber Threats	The County did consider this a hazard, but it is dealt with in other planning mechanisms in the County.
Airline Crashes	There have been few past occurrences in the County of airplane crashes. This is not a hazard to be included in the LHMP

Hazard Excluded	Why Excluded
Civil Disturbance	The County did consider this a hazard, but it is dealt with in other planning mechanisms in the County.
Well Stimulation and Hydraulic Fracking	This is not occurring in the County.

Table 4-3 was completed by the County and HMPC to identify, profile, and rate the significance of identified hazards. Those hazards identified as a high or medium significance are considered priority hazards for mitigation planning. Those hazards that occur infrequently or have little or no impact on the Planning Area were determined to be of low significance and not considered a priority hazard. Significance was determined based on the hazard profile, focusing on key criteria such as frequency, extent, and resulting damage, including deaths/injuries and property, crop, and economic damage. The ability of a community to reduce losses through implementation of existing and new mitigation measures was also considered as to the significance of a hazard. This assessment was used by the HMPC to prioritize those hazards of greatest significance to the Sutter County Planning Area, enabling the County to focus resources where they are most needed.

Table 4-3 Sutter County Hazard Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Highly Likely	Limited	Low	–
Climate Change	Extensive	Likely	Limited	Medium	
Dam Failure	Extensive	Occasional	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Limited	High	High
Earthquake	Extensive	Unlikely	Catastrophic	Medium	Low
Floods: 1%/0.5%/0.2% annual chance	Extensive	Likely	Critical	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Limited	Medium	Medium
Levee Failure	Significant	Occasional	Catastrophic	High	Medium
Pandemic	Extensive	Likely	Critical	High	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Limited	Medium	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Medium	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Limited	Medium	Medium
Wildfire	Significant	Highly Likely	Limited	Medium	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

4.1.2. Disaster Declaration History

One method used to identify hazards was the researching of past events that triggered federal and/or state emergency or disaster declarations in the Sutter County Planning Area. Federal and/or state disaster declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government's capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments' capacities are exceeded, a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration (SBA). FEMA also issues emergency declarations, which are more limited in scope and without the long-term federal recovery programs of major disaster declarations. The quantity and types of damage are the determining factors.

Based on the disaster declaration history provided in Table 4-4, Sutter County is among the many counties in California susceptible to disaster. Details on federal and state disaster declarations were obtained by FEMA and Cal OES and compiled in chronological order in Table 4-4. A review of state declared disasters indicates that Sutter County received 25 state declarations between 1950 and 2020. Of the 25 state declarations: 20 were associated with severe winter storms, heavy rains, or flooding; 2 were for drought; 1 was from economic disasters, 1 was from freeze, and 1 was from pandemic. A review of federal disasters shows 20 federal disaster declarations. Of these 20 federal declarations: 15 were associated with severe winter storms, heavy rains, or flooding, 1 was from dam failure, 1 was from drought, 1 was from freeze, 1 was from pandemic, and 1 was for hurricane (a nationwide declaration for Katrina evacuations). A summary of these events by disaster type is shown in Table 4-5.

Table 4-4 Sutter County State and Federal Disaster Declarations, 1950-2020

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
2020	Covid-19	Pandemic	Pandemic	DR-4482	3/4/2020	1/20/2020
2017	California Severe Winter Storms, Flooding, Mudslides	Flood	Storms	DR-4308	–	4/1/2017
2017	California Severe Winter Storms, Flooding, Mudslides	Flood	Storms	DR-4301	–	2/14/2017
2017	Oroville Spillway Incident	Dam Failure	Flood	EM-3381	–	2/7/2017
2014	California Drought	Drought	Drought	GP 2014-13	1/17/2014	–
2008	2008 January Storms	Flood	Flood	GP-2008-01	12/21/2007	–

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
2005/2006	2005/06 Winter Storms	Flood	Storms	DR-1628	–	2/3/2006
2005	Hurricane Katrina Evacuations	Economic	Hurricane	EM-3248 2005	–	9/13/2005
2001	Energy Emergency	Economic	Greed	GP 2001	1/1/2001	–
1998	1998 El Nino Floods	Flood	Flood	DR-1203	Proclaimed	2/19/1998
1997	1997 January Floods	Flood	Storms	DR-1155	1/2/97-1/31/97	1/4/1997
1995	California Severe Winter Storms, Flooding, Landslides, Mud Flows	Flood	Storms	DR-1046	Proclaimed	3/12/1995
1995	1995 Severe Winter Storms	Flood	Storms	DR-1044	1/6/95-3/14/95	1/13/1995
1990	Freeze	Freeze	Freeze	DR-894	12/19/1990-1/18/1991	2/11/1991
1986	1986 Storms	Flood	Storms	DR-758	2/18-86-3/12/86	2/18/1986
1983	1982-1983 Winter Storms	Flood	Storms	DR-677	12/8/1982-3/21/1983	2/9/1983
1977	1976 Drought	Drought	Drought	EM-3023	2/9/1976, 2/13/1976, 2/24/1976, 3/26/1976, 7/6/1976	1/20/1977
1973	Storms and Floods	Flood	Flood	–	2/28/1973	–
1972	Severe Weather Conditions	Flood	Flood	–	9/3/1972	–
1970	1970 Northern California Flooding	Flood	Flood	DR 283	1/27/1970 - 3/2/1970	2/16/1970
1964	1964 Late Winter Storms	Flood	Storms	DR-183	12/22/64, 12/23/64, 12/28/64, 1/5/65, & 1/14/65	12/24/1964
1963	1963 Floods	Flood	Storms	–	2/14/1964	–
1962	Flood and Rainstorm	Flood	Storms	–	10/17/1962, 10/25/1962, 10/30/1962, 11/4/1962	10/24/1962
1959	Unseasonal and Heavy Rainfall	Flood	Storms	–	9/17/1959	–

Year	Disaster Name	Disaster Type	Disaster Cause	Disaster #	State Declaration #	Federal Declaration #
1958	1958 April Storms and Floods	Flood	Storms	DR-52	4/5/1958	4/4/1958
1958	1958 February Storms and Floods	Flood	Storms	CDO 58-03	2/26/1958	–
1957	Unseasonal and Heavy Rainfall	Flood	Severe Storm, Economic	–	5/20/1957 (Cherry-producing)	–
1955	1955 Floods	Flood	Flood	DR-47	12/22/1955	12/23/1955
1950	1950 Floods	Flood	Flood	OCD 50-01	11/21/1950	–

Source: Cal OES, FEMA

Table 4-5 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017
Drought	2	1976, 2014	1	1976
Economic	1	2001	0	–
Freeze	1	1990	1	1990
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)
Hurricane	0	–	1	2005
Pandemic	1	2020	1	2020
Totals	**25**	–	**20**	**–**

Source: Cal OES, FEMA

Disasters since 2013

As detailed above, there have been four federal disaster declarations and two state disaster declarations since the 2013 plan:

- 2014 Drought (state)
- 2017 Dam Failure (federal)
- 2017 Flood (two federal)
- 2020 Pandemic (state and federal)

USDA Disaster Declarations

Another database of disaster declarations comes from the USDA. This database shows agricultural disasters that result from natural hazards. This database was searched from 2012 to 2020, and the results for Sutter County are shown on Table 4-6.

Table 4-6 Sutter County – USDA Disaster Declarations 2012-2020

Year	Declaration Number	Primary or Contiguous County	Disaster Type
2012	S3268	Primary	Drought-FAST TRACK
2012	S3379	Primary	Drought
2012	S3452	Primary	Drought
2013	S3569	Primary	Drought-FAST TRACK
2014	S3626	Contiguous	Drought-FAST TRACK
2014	S3637	Primary	Drought-FAST TRACK
2014	S3743	Contiguous	Drought
2014	S3797	Primary	Drought
2015	S3784	Primary	Drought-FAST TRACK
2016	S3952	Primary	Drought-FAST TRACK
2016	S4164	Primary	Severe weather including excessive rainfall and high winds
2016	S4170	Contiguous	Severe weather including excessive rainfall and high winds
2017	S4163	Contiguous	Drought-FAST TRACK
2019	S4565	Contiguous	Excessive rain
2020	S4691	Contiguous	Drought-FAST TRACK
2020	S4697	Primary	Drought-FAST TRACK

Source: USDA

EOC Activations since 2013

The Sutter County EOC has been activated multiple times since 2013. EOC activations in the County include:

- Flooding Jan 2017
- Oroville Dam Incident Feb 2017
- Camp Fire 2018
- COVID-19 2020
- 2 Butte Fires

4.2 Sutter County Assets at Risk

As a starting point for analyzing the Sutter County Planning Area's vulnerability to identified hazards, a variety of data was used to define a baseline against which all disaster impacts could be compared. If a catastrophic disaster was to occur, this section describes significant assets at risk in the Planning Area. Data used in this baseline assessment included:

- Values at risk;
- Critical facility inventory;

- Cultural, historical, and natural resources; and
- Growth and development trends.

Data Sources

Data used to support this assessment included the sources listed below. Where data and information from these studies, plans, reports, and other data sources were used, the source is referenced as appropriate throughout this vulnerability assessment.

- 2013-2021 Sutter County Housing Element
- CalAtlas
- CA DWR Special Populations and Disadvantaged Community Mapping
- California Department of Finance
- California Department of Finance P-1 Report
- California Department of Fish and Game
- California Department of Parks and Recreation Office of Historic Preservation
- California Natural Diversity Database
- CDC Social Vulnerability Index
- Climate Change and Health Profile Report – Sutter County Special Populations
- Hazus MH 4.2
- State of California Department of Conservation
- State of California Department of Conservation Farmland Mapping and Monitoring Program
- Sutter County Planning and Building Services Division
- Sutter County General Plan (2011)
- Sutter County General Plan Technical Background Report (2008)
- Sutter County GIS
- Sutter County 2020 Assessor/Parcel Data
- Sutter County 2030 General Plan Land Use Element
- US Census Bureau
- US Fish and Wildlife Service

4.2.1. Values at Risk

Parcel Inventory and Assessed Values

This analysis captures the values associated with assessed values located within Sutter County. The 2020 Sutter County Parcel/Assessor's data, obtained from Sutter County, was used for as the basis of this analysis. This data provided by Sutter County represents best available data.

Understanding the total assessed value of Sutter County is a starting point to understanding the overall value of identified values at risk in the County. When the total assessed values are combined with potential values associated with other community assets such as public and private critical infrastructure, historic and cultural resources, and natural resources, the big picture emerges as to what is potentially at risk and vulnerable to the damaging effects of natural hazards within the County.

Methodology

Sutter County's 2020 Assessor Data and the County's GIS parcel data were used as the basis for the inventory of assessed values for both improved and unimproved parcels within the County. This data provides the land and improved values assessed for each parcel, along with key information such as property use. Other GIS data, such as jurisdictional boundaries, roads, streams, and area features, was also obtained from Sutter County and CalAtlas to support countywide mapping and analysis of values at risk.

Data Limitations & Notations

Although based on best available data, the resulting information should only be used as an initial guide to overall values in the County. In the event of a disaster, structures and other infrastructure improvements are at the greatest risk of damage. Depending on the type of hazard and resulting damages, the land itself may not suffer a significant loss. For that reason, the values of structures and other infrastructure improvements are of greatest concern. As such, it is critical to note a specific limitation to the assessed values data within the County, created by Proposition 13. Instead of adjusting property values annually, no adjustments are made until a property transfer occurs. As a result, overall property value information is most likely low and may not reflect current market or true potential loss values for properties within the County.

Another limitation to this data is found in the Williamson Act, also known as the California Land Conservation Act of 1965, that enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. When the County enters into a contract with the landowners under the Williamson Act, the landowner agrees to limit the use of the land to agriculture and compatible uses for a period of at least ten years and the County agrees to tax the land at a rate based on the agricultural production of the land rather than its real estate market value. This further affects the County's overall values for assessed taxable lands.

The 2020 GIS parcel and Assessor data was obtained to perform the spatial analysis. GIS was used to convert the parcel polygons into centroids representing each record in the assessor database. For the purposes of this analysis, the centroids which were not coincident in locations were re-positioned to overlay on the corresponding polygons so that each assessor record (with a unique assessor parcel number) was spatially positioned on the corresponding parcel. In addition, multiple parcels polygons in the GIS data were constructed as multi-part features, of which only one centroid was representative of each parcel polygon. The position of the centroids may result in less accurate hazard analysis overlay results. The data did not contain duplicate records.

Property Use Categories

Sutter County's GIS data contained land use designations which provide detailed descriptive information about how each property is generally used, such as agricultural, commercial, government, industrial, institutional, recreational, residential, and right of way. The land use codes from County assessor data were refined and categorized into seven property use categories and linked back to the Sutter County Assessor data. The final property use categories for Sutter County are:

- Agricultural
- Commercial
- Industrial
- Institutional
- Miscellaneous
- Residential
- Vacant

Once the land use descriptions were grouped into categories, the number of total and improved parcels, as well as land, improved, and personal property values were inventoried for the County by property use.

Estimated Content Replacement Values

Sutter County's assigned property use categories were used to develop estimated content replacement values (CRVs) that are potentially at loss from hazards. FEMA's standard CRV factors were utilized to develop more accurate loss estimates for all mapped hazard analyses. FEMA's CRV factors estimate value as a percent of improved structure value by property use. Table 4-7 shows the breakdown of the different property uses in the County and their estimated CRV factors.

Table 4-7 Sutter County – Content Replacement Factors by Property Use

Sutter County Property Use Categories	Hazus Property Use Categories	Hazus Content Replacement Values
Agricultural	Agricultural	100%
Commercial	Commercial	100%
Industrial	Industrial	150%
Institutional	Institutional	100%
Miscellaneous	–	100%
Residential	Residential	50%
Vacant	–	0%

Source: Hazus

Sutter County Values at Risk Results

Values associated with land and improved structures were identified and summed in order to determine assessed values at risk in the Sutter County Planning Area. Together, the land and improved structure values make up the majority of assessed values associated with each identified parcel or asset. Improved parcel counts were based on the assumption that a parcel was improved if a structure value was present. Content replacement values were then added to the assessed values, as described below, to provide an estimate of values at risk in the Planning Area.

Table 4-8 shows the values or total exposure for the Sutter County Planning Area including estimated contents values (using CRV multipliers from Table 4-7). In addition, loss estimates contained in the hazard vulnerability sections of this Chapter will use calculations based on these values, including content replacement values.

Table 4-8 Sutter County Planning Area – Values at Risk by Jurisdiction

Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
City of Live Oak	2,836	2,334	$129,056,822	$376,507,955	$225,764,558	$731,329,335
City of Yuba City	20,292	18,540	$1,480,747,541	$4,467,117,403	$2,895,777,782	$8,843,642,726
Unincorporated Sutter County	13,031	8,902	$2,216,399,839	$1,564,862,584	$1,292,993,711	$5,074,256,134
Grand Total	**36,159**	**29,776**	**$3,826,204,202**	**$6,408,487,942**	**$4,414,536,051**	**$14,649,228,195**

Source: Sutter County 2020 Parcel/Assessor's Data

The values for unincorporated Sutter County are broken out by property use type and are provided in Table 4-9. More information on assets at risk for each jurisdiction can be found in their respective annexes.

Table 4-9 Unincorporated Sutter County – Total Values at Risk by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	6,596	3,925	$1,850,775,498	$564,764,685	$564,764,685	$2,980,304,868
Commercial	229	197	$41,562,562	$89,673,450	$89,673,450	$220,909,462
Industrial	232	125	$37,042,958	$155,864,635	$233,796,953	$426,704,546
Institutional	597	112	$32,360,924	$54,989,127	$54,989,127	$142,339,178
Miscellaneous	175	–	$0	$0	$0	$0
Residential	4,785	4,539	$242,032,409	$699,538,993	$349,769,497	$1,291,340,899
Vacant	417	4	$12,625,488	$31,694	$0	$12,657,182
Unincorporated Sutter County Total	**13,031**	**8,902**	**$2,216,399,839**	**$1,564,862,584**	**$1,292,993,711**	**$5,074,256,134**

Source: Sutter County 2020 Parcel/Assessor's Data

4.2.2. Critical Facility Inventory

Sutter County developed a definition of critical facilities for the Sutter County Planning Area. For purposes of this plan, a critical facility is defined as:

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A summary of critical facilities in the Sutter County Planning Area can be found in Figure 4-1 and Table 4-10. Table 4-11 details critical facilities by category. Additional details of individual critical facilities can be found in Appendix F of this Plan.

Figure 4-1 Sutter County Planning Area – Critical Facilities

Table 4-10 Sutter County Planning Area – Critical Facility Summary

Source: Sutter County GIS

Table 4-11 Sutter County Planning Area – Critical Facilities by Facility Type

Source: Sutter County GIS

4.2.3. Cultural, Historical, and Natural Resources

Assessing Sutter County's vulnerability to disasters also involves inventorying the cultural, historical, and natural resource assets of the area. This information is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- In the event of a disaster, an accurate inventory of cultural, historical and natural resources allows for more prudent care in the disaster's immediate aftermath when the potential for additional impacts is higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, for example, wetlands and riparian and sensitive habitats which help absorb and attenuate floodwaters and thus support overall mitigation objectives.

Cultural and Historical Resources

Sutter County has a large stock of historically significant homes, public buildings, and landmarks. To inventory these resources, information was collected from a number of sources. The California Department of Parks and Recreation Office of Historic Preservation (OHP) was the primary source of information. The OHP is responsible for the administration of federally and state mandated historic preservation programs to further the identification, evaluation, registration, and protection of California's irreplaceable archaeological and historical resources. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs. Each program has different eligibility criteria and procedural requirements.

- The **National Register of Historic Places** is the nation's official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.
- The **California Register of Historical Resources** program encourages public recognition and protection of resources of architectural, historical, archeological, and cultural significance and identifies

historical resources for state and local planning purposes; determines eligibility for state historic preservation grant funding; and affords certain protections under the California Environmental Quality Act. The Register is the authoritative guide to the state's significant historical and archeological resources.

- **California Historical Landmarks** are sites, buildings, features, or events that are of statewide significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Landmarks #770 and above are automatically listed in the California Register of Historical Resources.
- **California Points of Historical Interest** are sites, buildings, features, or events that are of local (city or county) significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Points designated after December 1997 and recommended by the State Historical Resources Commission are also listed in the California Register.

Historical resources included in the programs above are identified in Table 4-12.

Table 4-12 Sutter County Planning Area – Historical Resources

Resource Name (Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/ Community
Bill Butler House (P395)				X	3/20/1975	Yuba City
Butte House Watering Trough (P315)				X	7/13/1973	Sutter
Campbell's House (P390)				X	3/20/1975	Yuba City
E. G. Van Arsdale House (P393)				X	3/20/1975	Yuba City
East Nicolaus High School (P333)				X	5/15/1974	East Nicolaus
Eugene Boyd House (P396)				X	3/20/1975	Yuba City
Fremont Monument (P309)				X	7/13/1973	Sutter
G.W. Carpenter House (P391)				X	3/20/1975	Yuba City
H. C. Mclaughlin Law Office (P311)				X	7/13/1973	Yuba City
Hock Farm (Site Of) (346)		X			8/8/1939	Yuba City
Live Oak Historic Commercial District (N2012)	X				1/23/1998	Live Oak
Mcgruder House (P389)				X	3/20/1975	Yuba City
Mckague, Frank W., And Wife, Home (P98)				X	6/7/1968	East Nicolaus
Old Brick House Of Sumner Paine (P314)				X	7/13/1973	Meridian
S.G. Stabler And Swinson House (P394)				X	3/20/1975	Yuba City
Sanborn Law Office/Winship Hall (P312)				X	7/13/1973	Yuba City

Resource Name (Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/ Community
Site Of Propagation Of The Thompson Seedless Grape (929)	X				10/15/1979	Yuba City
Sutter County Canning & Packing Company (P313)				X	7/13/1973	Yuba City
Sutter County Courthouse (P387)				X	3/20/1975	Yuba City
Sutter County Hall Of Records (P388)				X	3/20/1975	Yuba City
Sutter County Masonic Temple (P826)				X	3/3/1997	Yuba City
Thomas D. Boyd House (P392)				X	3/20/1975	Yuba City
William Harkey House (P385)				X	3/20/1975	Yuba City
William O'Banion House (P386)				X	3/20/1975	Yuba City
Wooley's Grave (P310)				X	7/13/1973	Meridian

Source: California Department of Parks and Recreation Office of Historic Preservation, http://ohp.parks.ca.gov/

It should be noted that these lists may not be complete, as they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by CEQA and NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Natural Resources

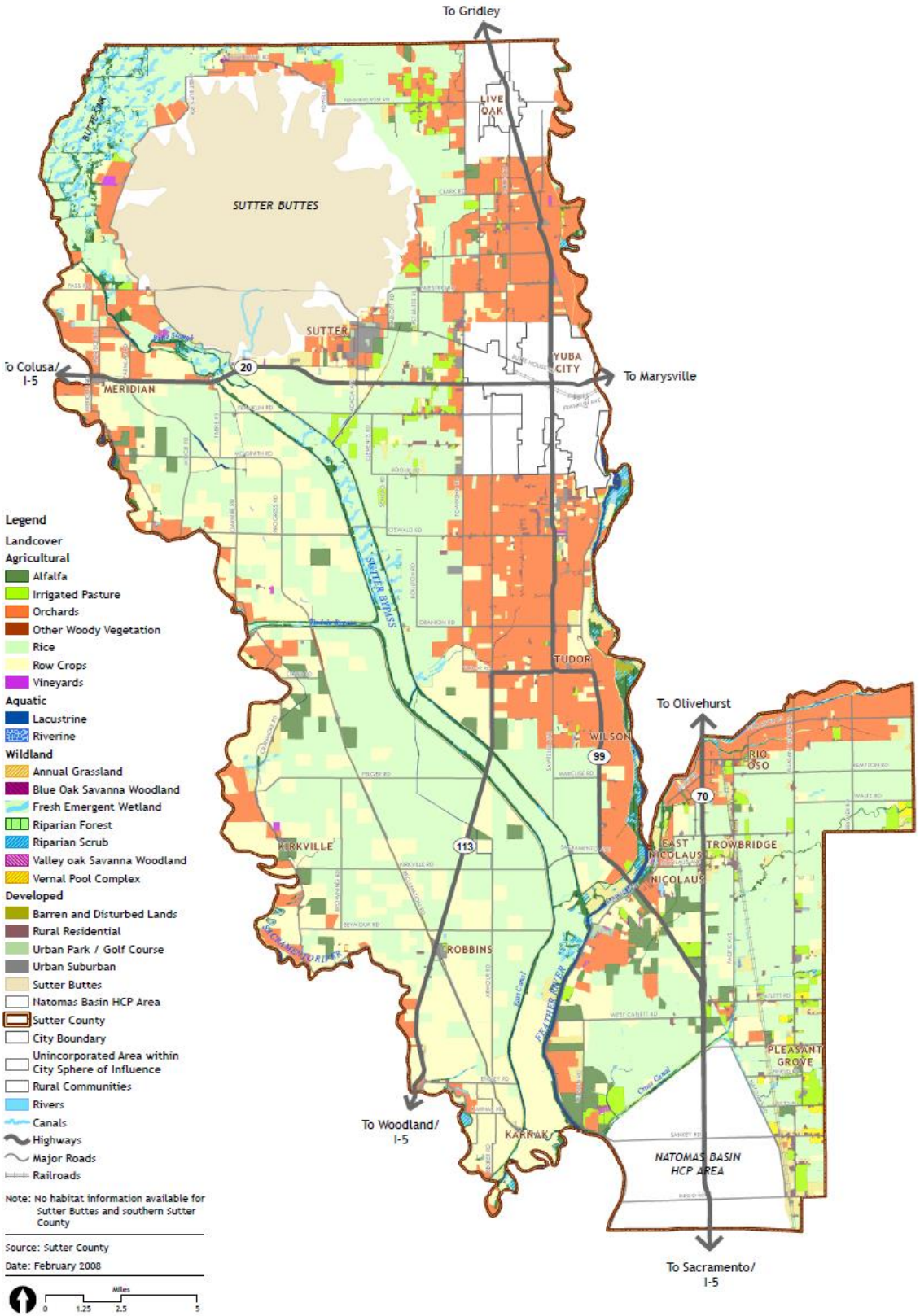
Natural resources are important to include in cost/benefit analyses for future projects and may be used to leverage additional funding for mitigation projects that also contribute to community goals for protecting sensitive natural resources. Awareness of natural assets can lead to opportunities for meeting multiple objectives. For instance, protecting wetland areas protects sensitive habitat as well as reducing the force of and storing floodwaters.

The County encompasses approximately 388,358 acres. Historically, the natural habitats within the County included perennial grasslands, riparian woodlands, oak woodlands, and a variety of wetlands including vernal pools, seasonal wetlands, freshwater marshes, ponds, streams and rivers. Over the last 150 years, development for agriculture, irrigation, flood control and urbanization has resulted in the alteration or loss of much of the natural habitat within the County. One exception to this is the Sutter Buttes which contain the largest expanses of relatively undisturbed habitat in the County. The Sutter Buttes is a volcanic formation in northern central Sutter County that is over 2,000 feet in elevation, and covers approximately 40,000 acres. Although almost entirely under private ownership and used for livestock grazing, the Sutter Buttes support a high diversity of vegetation communities including oak woodland, chaparral, non-native grassland, with vernal pools and other seasonal wetlands. Plant and wildlife species found here are also

diverse, and include some endemic, and/or special-status species such as the Marysville kangaroo rat, the San Francisco campion, and rose mallow.

County wide, as with most of the rest of the state, non-native annual grasses have replaced the native perennial grasslands. Many natural streams in the County have been channelized, much of the riparian and oak woodlands have been cleared, and most of the marshes have been drained and converted to agricultural or urban uses. However, due to the scarcity of urban development relative to many nearby counties, valuable plant and wildlife habitat still exists. These habitats are located primarily along the Sacramento River, Feather River, Bear River, and Sutter Bypass, but also in a number of undeveloped parcels distributed throughout the County. These habitats include annual grasslands, riparian woodlands, oak woodlands, oak savanna, riverine (rivers and streams), ponds, freshwater marshes, seasonal wetlands and vernal pools (Figure 4-2).

Figure 4-2 Habitats in Sutter County



Source: Sutter County General Plan Technical Background Report

Special Status Species

To further understand natural resources that may be particularly vulnerable to a hazard event, as well as those that need consideration when implementing mitigation activities, it is important to identify at-risk species (i.e., endangered species) in the Planning Area. An endangered species is any species of fish, plant life, or wildlife that is in danger of extinction throughout all or most of its range. A threatened species is a species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Both endangered and threatened species are protected by law and any future hazard mitigation projects are subject to these laws. Candidate species are plants and animals that have been proposed as endangered or threatened but are not currently listed.

The California Natural Diversity Database, a program that inventories the status and locations of rare plants and animals in California, was queried to create an inventory of special status species in Sutter County. A summary list of these species is found below in Table 4-13. Appendix E list the name, federal status, state status, California Department of Fish and Wildlife (USFWS) status, and the California Rare Plant rank of species in Sutter County.

Table 4-13 Sutter County Planning Area – Summary of Special Status Species

Type	Number
Animals - Amphibians	2
Animals - Birds	27
Animals – Crustaceans	3
Animals - Fish	18
Animals - Insects	4
Animals - Mammals	10
Animals – Mollusks	1
Animals – Reptiles	3
Community – Terrestrial	5
Plants – Vascular	19

Source: California Natural Diversity Database

Wetlands

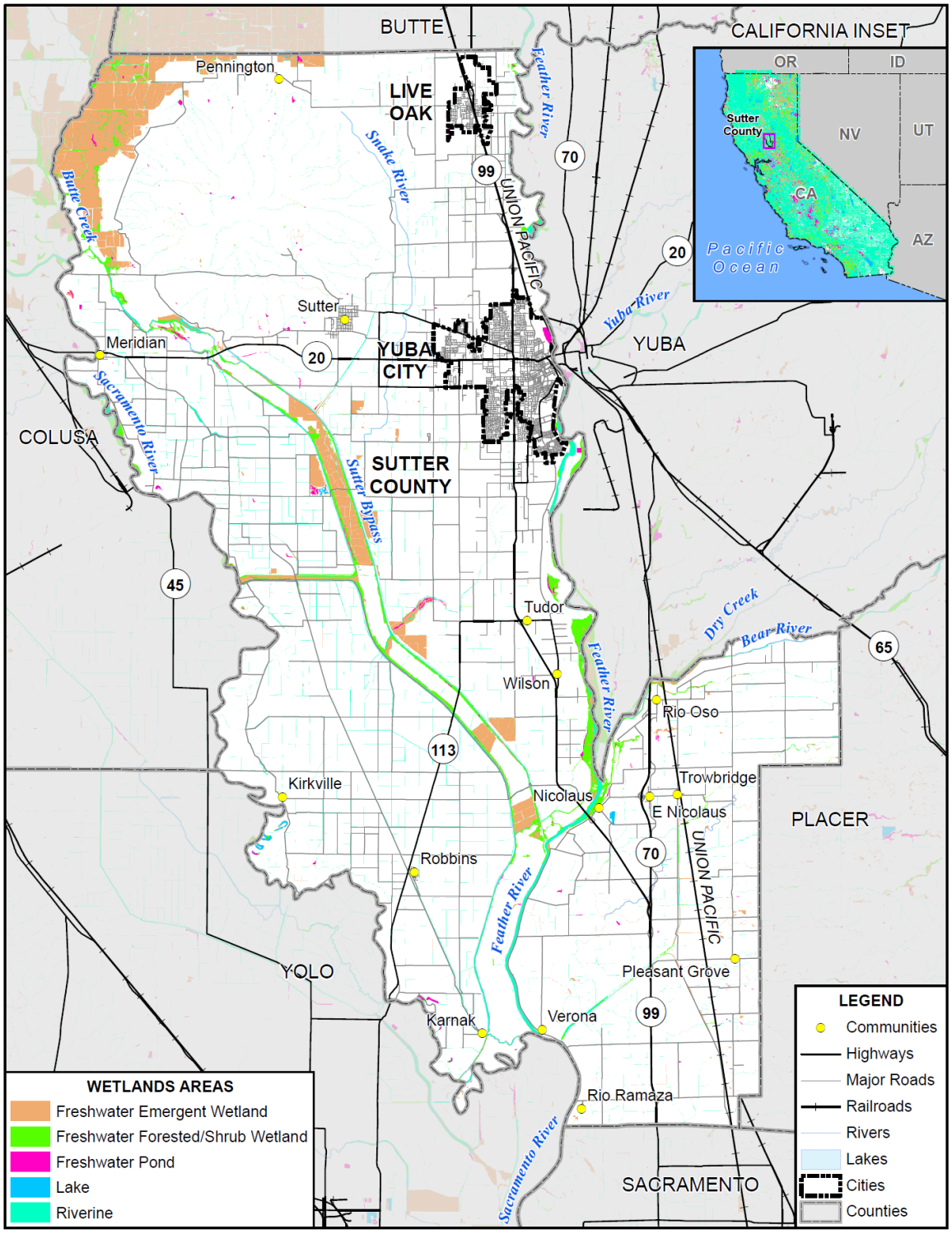
Wetlands are habitats in which soils are intermittently or permanently saturated or inundated. Wetland habitats vary from rivers to seasonal ponding of alkaline flats and include swamps, bogs, marshes, vernal pools, and riparian woodlands. Wetlands are considered to be waters of the United States and are subject to the jurisdiction of the U.S. Army Corps of Engineers as well as the California Department of Fish and Wildlife. Where the waters provide habitat for federally endangered species, the USFWS may also have authority.

Wetlands are a valuable natural resource for communities providing beneficial impact to water quality, wildlife protection, recreation, and education, and play an important role in hazard mitigation. Wetlands provide drought relief in water-scarce areas where the relationship between water storage and streamflow

regulation is vital, and reduce flood peaks and slowly release floodwaters to downstream areas. When surface runoff is dampened, the erosive powers of the water are greatly diminished. Furthermore, the reduction in the velocity of inflowing water as it passes through a wetland helps remove sediment being transported by the water.

The US Fish and Wildlife Service has mapped wetlands areas throughout the United States. Figure 4-3 shows the wetlands areas in the County. These areas are detailed in Table 4-14 by wetland type.

Figure 4-3 Sutter County – Wetlands Areas



Data Source: U.S. Fish and Wildlife Service National Wetlands Inventory (May 2020), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table 4-14 Sutter County Planning Area – Wetlands Areas by Area Type

Wetlands Area Type	Wetlands Area (in Acres)
Freshwater Emergent Wetland	15,114.07
Freshwater Forested/Shrub Wetland	5,264.93
Freshwater Pond	730.66
Lake	145.66
Riverine	8,041.33
Grand Total	**29,296.65**

Source: US Fish and Wildlife Service

Natural and Beneficial Functions

Wetlands are often found in floodplains and depressional areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flow. Wetlands perform a variety of ecosystem functions including food web support, habitat for insects and other invertebrates, fish and wildlife habitat, filtering of waterborne and dry-deposited anthropogenic pollutants, carbon storage, water flow regulation (e.g., flood abatement), groundwater recharge, and other human and economic benefits.

Wetlands, and other riparian and sensitive areas, provide habitat for insects and other invertebrates that are critical food sources to a variety of wildlife species, particularly birds. There are species that depend on these areas during all parts of their lifecycle for food, overwintering, and reproductive habitat. Other species use wetlands and riparian areas for one or two specific functions or parts of the lifecycle, most commonly for food resources. In addition, these areas produce substantial plant growth that serves as a food source to herbivores (wild and domesticated) and a secondary food source to carnivores.

Wetlands slow the flow of water through the vegetation and soil, and pollutants are often held in the soil. In addition, because the water is slowed, sediments tend to fall out, thus improving water quality and reducing turbidity downstream.

These natural floodplain functions associated with the natural or relatively undisturbed floodplain that moderates flooding, such as wetland areas, are critical for maintaining water quality, recharging groundwater, reducing erosion, redistributing sand and sediment, and providing fish and wildlife habitat. Preserving and protecting these areas and associated functions are a vital component of sound floodplain management practices for the Sutter County Planning Area.

Farmlands

Farmlands are important considerations in rural counties in California. Sutter County is located within the northern portion of California's Central Valley in the area known as the Sacramento Valley. It contains some of the richest soils in the State. These soils make the County's agricultural resources very productive. Sutter County is one of California's leading agricultural counties, with 83 percent of the County's total land acreage currently being used for agricultural purposes. The County has continued to stay predominantly agricultural. Even though agricultural production is dependent on weather and economic market fluctuations, local agricultural market revenues continue to rise in Sutter County.

Approximately 15 percent of the farms in the county are 500 acres or larger; however, this small percentage of farms controls over 72 percent of the total farm acres in the County. While the total number of smaller farms up to 100 acres in size is greater than the number of the larger farms, these small farms only control approximately 5 percent of the farming acreage in the County.

Williamson Act

The Williamson Act, also known as the California Land Conservation Act of 1965, enables local governments to enter into contracts with private landowners for the purpose of restricting specific parcels of land to agricultural or related open space use. When the County enters into a contract with the landowners under the Williamson Act, the landowner agrees to limit the use of the land to agriculture and compatible uses for a period of at least ten years and the County agrees to tax the land at a rate based on the agricultural production of the land rather than its real estate market value. This affects the County's overall values for assessed taxable lands. The County has designated areas as agricultural preserves within which the County will enter into contracts for the preservation of the land in agriculture. In an October 8, 2020 Sutter County Board of Supervisors Agenda Packet, a note on Williamson Act Lads from the Public Works/Support Services Committee noted:

> ***To date, the Board of Supervisors has approved one hundred forty-five (145) contracts covering approximately 50,408 acres of prime agricultural land and 13,164 acres of non-prime agricultural land. There are no changes to be reported in the amount of acreage under contract over the past year.***

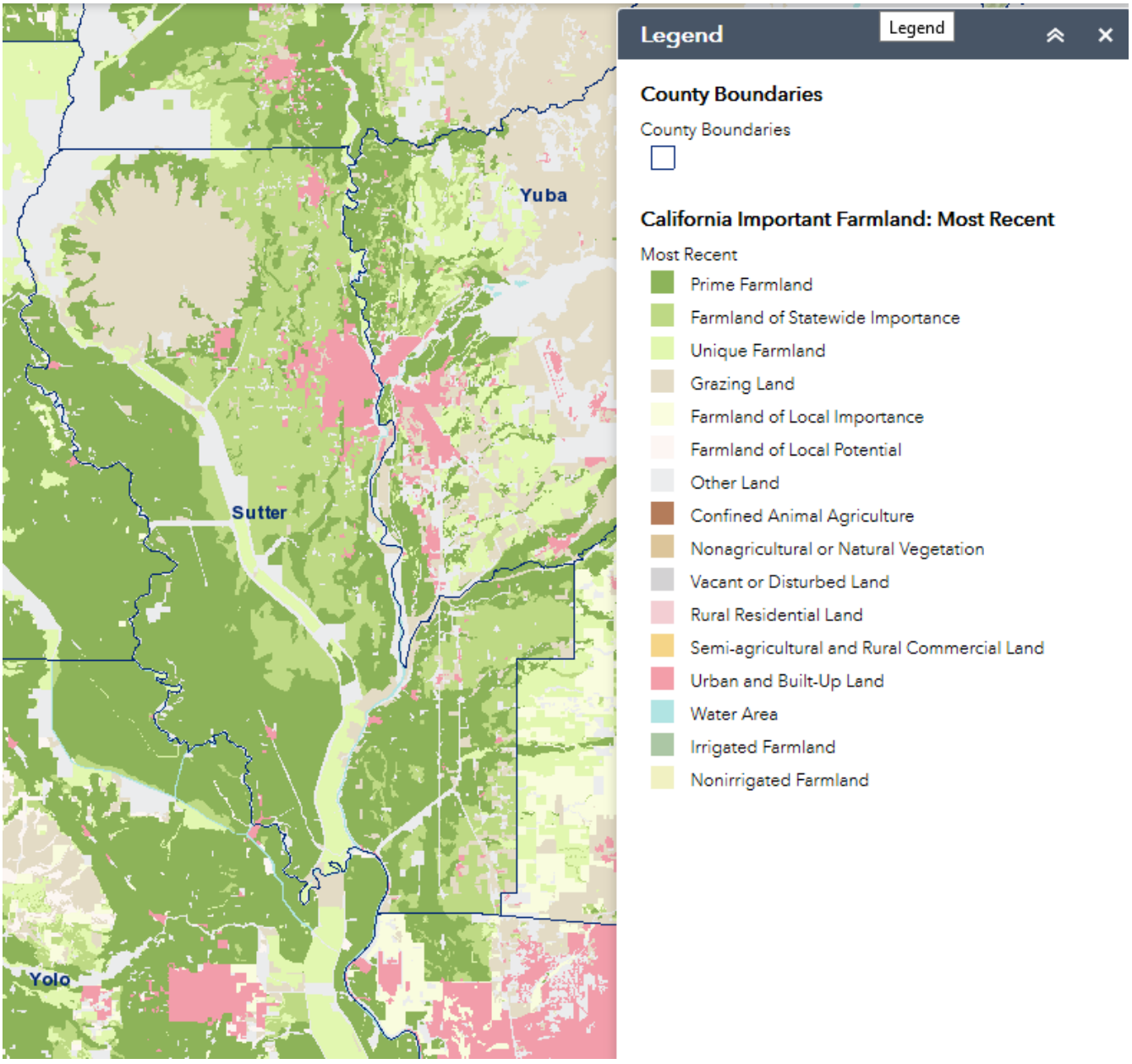
State Inventory of Important Farmland

The Farmland Mapping and Monitoring Program was established in 1984 to document the location, quality, and quantity of agricultural lands and conversion of those lands over time. The program provides impartial analysis of agricultural land use changes throughout California. For inventory purposes, several categories were developed to describe the qualities of land in terms of its suitability for agricultural production. The State Department of Conservation utilizes the following classification system:

- The Prime Farmland category describes farmland with the best combination of physical and chemical features able to sustain long term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date.
- Farmland of Statewide Importance is farmland similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ability to store soil moisture. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date.
- Unique Farmland is farmland of lesser quality soils used for the production of the state's leading agricultural crops. This land is usually irrigated, but may include non-irrigated orchards or vineyards as found in some climatic zones in California. Land must have been cropped at some time during the four years prior to the mapping date.
- Farmland of Local Importance is either currently producing crops or has the capability of production. This farmland category is determined by each county's board of supervisors and a local advisory committee.

The 2016 maps are the most recent versions. These lands are shown in Figure 4-4.

Figure 4-4 Sutter County – Farmland of Importance



Source: California Department of Conservation

4.2.4. Growth and Development Trends

As part of the planning process, the HMPC looked at changes in growth and development, both past and future, and examined these changes in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability over time. Information from the Sutter County General Plan Housing Element, the California Department of Finance, and the US Census Bureau form the basis of this discussion.

Current Status and Past Populations

The estimated population of Sutter County (both incorporated communities and the unincorporated County) for January 1, 2020 was 100,750 (of which 21,092 were in the unincorporated County), representing an almost five and a half-fold increase from 18,680 people in 1940. Table 4-15 illustrates the pace of population growth in Sutter County dating back to 1940. Growth in the County has been steady, with smaller growth coming in the last decade.

Table 4-15 Sutter County Planning Area - Population Growth 1940-2020

Year	Population	Percent Increase
1940	18,680	–
1950	25,200	34.9%
1960	33,700	33.7%
1970	41,935	24.4%
1980	52,600	25.4%
1990	64,800	23.2%
2000	79,499	22.7%
2010	94,669	19.1%
2020	100,750	6.4%

Sources: 2013-2021 Sutter County Housing Element, California Department of Finance, US Census Bureau

Special Populations and Disadvantaged Communities

The County noted that special populations and disadvantaged communities in the County were discussed by three sources:

- CDC Social Vulnerability Index
- CA DWR Special Populations and Disadvantaged Community Mapping
- Climate Change and Health Profile Report – Sutter County Special Populations

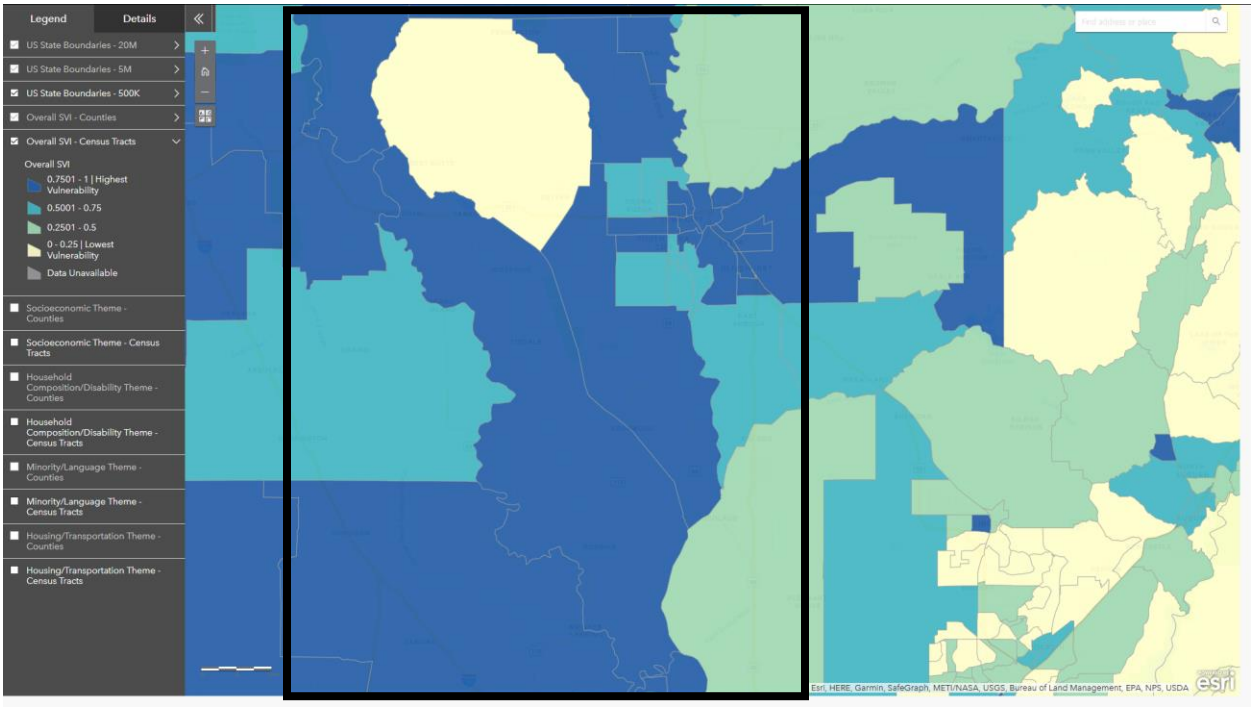
CDC Social Vulnerability Index

Every community must prepare for and respond to hazardous events, whether a natural disaster like a tornado or disease outbreak, or a human-made event such as a harmful chemical spill. A number of factors, including poverty, lack of access to transportation, and crowded housing may weaken a community's ability to prevent human suffering and financial loss in a disaster. These factors are known as social vulnerability.

Social vulnerability refers to the potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused disasters, or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss. CDC Social Vulnerability Index (CDC SVI) uses 15 U.S. census variables to help local officials identify communities that may need support before, during, or after disasters.

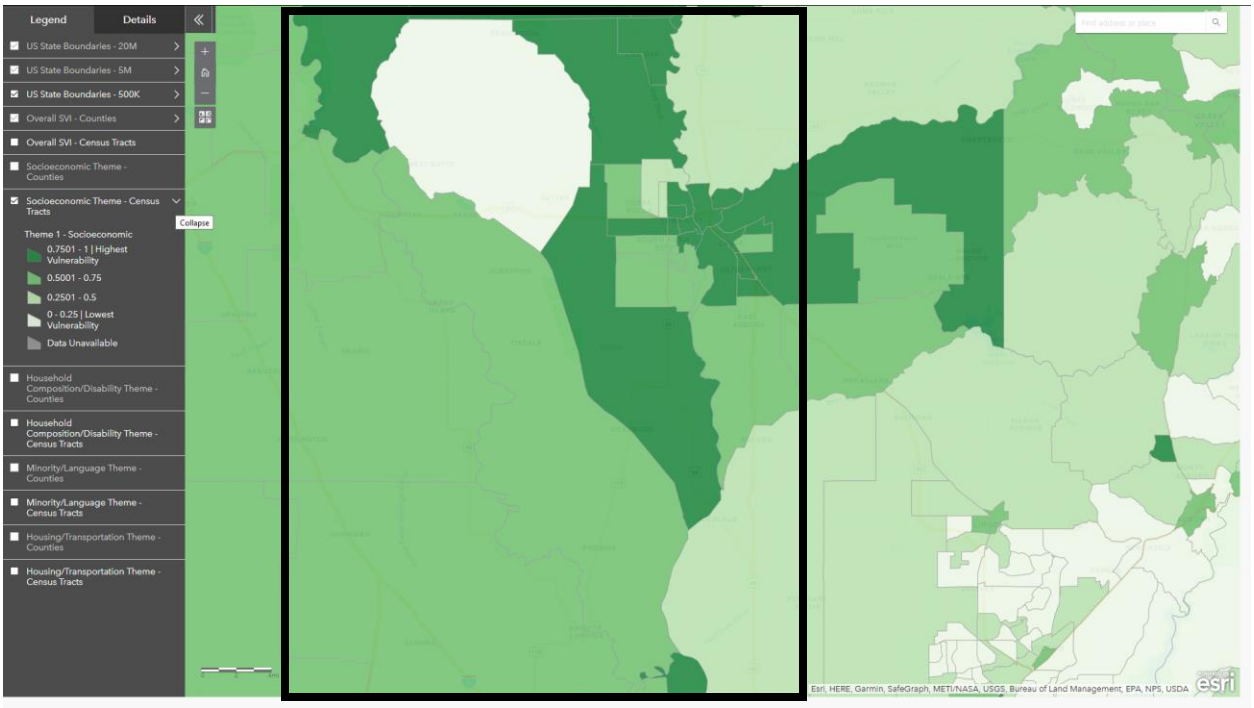
ATSDR's Geospatial Research, Analysis & Services Program (GRASP) created databases to help emergency response planners and public health officials identify and map communities that will most likely need support before, during, and after a hazardous event. CDC SVI uses U.S. Census data to determine the social vulnerability of every census tract. Census tracts are subdivisions of counties for which the Census collects statistical data. The CDC SVI ranks each tract on 15 social factors, including poverty, lack of vehicle access, and crowded housing, and groups them into four related themes. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking. Maps of the four themes are shown in the figure below. The overall SVI map is shown in Figure 4-5; the socioeconomic SVI for the County is shown in Figure 4-6; the household composition SVI for the County is shown in Figure 4-7; ; the minority and language SVI for the County is shown in Figure 4-8; and the housing and transportation SVI for the County is shown in Figure 4-9.

Figure 4-5 Sutter County – Overall Social Vulnerability



Source: CDC Social Vulnerability Index – map retrieved 11/30/2020

Figure 4-6 Sutter County – Socioeconomic Status Vulnerability



Source: CDC Social Vulnerability Index – map retrieved 11/30/2020

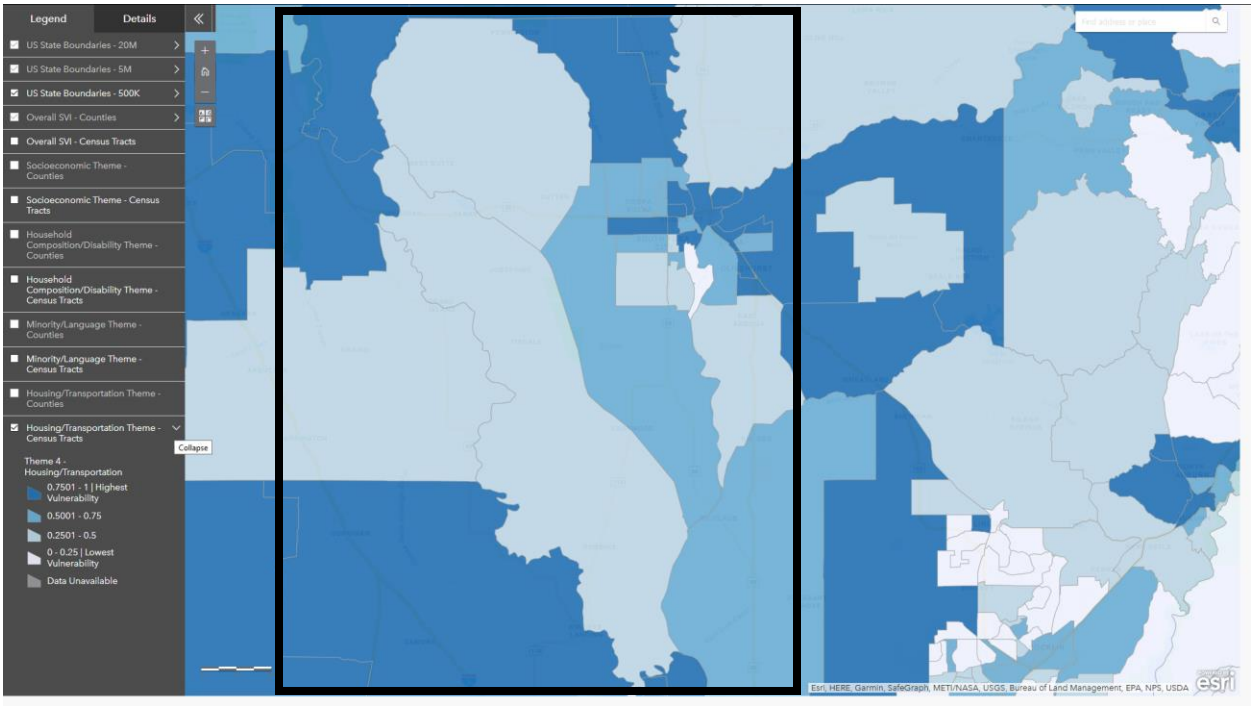
Figure 4-7 Sutter County – Household Composition and Disabilities Social Vulnerability

Source: CDC Social Vulnerability Index – map retrieved 11/30/2020

Figure 4-8 Sutter County – Minority/Language Social Vulnerability

Source: CDC Social Vulnerability Index – map retrieved 11/30/2020

Figure 4-9 Sutter County – Housing/Transportation Social Vulnerability



Source: CDC Social Vulnerability Index – map retrieved 11/30/2020

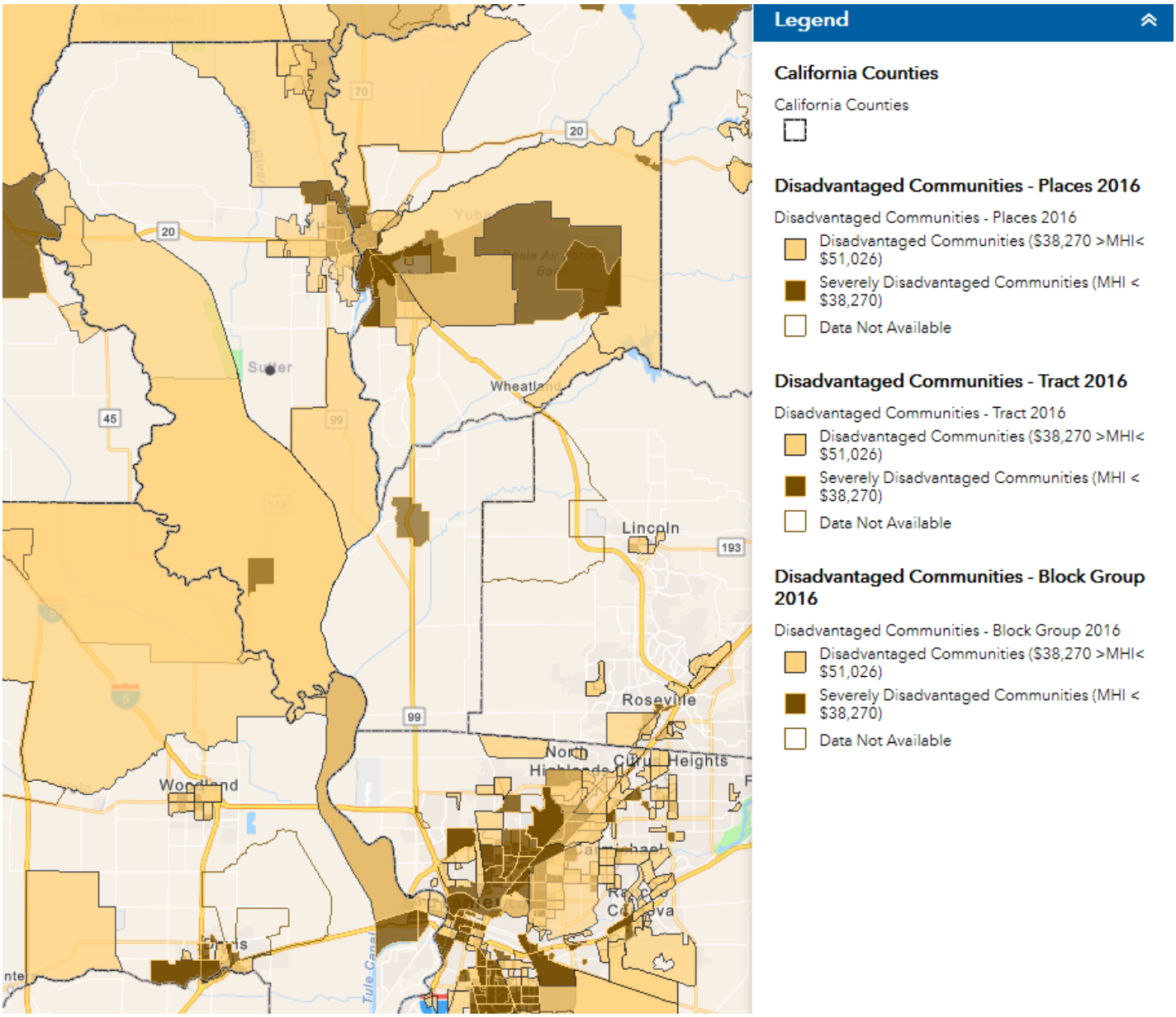
CA DWR Special Population and Disadvantaged Community Mapping

CA DWR has developed a web-based application to assist local agencies and other interested parties in evaluating disadvantaged community (DAC) status throughout the State, using the definition provided by Proposition 84 Integrated Regional Water Management (IRWM) Guidelines (2015). The DAC Mapping Tool is an interactive map application that allows users to overlay the following three US Census geographies as separate data layers:

- Census Place
- Census Tract
- Census Block Group

Only those census geographies that meet the DAC definition are shown on the map (i.e., only those with an annual median household income (MHI) that is less than 80 percent of the Statewide annual MHI (PRC Section 75005(g)). In addition, those census geographies having an annual MHI that is less than 60 percent of the Statewide annual MHI are shown as "Severely Disadvantaged Communities" (SDAC). The DAC map for Sutter County is shown in Figure 4-10.

Figure 4-10 Sutter County – Disadvantaged Communities



Source: CA DWR

Climate Change and Health Profile Report – Sutter County Special Populations

The 2017 Climate Change and Health Profile Report for Sutter County was done by the California Department of Public Health and the University of California-Davis. The report noted that there are special populations in the County.

> ***In 2010, within the total county population (94,737), the age-adjusted death rate in Sutter County was higher than the state average. Disparities in death rates among race/ethnicity groups highlight how certain populations***

disproportionately experience health impacts. Within the county, the highest death rate occurred among Whites and the lowest death rate occurred among Asians.

In 2012, nearly 48% of adults (58,152; pooled for Sutter and Yuba Counties) reported one or more chronic health conditions including heart disease, diabetes, asthma, severe mental stress or high blood pressure. In 2012, 16% of adults reported having been diagnosed with asthma. In 2012, approximately 30% of adults were obese (statewide average was 25%). In 2012, nearly 14% of residents aged 5 years and older had a mental or physical disability (statewide average was 10%).

In 2005-2010, there was an annual average of 15 heat-related emergency room visits and an age-adjusted rate of 16 emergency room visits per 100,000 persons (the statewide age-adjusted rate was 10 emergency room visits per 100,000 persons).

Among climate-vulnerable groups in 2010 were 7,153 children under the age of 5 years and 11,990 adults aged 65 years and older. In 2010, there were approximately 1,060 people living in nursing homes, dormitories, and other group quarters where institutional authorities would need to provide transportation in the event of emergencies.

Social and demographic factors and inequities affect individual and community vulnerability to the health impacts of climate change. In 2010, 11% of households (3,550) did not have a household member 14 years or older who spoke English proficiently (called linguistically isolated; statewide average was 10%).

In 2010, approximately 22% of adults aged 25 years and older had less than a high school education (statewide average was 19%). In 2010, 14% of the population had incomes below the poverty level (the statewide average was 14%).

Nineteen percent of households paid 50% or more of their annual income on rent or a home mortgage (statewide average was 22%). In 2012, approximately 14,000 (46%) low-income residents reported they did not have reliable access to a sufficient amount of affordable, nutritious food (called food insecurity; statewide average was 42%).

In 2010, Sutter County had approximately 5,214 outdoor workers whose occupation increased their risk of heat illness. In 2010, roughly six percent of

households did not own a vehicle that could be used for evacuation (statewide average was 8%).

In 2009, approximately 7% of households were estimated to lack air conditioning, a strategy to counter adverse effects of heat (statewide average was 36%). In 2011, tree canopy, which provides shade and other environmental benefits, was present on 10% of the county's land area (statewide average was 8%).

Development since 2013 Plan

The Sutter County Development Services - Building Division tracks total building permits issued since 2013 for unincorporated Sutter County. A summary of this development is shown in Table 4-16. Development by known flood fire, and other hazard areas is shown in Table 4-17. All development in the identified hazard areas, including the 1% annual chance floodplains and high wildfire risk areas, were completed in accordance with all current and applicable development codes and standards and should be adequately protected. Thus, with the exception of more people living in the area potentially exposed to natural hazards, this growth should not cause a significant change in vulnerability of the County to identified priority hazards.

Table 4-16 Sutter County Development 2013-2020 Summary

Property Use	2013	2015	2016	2017	2018	2019	2020
Residential							
Commercial							
Industrial							
Total							

Source: Sutter County Development Services - Building Division

Table 4-17 Sutter County Development in Hazard Zones since 2013

Property Use	1% Annual Chance Flood	Wildfire Risk Area	Other
Residential			
Commercial			
Industrial			
Other			
Total			

Source: Sutter County Development Services - Building Division

Future Development

Future development in the County is discussed in the sections below.

Future Population Projections

As indicated in the previous section, Sutter County had been steadily growing from 1940 to 2010, with a recent slowing in population growth. Long term forecasts by the California Department of Finance project population growth in Sutter County continuing through 2060. Table 4-18 shows the population projections for the County as a whole through 2060. Based on this data, population growth continues steadily through 2060.

Table 4-18 Population Projections for Sutter County (incorporated and unincorporated), 2020-2060

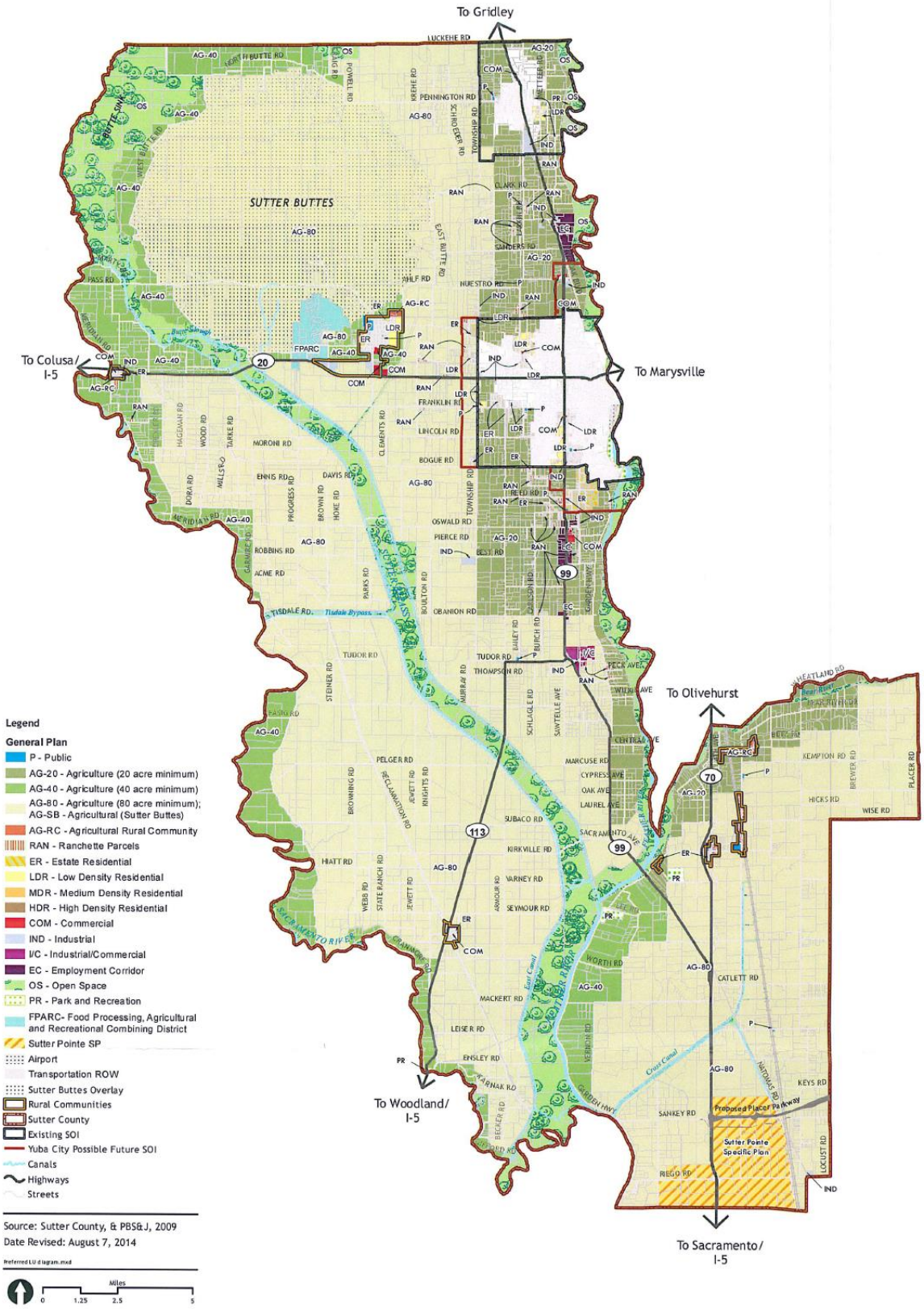
	2020	2030	2040	2050	2060
Sutter County	105,757	121,736	133,610	143,827	157,991

Source: California Department of Finance P-1 Report

Future Land Use

The future use of land in the County is fundamental to attaining the vision of a balanced, self-sustaining community. A land use pattern which balances growth between rural and urban areas, as well as providing a balance between housing, employment, natural resources, and services in the County is a key element in maintaining the quality of life and unique character of the County. Descriptions of allowed uses for each classification are detailed in the Sutter County General Plan Land Use Element. Figure 4-11 is sourced from this section.

Figure 4-11 Sutter County General Plan Land Use



Source: Sutter County 2030 General Plan Land Use Element

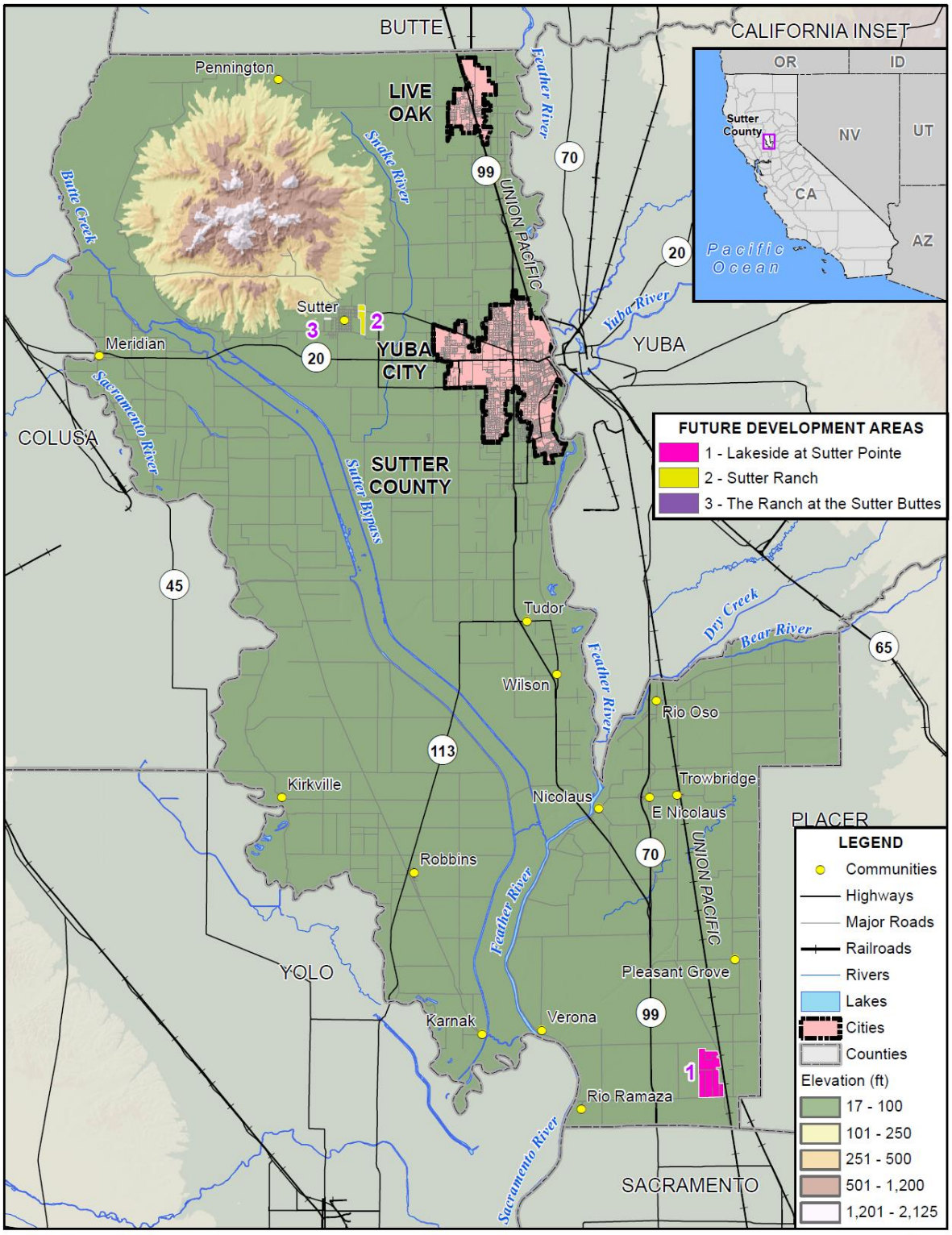
Future Development GIS Analysis

Unincorporated Sutter County has defined three separate locations in the County:

- Lakeside at Sutter Pointe
- Sutter Ranch Subdivision
- The Ranch at Sutter Buttes Subdivision

The above areas were provided by Sutter County and were mapped into GIS format. Using GIS, the following methodology was used in determining parcel counts and acres associated with future development in the unincorporated Amador County Planning Area. Sutter County's 2020 Parcel/Assessor's data and data from the County planning department were used as the basis for the unincorporated County's inventory of parcels and acres of future development areas. Using the GIS parcel spatial file and the APNs, the three future development projects were mapped. These areas can be seen on Figure 4-12 and detailed in Table 4-62. Analysis of future developments for Live Oak and Yuba City can be found in their respective annexes to this Plan Update.

Figure 4-12 Sutter County – Future Development Areas



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table 4-19 Unincorporated Sutter County – Future Development Area Parcels and Acres

Jurisdiction / Future Development	Total Parcel Count	Improved Parcel Count	Total Acres
Lakeside at Sutter Pointe	6	4	871.2
Sutter Ranch	2	1	137.4
The Ranch at the Sutter Buttes	15	2	8.2
Unincorporated Sutter County Total	**23**	**7**	**1,016.9**

Source: Sutter County GIS

4.3 Hazard Profiles and Vulnerability Assessment

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

The hazards identified in Section 4.1 Hazard Identification, are profiled individually in this section. These hazard profiles set the stage for the Vulnerability Assessment, where the vulnerability is quantified for each of the hazards.

Hazard Profiles

Each hazard is profiled in the following format:

- **Hazard/Problem Description**—This section gives a description of the hazard and associated issues followed by details on the hazard specific to the Sutter County Planning Area and the unincorporated County. Where known, this includes information on the hazard location, extent, seasonal patterns, speed of onset/duration, and magnitude and/or any secondary effects.
- **Past Occurrences**—This section contains information on historical hazard events, including location, impacts, and damages where known. Hazard research, historical incident worksheets and other input from the HMPC were used to capture information on past occurrences.
- **Frequency/Likelihood of Future Occurrence**—The frequency of past events is used in this section to gauge the likelihood of future occurrences. Where possible, frequency was calculated based on existing data. It was determined by dividing the number of events observed by the number of years on record and multiplying by 100. This gives the percent chance of the event happening in any given year (e.g., three droughts over a 30-year period equates to a 10 percent chance of experiencing a drought in any given year). The likelihood of future occurrences is categorized into one of the following classifications:
  - ✓ **Highly Likely**—Near 100 percent chance of occurrence in next year or happens every year

- ✓ **Likely**—Between 10 and 100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less
- ✓ **Occasional**—Between 1 and 10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years
- ✓ **Unlikely**—Less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

- **Climate Change**—This section contains the effects of climate change (if applicable). The possible ramifications of climate change on each hazard are discussed.

Vulnerability Assessment

With Sutter County's hazards identified and profiled, a vulnerability assessment was conducted to describe the vulnerability and impact that each hazard would have on the County. The vulnerability assessment quantifies, to the extent feasible using best available data, assets at risk to identified hazards and estimates potential losses. This section focuses on the vulnerabilities of the Sutter County Planning Areas (i.e., unincorporated Sutter County) as a whole.

An estimate of the vulnerability of the Sutter County Planning Area and unincorporated Sutter County to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Vulnerability can be quantified in those instances where there is a known, identified hazard area, such as a mapped floodplain. In these instances, the numbers and types of buildings subject to the identified hazard can be counted and their values tabulated. Other information can be collected in regard to the hazard area, such as the location of critical community facilities, historic structures, and valued natural resources. Together, this information conveys the impact, or vulnerability, of the Sutter County Planning Area to that hazard.

The vulnerability assessment identified five hazards in the Planning Area for which specific geographical hazard areas have been defined and for which sufficient data exists to support a quantifiable vulnerability analysis. These five hazards are dam failure, earthquake, flood, levee failure, and wildfire. The

vulnerability of the flood dam failure, (1%/0.2% annual chance), levee failure, and wildfire hazards were analyzed using GIS and County parcel and assessor data.

FEMA's loss estimation software, HAZUS-MH, was used to analyze the County's vulnerability to earthquakes.

For dam failure, flood (1%/0.2% annual chance), levee failure, and wildfire, the following elements were inventoried for each community, to the extent possible, to quantify vulnerability in identified hazard areas:

- General vulnerability and hazard-related impacts, including impacts to life, safety, and health
- Values at risk (i.e., types, numbers, and value of land and improvements)
- Population at risk
- Critical facilities at risk
- Overall community impact
- Future development/development trends within the identified hazard area

The vulnerability and potential impacts from priority hazards that do not have specific mapped areas nor the data to support additional vulnerability analysis are discussed in more general terms. These include:

- Aquatic Invasive Species
- Climate Change
- Drought and Water Shortage
- Flood: Localized/Stormwater
- Pandemic
- Severe Weather: Extreme Cold and Freeze
- Severe Weather: Extreme Heat
- Severe Weather: Heavy Rain and Storms

The following sections provide the hazard profile and vulnerability assessments for each of the hazards identified in Section 4.1 Hazard Identification. ***The severe weather hazards are discussed first to paint the picture of the County's climate and hazard environment which often lead to other hazards such as flood and wildfire. The remainder of the hazards follow alphabetically.***

Data Sources

In general, information provided by the County and HMPC members is integrated into this section with information from other data sources. The data sources listed below formed the basis for this Hazard Profiles and Vulnerability section of this Plan. Where data and information from these studies, plans, reports, and other data sources were used, the source is referenced as appropriate throughout this risk assessment.

- 2013-2021 Sutter County Housing Element
- 2018 California State Hazard Mitigation Plan
- ArkStorm at Tahoe - Stakeholder Perspectives on Vulnerabilities and Preparedness for an Extreme Storm Event in the Greater Lake Tahoe, Reno and Carson City Region. 2014.
- Bureau of Land Management
- CA DWR Best Available Maps
- CA DWR Division of Safety of Dams

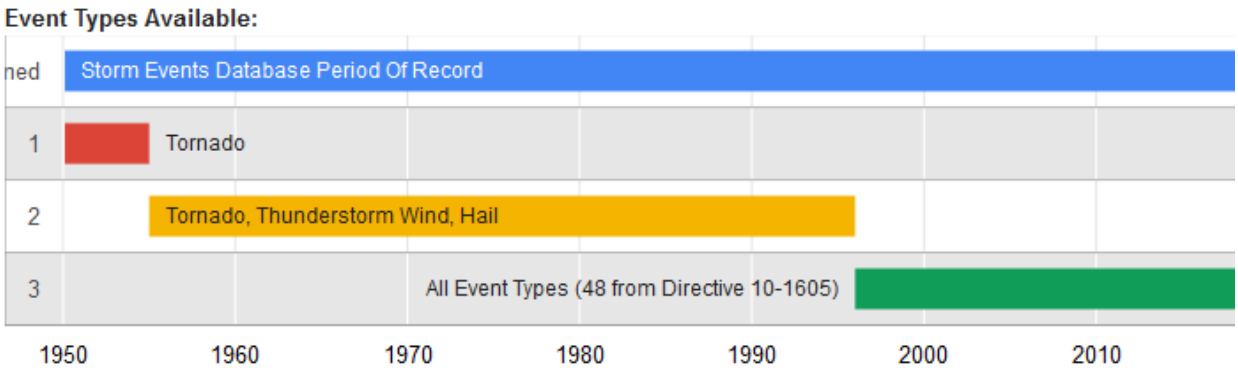
- Cal Adapt – Extended Drought Scenarios
- CAL FIRE GIS datasets
- Cal OES
- Cal-Adapt
- Cal-Adapt – Annual Average of Acres Burned
- Cal-Adapt – Number of Extreme Heat Days by Year
- Cal-Adapt – Precipitation: Decadal Averages Map
- California Adaptation Planning Guide
- California Climate Adaptation Strategy (CAS) – 2014
- California Department of Water Resources
- California Department of Water Resources (CA DWR) Division of Safety of Dams
- California Department of Water Resources Best Available Maps
- California Department of Water Resources Division of Safety of Dams
- California Division of Mines and Geology
- California Geological Survey
- California Office of Emergency Services – Dam Inundation Data
- California's Drought of 2007-2009, An Overview. State of California Natural Resources Agency, California Department of Water Resources.
- Climate Change and Health Profile Report – Sutter County
- County staff
- Existing plans and studies
- FEMA
- FEMA: Building Performance Assessment: Oklahoma and Kansas Tornadoes
- FEMA's HAZUS-MH 4.2 GIS-based inventory data
- Integrated Regional Water Management Plan
- IPCC Fifth Assessment Synthesis Report (2014)
- Kenward, Alyson PhD, Adams-Smith, Dennis, and Raja, Urooj. Wildfires and Air Pollution – The Hidden Health Hazards of Climate Change. Climate Central. 2013.
- Levees in History: The Levee Challenge. Dr. Gerald E. Galloway, Jr., P.E., Ph.D., Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.
- Liu, J.C., Mickley, L.J., Sulprizio, M.P. et al. Climatic Change. 138: 655. doi:10.1007/s10584-016-1762-6. 2016.
- Multi-Hazard Identification and Risk Assessment, FEMA 1997
- National Drought Mitigation Center
- National Drought Mitigation Center – Drought Impact Reporter
- National Integrated Drought Information System
- National Levee Database
- National Oceanic and Atmospheric Administration's National Climatic Data Center
- National Weather Service
- Natural Resource and Conservation Service
- NOAA Storm Prediction Center
- Pacific Gas and Electric Company
- Personal interviews with planning team members and staff from the County
- Proceedings of the National Academy of Sciences
- Public Health Alliance of Southern California
- Public Policy Institute of California

- Science Magazine
- Statewide GIS datasets from other agencies such as Cal OES, FEMA, USGS, CGS, Cal Atlas, and others
- Sutter County 2020 Assessor/Parcel Data
- Sutter County 2030 General Plan Land Use Element
- Sutter County Climate Action Plan – 2010
- Sutter County General Plan (2011)
- Sutter County General Plan Technical Background Report (2008)
- Sutter County GIS
- Sutter County Planning and Building Services Division
- U.S. Census Bureau 2010 Household Population Estimates
- U.S. Fish and Wildlife Service
- U.S. Fish and Wildlife Service's National Wetlands Inventory maps
- U.S. Forest Service GIS datasets
- U.S. Geological Survey
- U.S. Occupational Safety and Health Administration
- United States Geological Survey Open File Report 2015-3009
- University of California
- US Army Corps of Engineers
- US Department of Agriculture
- US Farm Service Agency
- US Fish and Wildlife Service
- USDA Forest Service Region 5
- USGS Bulletin 1847
- USGS National Earthquake Information Center
- USGS Publication 2014-3120
- Vaisala National Lightning Detection Network
- Western Regional Climate Center
- World Health Organization
- Written descriptions of inventory and risks provided by Sutter County

4.3.1. Severe Weather: General

Severe weather is generally any destructive weather event, but usually occurs throughout the Sutter County Planning Area as localized storms that bring heavy rains and floods; severe cold, snow, and winter weather; extreme heat, and strong winds. The NOAA's NCDC has been tracking severe weather since 1950. Their Storm Events Database contains data on the following events shown on Figure 4-13.

Figure 4-13 NCDC Storm Events Database Period of Record



Event Types Available:
Add more info about event types here. Link to collections page/tab when referencing data collection source.

1. Tornado: From 1950 through 1954, only tornado events were recorded.

2. Tornado, Thunderstorm Wind and Hail: From 1955 through 1992, only tornado, thunderstorm wind and hail events were keyed from the paper publications into digital data. From 1993 to 1995, only tornado, thunderstorm wind and hail events have been extracted from the Unformatted Text Files.

3. All Event Types (48 from Directive 10-1605): From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605.

Source: NCDC

The NCDC's Storm Events Database contains data on the following: all weather events from 1993 to current (except from 6/1993-7/1993); and additional data from the Storm Prediction Center, which includes tornadoes (1950-1992), thunderstorm winds (1955-1992), and hail (1955-1992). This database contains 237 severe weather events that occurred in Sutter County between January 1, 1950, and April 30, 2020. Table 4-20 summarizes these events.

*Table 4-20 NCDC Severe Weather Events for Sutter County 1950-4/30/2020**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Astronomical Low Tide	1	0	0	0	0	$0	$0
Cold/Wind Chill	15	0	0	0	0	$0	$2,400,000
Dense Fog	6	6	1	38	0	$2,120,000	$0
Dense Smoke	1	0	0	0	0	$0	$0
Drought	29	0	0	0	0	$0	$0
Excessive Heat	7	8	2	3	0	$0	$0
Extreme Cold/Wind Chill	1	0	0	0	0	$0	$0
Flood	23	0	0	0	0	$5,225,000	$7,800,000
Frost/Freeze	10	0	0	0	0	$200,000	$5,000,000

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Funnel Cloud	4	0	0	0	0	$0	$0
Hail	4	0	0	0	0	$0	$0
Heat	38	1	1	18	1	$0	$0
Heavy Rain	4	0	0	0	0	$0	$0
Heavy Snow	1	0	0	0	0	$0	$0
High Surf	2	0	0	0	0	$0	$0
High Wind	47	1	0	1	0	$15,457,000	$30,037,000
Strong Wind	25	0	1	2	2	$3,919,000	$0
Thunderstorm Wind	1	0	0	0	0	$0	$0
Tornado	6	0	0	0	0	$90,000	$55,000
Wildfire	10	4	0	4	7	$500,000	$0
Winter Storm	2	0	0	0	0	$150,000	$0
Total	**237**	**20**	**5**	**66**	**10**	**$27,661,000**	**$45,292,000**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Sutter County

The NCDC table above summarize severe weather events that occurred in Sutter County. Only a few of the events actually resulted in state and federal disaster declarations. It is further interesting to note that different data sources capture different events during the same time period, and often display different information specific to the same events. The value in this data is that it provides data depicting the County's "big picture" hazard environment.

As previously mentioned, many of Sutter County's state and federal disaster declarations have been a result of severe weather. For this plan, severe weather is discussed in the following subsections:

- Extreme Cold and Freeze
- Extreme Heat
- Heavy Rains and Storms

For purposes of this Plan, the Marysville co-op weather station (elevation: 70 feet above mean sea level (msl)) was used to illustrate and inform the severe weather hazards. This station was chosen due to its length of record (1897 to 2007) and its proximity to the County.

4.3.2. Severe Weather: Extreme Cold and Freeze

Hazard Profile

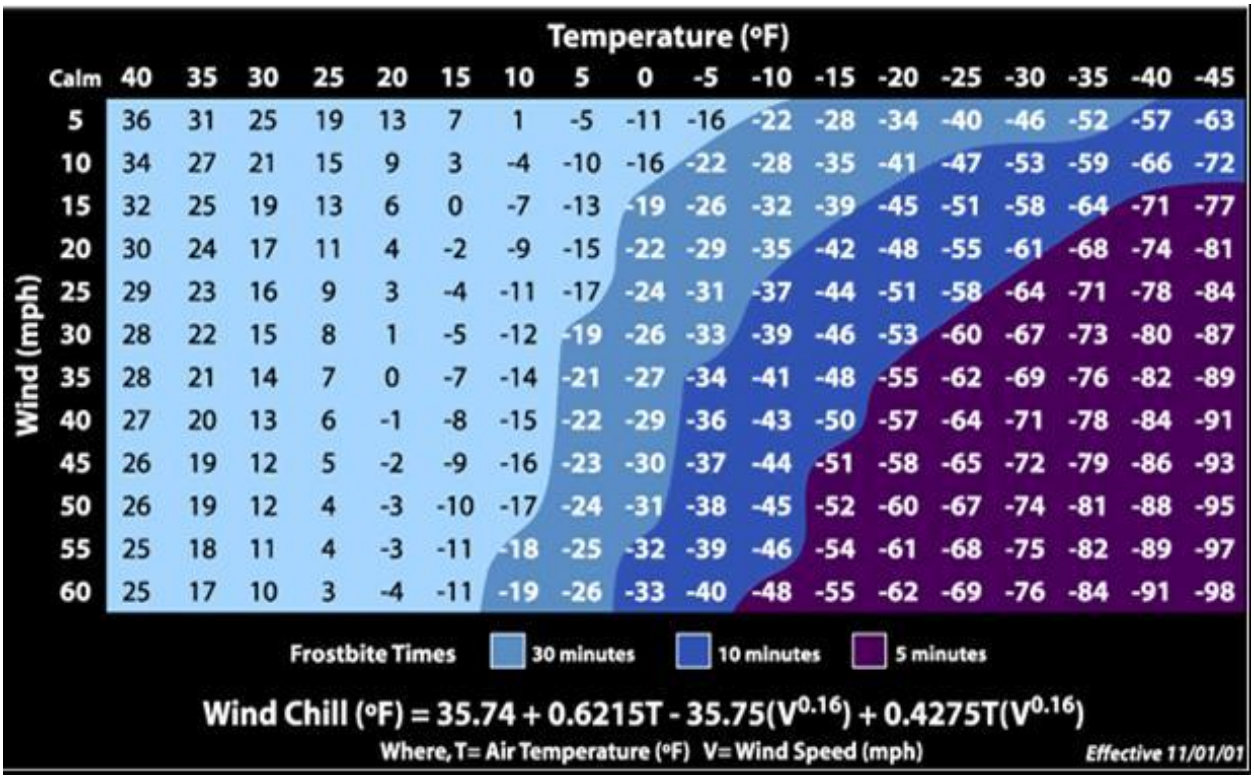
This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

According to the National Weather Service (NWS) and the Western Regional Climate Center (WRCC), extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to cold can cause frostbite or hypothermia and can be life-threatening. Infants and the elderly are most susceptible. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Freezing temperatures can cause significant damage to the agricultural industry.

In 2001, the NWS implemented an updated Wind Chill Temperature index (shown in Figure 4-14), which is reproduced below. This index was developed to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Figure 4-14 Wind Chill Temperature Chart



Source: National Weather Service

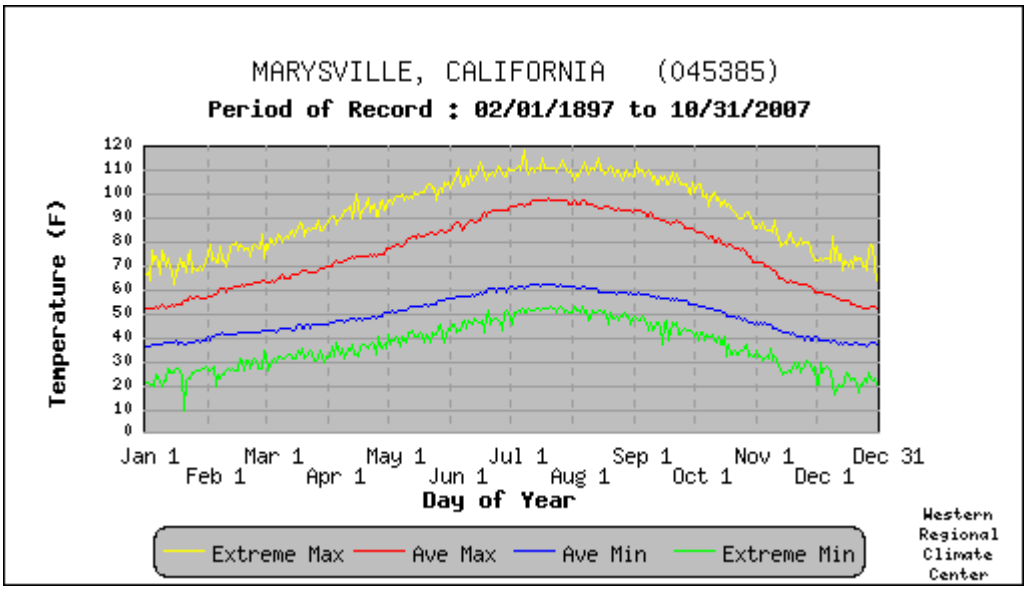
Information on extreme cold and freeze from the WRCC coop station for the County is shown below.

Sutter County— Marysville Weather Station, Period of Record 1897 to 2007

According to the WRCC, in Sutter County monthly average minimum temperatures from November through April range from the upper-30s to upper-40s. The lowest recorded daily extreme was 9°F on January 20, 1907. In a typical year, minimum temperatures fall below 32°F on 18.3 days with 0 days falling

below 0°F. Table 4-21 shows the record low temperatures by month for Sutter County. Average daily temperatures for Sutter County are shown in Figure 4-15.

Figure 4-15 Sutter County— Daily Temperature Averages and Extremes



Source: Western Regional Climate Center

Table 4-21 Sutter County – Record Low Temperatures 1897 to 2007

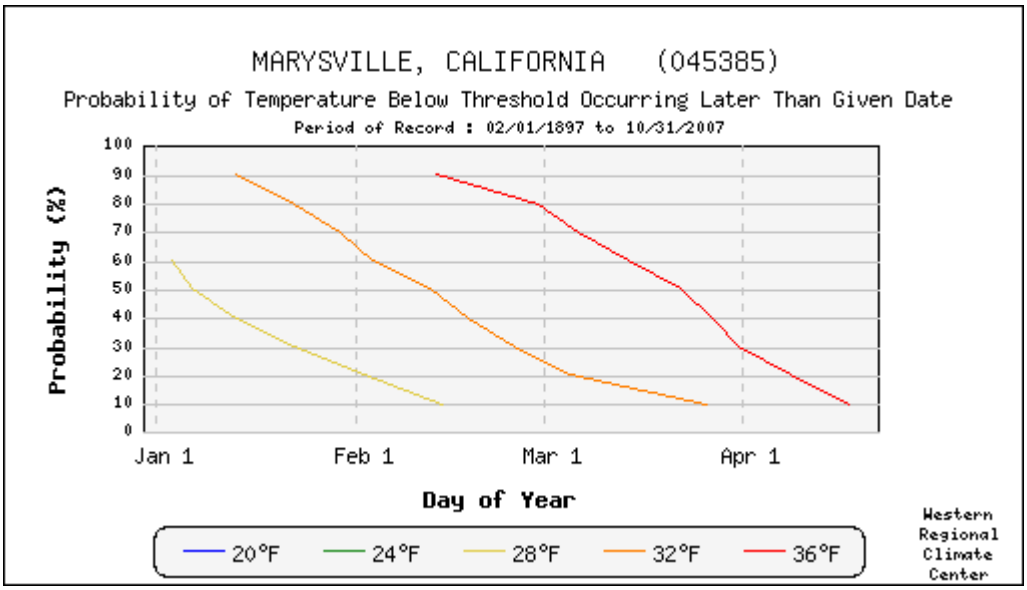
Month	Record Low	Date	Month	Record Low	Date
January	9°	1/20/1907	July	45°	7/2/1956
February	19°	2/5/1910	August	45°	8/30/1912
March	26°	3/2/1971	September	37°	9/15/1911
April	30°	4/28/1934	October	32°	10/17/1905
May	36°	5/7/1916	November	24°	11/14/1916
June	41°	6/28/1934	December	16°	12/10/1932

Source: Western Regional Climate Center

Location and Extent

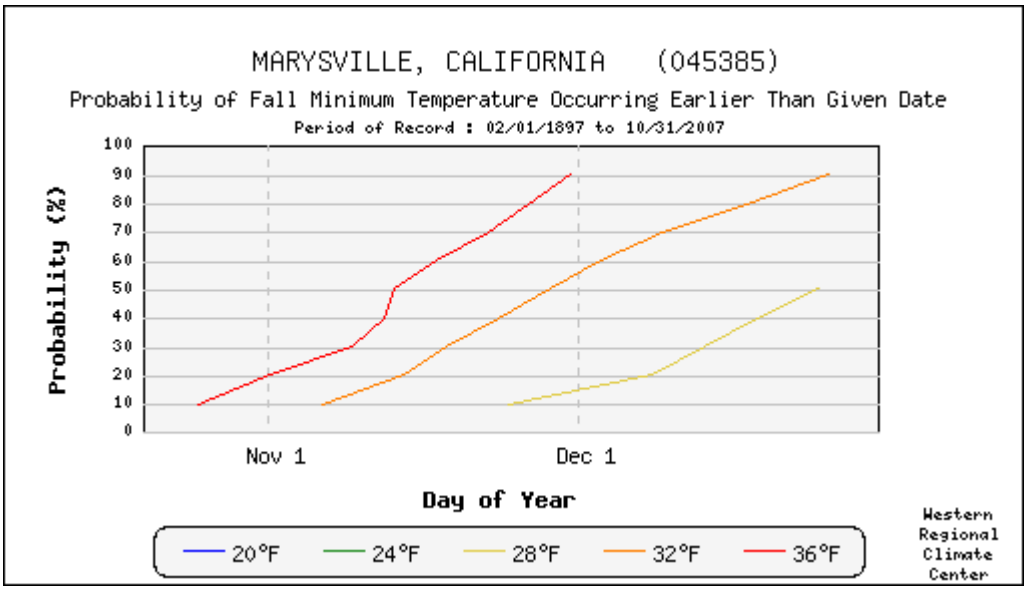
Extreme cold and freeze events occur on a regional basis. Extreme cold can occur in any location of the County. All portions of the County are at risk to extreme cold. While there is no scale (i.e. Richter, Enhanced Fujita) to measure the effects of freeze, temperature data from the County from the WRCC indicates that there are 18.3 days that fall below 32°F. Freeze has a slow onset and can be generally be predicted in advance for the County. Freeze events can last for hours (in a cold overnight), or for days to weeks at a time. Figure 4-16 and Figure 4-17 show the probabilities in the County of freeze for both spring and fall.

Figure 4-16 Sutter County – Spring Freeze Probabilities



Source: Western Regional Climate Center

Figure 4-17 Sutter County – Fall Freeze Probabilities



Source: Western Regional Climate Center

Past Occurrences

Disaster Declaration History

The County has had no past federal or state disaster declarations for extreme cold and freeze, as shown on Table 4-4. The County had no USDA disaster declarations since 2012 related to freeze, as shown on Table 4-6.

NCDC Events

The NCDC reports 26 events of past extreme cold and freeze for Sutter County since 1996 as shown on Table 4-22.

*Table 4-22 NCDC Extreme Cold and Freeze Events for Sutter County 1996 – 4/30/2020**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Cold/Wind Chill	15	0	0	0	0	$0	$2,400,000
Extreme Cold/Wind Chill	1	0	0	0	0	$0	$0
Frost/Freeze	10	0	0	0	0	$200,000	$5,000,000
Total	**26**	**0**	**0**	**0**	**0**	**$200,000**	**$7,400,000**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Sutter County

Hazard Mitigation Planning Committee Events

The HMPC also noted that extreme cold and freeze is an annual event, but no events causing damages, injuries, or deaths could be recalled.

Likelihood of Future Occurrence

Highly Likely—Extreme cold and freeze are likely to continue to occur annually in the Sutter County Planning Area. In a typical year, minimum temperatures fall below 32°F on 18.3 days in the County. This equates to a likelihood of future occurrences being considered highly likely.

Climate Change and Freeze and Snow

According to the CAS, freezing spells are likely to become less frequent in California as climate temperatures increase; if emissions increase, freezing events could occur only once per decade in large portion of the State by the second half of the 21st century. According to a California Natural Resources Report in 2014, it was determined that while fewer freezing spells would decrease cold related health effects, too few freezes could lead to increased incidence of disease as vectors and pathogens do not die off.

Vulnerability Assessment

Vulnerability—Medium

Extreme cold and freeze events happen in Sutter County each year. It can impact both structures and populations in Sutter County.

Impacts

Extreme cold and freeze events happen in Sutter County each year. Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to cold can cause frostbite or hypothermia and can be life-threatening. Vulnerable populations to cold and freeze include:

- Homeless
- Infants and children under age five
- Elderly (65 and older)
- Individuals with disabilities
- Individuals dependent on medical equipment
- Individuals with impaired mobility

Of significant concern is the impact to populations with special needs such as the elderly and those requiring the use of medical equipment. The residents of nursing homes and elder care facilities are especially vulnerable to extreme temperature events. It is encouraged that such facilities have emergency plans or backup power to address power failure during times of extreme cold and freeze. In addition to vulnerable populations, pets and livestock are at risk to freeze and cold.

Impacts to the County as a result of extreme cold and freeze include damage to infrastructure, utility outages, road closures, traffic accidents, and interruption in business and school activities. Delays in emergency response services can be of significant concern. Pipes may freeze and burst in homes or buildings that are poorly insulated or without heat. Freezing temperatures and ice can cause accidents and road closures and can cause significant damage to the agricultural industry. Extreme cold can affect agricultural products and cattle in the County. Freeze damages reduce the values of agricultural crops.

Future Development

Future development built to code should be able to withstand extreme cold and freeze. Pipes at risk of freezing should be mitigated be either burying or insulating them from freeze as new facilities are improved or added. Current County codes provide such provisions for new construction. The County will continue to implement Title 24 (State's Energy Efficiency requirements) that is adopted as part of the State Building Code. Vulnerability to extreme cold will increase as the average age of the population in the County shifts resulting in a larger number of senior citizens in the Planning Area.

4.3.3. Severe Weather: Extreme Heat

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

According to information provided by FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In a normal year, about 175 Americans succumb to the demands of summer heat. In the 40-year period from 1936 through 1975, nearly 20,000 people were killed in the United States by the effects of heat and solar radiation. In the heat wave of 1980, more than 1,250 people died. Extreme heat conditions can also compound the effects of other hazards, such as drought and wildfire and can contribute to increases in tree mortality. Extreme heat can also affect agriculture in Sutter County. During times of high heat, low humidity, and winds, PG&E can issue a Public Safety Power Shutdown (PSPS) for the County.

Heat disorders generally have to do with a reduction or collapse of the body's ability to shed heat by circulatory changes and sweating or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds a level at which the body can remove it, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body's inner core begins to rise, and heat-related illness may develop. Elderly persons, small children, chronic invalids, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions.

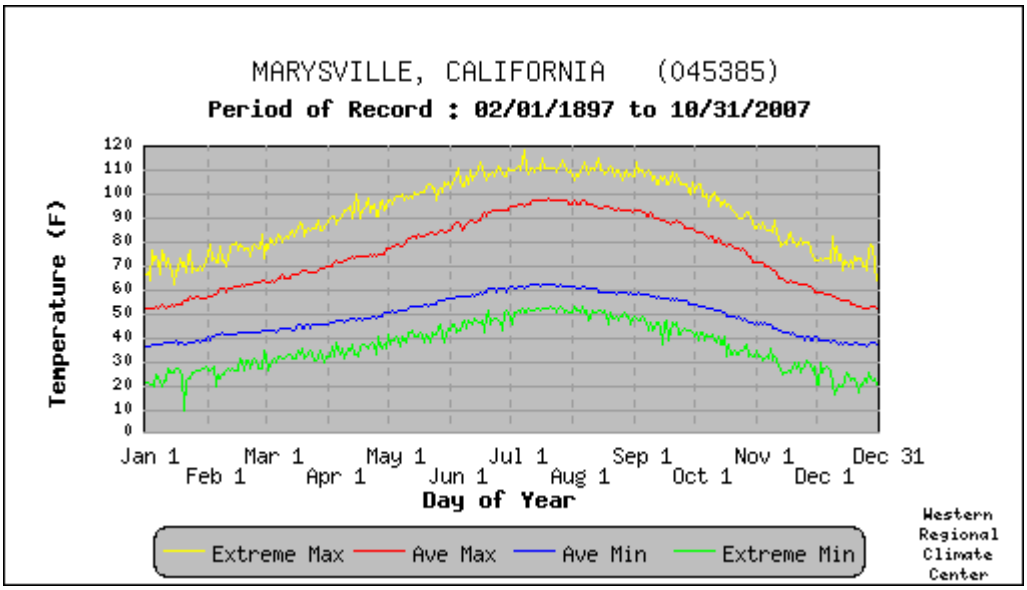
Location and Extent

Extreme heat events occur on a regional basis. Extreme heat can occur in any location of the County. All portions of the County are at some risk to extreme heat. Extreme heat occurs throughout the Planning Area primarily during the summer months. The WRCC maintains data on weather normal and extremes in the western United States. Information from the representative weather station introduced in Section 4.3.1 is summarized below.

Marysville Weather Station, Period of Record 1897 to 2007 (Elevation of 70 feet above msl)

According to the WRCC, in Sutter County, monthly average maximum temperatures in the warmest months (May through October) range from the low-80s to the mid-90s. The highest recorded daily extreme was 118°F on July 8, 1908. In a typical year, maximum temperatures exceed 90°F on 91.5 days. Figure 4-18 shows the average daily high temperatures and extremes for the County. Table 4-23 shows the record high temperatures by month for the County.

Figure 4-18 Sutter County—Daily Temperature Averages and Extremes



Source: Western Regional Climate Center, www.wrcc.dri.edu/

Table 4-23 Sutter County – Record High Temperatures

Month	Record High	Date	Month	Record High	Date
January	96°	1/16/1907	July	118°	7/08/1905
February	83°	2/28/1985	August	115°	8/14/1933
March	89°	3/27/1988	September	113°	9/2/1950
April	100°	4/15/1947	October	104°	10/3/2001
May	105°	5/29/1910	November	89°	11/10/1955
June	113°	6/16/1961	December	82°	12/9/1909

Source: Western Regional Climate Center

Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly take the lives of vulnerable populations. Heat waves do not generally cause damage or elicit the immediate response of floods, fires, earthquakes, or other more "typical" disaster scenarios. While heat waves are obviously less dramatic, they are potentially deadlier. According to the 2018 California State Hazard Mitigation Plan, the worst single heat wave event in California occurred in Southern California in 1955, when an eight-day heat wave resulted in 946 deaths.

The NWS has in place a system or scale to initiate alert procedures (advisories or warnings) when extreme heat is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. The NWS HeatRisk forecast provides a quick view of heat risk potential over the upcoming seven days. The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. This can be seen in Table 4-24.

Table 4-24 National Weather Service HeatRisk Categories

Category	Level	Meaning
Green	0	No Elevated Risk
Yellow	1	Low Risk for those extremely sensitive to heat, especially those without effective cooling and/or adequate hydration
Orange	2	Moderate Risk for those who are sensitive to heat, especially those without effective cooling and/or adequate hydration
Red	3	High Risk for much of the population, especially those who are heat sensitive and those without effective cooling and/or adequate hydration
Magenta	4	Very High Risk for entire population due to long duration heat, with little to no relief overnight

Source: National Weather Service

The NWS office in Sacramento can issue the following heat-related advisory as conditions warrant.

- **Heat Advisories** are issued during events where the HeatRisk is on the Orange/Red threshold (Orange will not always trigger an advisory)
- **Excessive Heat Watches/Warnings** are issued during events where the HeatRisk is in the Red/Magenta output

Past Occurrences

Disaster Declaration History

There have been no FEMA or Cal OES disasters related to extreme heat, as shown in Table 4-4. The County had no USDA disaster declarations since 2012 related to extreme heat, as shown on Table 4-6.

NCDC Events

The NCDC data showed 45 extreme heat incidents for Sutter County since 1993.

*Table 4-25 NCDC Heat Events for Sutter County 1950-4/30/2020**

Event Type	Number of Events	Deaths**	Deaths** (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Excessive Heat	7	8	2	3	0	$0	$0
Heat	38	1	1	18	1	$0	$0
Total	**45**	**9**	**3**	**21**	**1**	**$ 0**	**$ 0**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Sutter County

**Due to the regional nature of reporting of extreme heat type events, all of these deaths occurred outside of Sutter County

Hazard Mitigation Planning Committee Events

Members of the HMPC recalled the following events:

Fall 2020 saw extreme heat days where the Cooling Center at Sutter Ettl Hall had to be opened and a public education campaign was put forward.

The HMPC also noted that extreme heat was an annual event, but events causing damages, deaths, or injuries could not be recalled.

Likelihood of Future Occurrence

Highly Likely—Temperature extremes are likely to continue to occur annually in the Sutter County Planning Area. Temperatures at or above 90°F are common most summer days in the County.

Climate Change and Extreme Heat

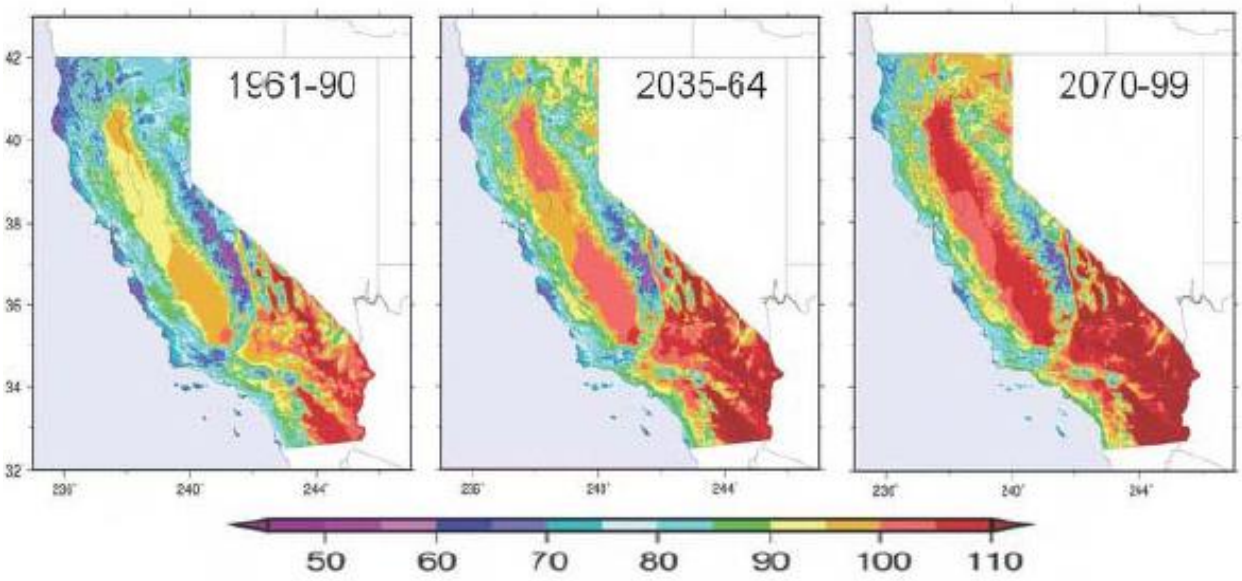
Climate change and its effect on extreme heat in the County has been discussed utilizing three sources:

- California Climate Adaptation Strategy (CAS) – 2014
- Climate Change and Health Profile Report – Sutter County
- Cal-Adapt

Climate Adaptation Strategy

The California Climate Adaptation Strategy (CAS), citing a California Energy Commission study, states that "over the past 15 years, heat waves have claimed more lives in California than all other declared disaster events combined." This study shows that California is getting warmer, leading to an increased frequency, magnitude, and duration of heat waves. These factors may lead to increased mortality from excessive heat, as shown in Figure 4-19.

Figure 4-19 California Historical and Projected Temperature Increases – 1961 to 2099



Source: Dan Cayan; California Climate Adaptation Strategy

As temperatures increase, California and Sutter County will face increased risk of death from dehydration, heat stroke, heat exhaustion, heart attack, stroke and respiratory distress caused by extreme heat. According to the 2014 CAS report and the 2018 State of California Hazard Mitigation Plan, by 2100, hotter temperatures are expected throughout the state, with projected increases of 3-5.5°F (under a lower emissions scenario) to 8-10.5°F (under a higher emissions scenario). These changes could lead to an increase in deaths related to extreme heat in Sutter County.

Climate Change and Health Profile Report – Sutter County

The Climate Change and Health Profile Report (CCHPR) noted for Sutter County that increased temperatures manifested as heat waves and sustained high heat days directly harm human health through heat-related illnesses (mild heat stress to fatal heat stroke) and the exacerbation of pre-existing conditions in the medically fragile, chronically ill, and vulnerable. Increased heat also intensifies the photochemical reactions that produce smog and ground level ozone and fine particulates (PM2.5), which contribute to and exacerbate respiratory disease in children and adults. Increased heat and carbon dioxide enhance the growth of plants that produce pollen, which are associated with allergies. Increased temperatures also add to the heat load of buildings in urban areas and exacerbate existing urban heat islands adding to the risk of high ambient temperatures.

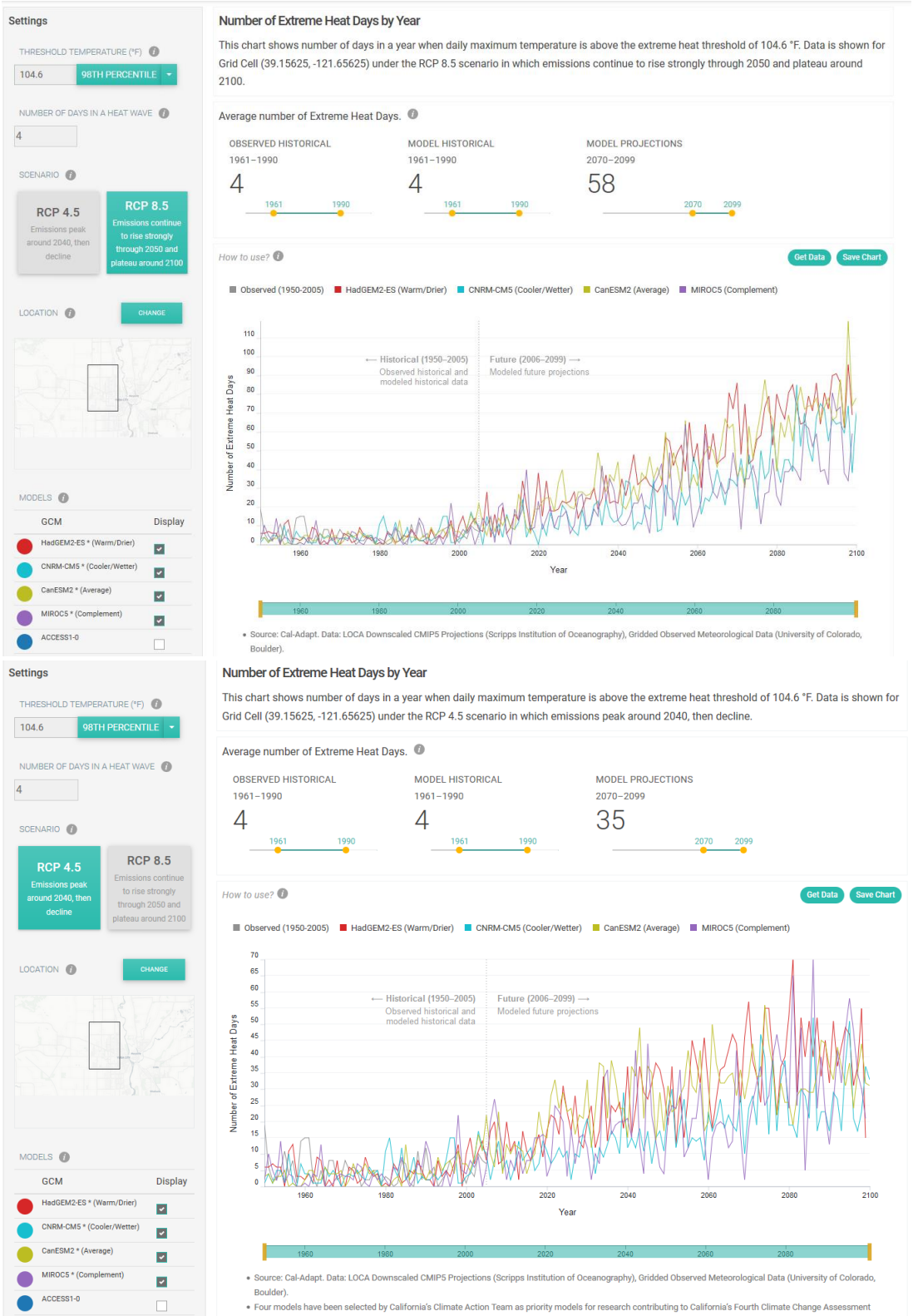
Cal-Adapt

Cal Adapt also noted that overall temperatures are expected to rise substantially throughout this century. During the next few decades, scenarios project average temperature to rise between 1 and 2.3°F; however, the projected temperature increases begin to diverge at mid-century so that, by the end of the century, the temperature increases projected in the higher emissions scenario (Representative Concentration Pathways (RCP) 8.5) are approximately twice as high as those projected in the lower emissions scenario (RCP 4.5).

These projections also differ depending on the time of year and the type of measurement (highs vs. lows), all of which have different potential effects to the state's ecosystem health, agricultural production, water use and availability, and energy demand. Future temperature estimates from Cal-Adapt for the Sutter County Planning (using the quad that contains the Yuba City) are shown in Figure 4-20. It shows the following:

- The upper chart shows number of days in a year when daily maximum temperature is above the extreme heat threshold of 90.0°F. Data is shown for Sutter County under the RCP 8.5 scenario in which emissions continue to rise strongly through 2050 and plateau around 2100.
- The lower chart shows number of days in a year when daily maximum temperature is above the extreme heat threshold of 90.0 °F. Data is shown for Sutter County under the RCP 4.5 scenario in which emissions peak around 2040, then decline.

Figure 4-20 Sutter County – Future Temperature Estimates in Low and High Emission Scenarios



Source: Cal-Adapt – Number of Extreme Heat Days by Year

Vulnerability Assessment

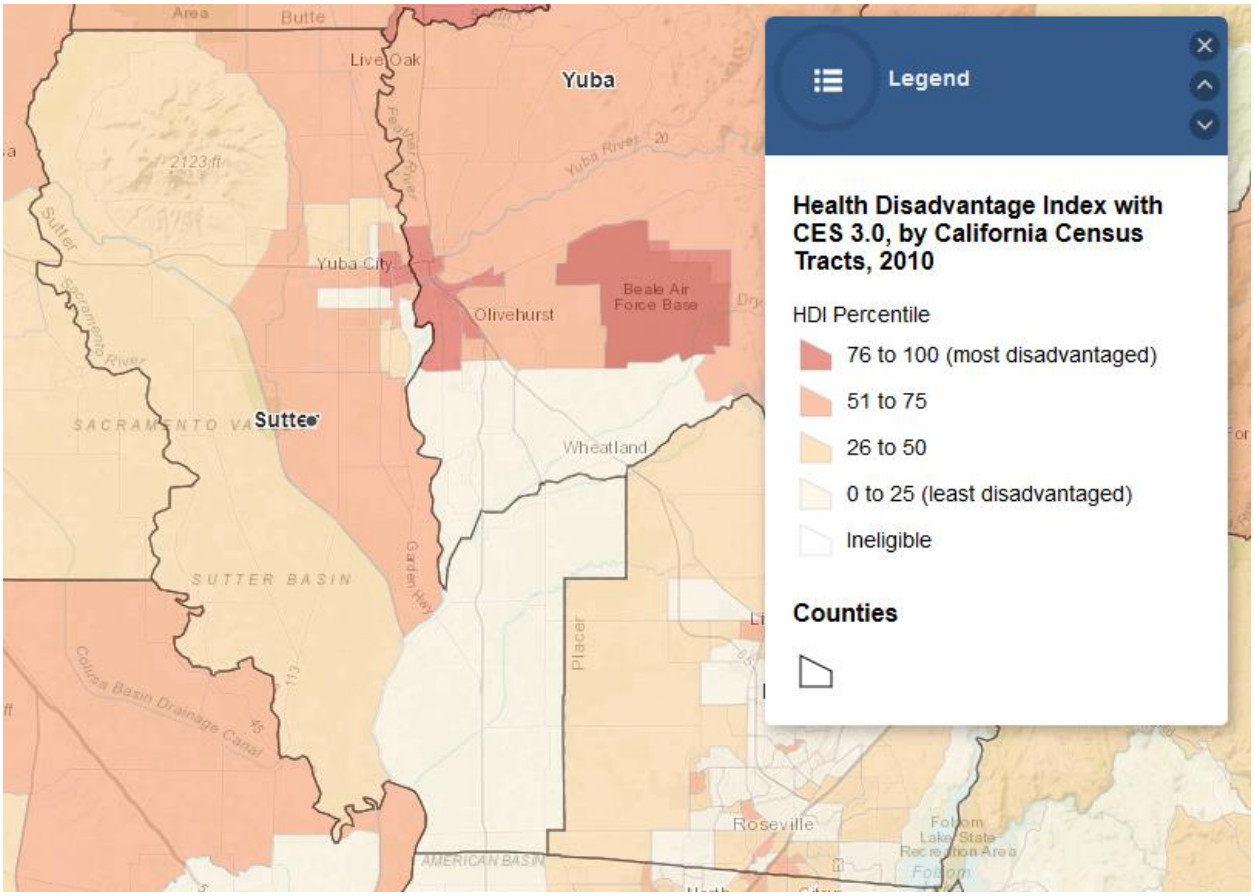
Vulnerability—Medium

Extreme heat happens in Sutter County each year. Extreme heat rarely affects buildings in the County, but affects the population inside the County as well as the County's agricultural industry.

Impacts from Extreme Heat

Vulnerable populations are at the greatest risk to the effects of extreme heat. The Public Health Alliance has developed a composite index to identify cumulative health disadvantage in California. Factors such as those bulleted above were combined to show what areas are at greater risk to hazards like extreme heat. This is shown on Figure 4-21.

Figure 4-21 Health Disadvantage Index by California Census Tract



Source: Public Health Alliance of Southern California

Vulnerable populations to extreme heat include:

- Homeless
- Infants and children under age five
- Elderly (65 and older)

- Individuals with disabilities
- Individuals dependent on medical equipment
- Individuals with impaired mobility

In addition to vulnerable populations, heat can cause stress to agricultural crops and livestock in the County. Extreme heat dries out vegetation in the County, creating greater risks from wildfires. Hot weather and extreme heat can worsen ozone levels and air quality as well as leading to drought conditions. Excessive heat and prolonged dry or drought conditions can impact agriculture by creating worker safety issues for farm field workers, severely damaging crops, and reducing availability of water and food supply for livestock. Extreme heat dries out vegetation in the County, creating greater risks from wildfires, which is discussed in Section 4.3.14.

Power Shortage/Failure

An additional impact of extreme heat is power outage or power failure. The US power grid crisscrosses the country, bringing electricity to homes, offices, factories, warehouses, farms, traffic lights and even campgrounds. According to statistics gathered by the Department of Energy, major blackouts are on the upswing. Over the past two decades, blackouts impacting at least 50,000 customers have increased 124 percent. The electric power industry does not have a universal agreement for classifying disruptions. Nevertheless, it is important to recognize that different types of outages are possible so that plans may be made to handle them effectively. Electric power disruptions can be generally grouped into two categories: intentional and unintentional.

Intentional Disruptions

There are four types of intentional disruptions:

- **Planned**: Some disruptions are intentional and can be scheduled based maintenance or upgrading needs
- **Unscheduled**: Some intentional disruptions must be done "on the spot." in response to an emergency
- **Demand-Side Management**: Some customers (i.e., on the demand side) have entered into an agreement with their utility provider to curtail their demand for electricity during periods of peak system loads
- **Load Shedding**: When the power system is under extreme stress due to heavy demand and/or failure of critical components, it is sometimes necessary to intentionally interrupt the service to selected customers to prevent the entire system from collapsing, resulting in rolling blackouts

The California Independent System Operator (CAISO) is tasked with managing the power distribution grid that supplies most of California, except in areas served by municipal utilities. CAISO is thus the entity that coordinates statewide flow of electrical supply. CAISO uses a series of stage alerts to the media based on system conditions. The alerts are:

- Stage 1 – reserve margin falls below 7 percent
- Stage 2 – reserve margin falls below 5 percent
- Stage 3 – reserve margin falls below 1.5 percent

Rotating blackouts become a possibility when Stage 3 is reached. Rotating outages and/or blackouts such as those experienced in 2000/2001 and 2006 can occur due to losses in transmission or generation and/or extremely severe temperatures that lead to heavy electric power consumption.

On January 17, 2001, CAISO declared a Stage 3 Emergency and notified the then Governor's Office of Emergency Services (Cal OES) that PG&E was dropping firm load of 500 megawatts (MW) in Northern California leading to rolling black-outs. Cal OES, in turn, issued an Electrical Emergency Message to all Emergency Services Agencies to prepare for rolling blackouts. This scenario was repeated the following day, January 18, 2001, and again on March 19, 2001.

A July 2006 heat storm event affected the entire state as well as most of the West, producing record energy demand levels in California. The state was able to avoid rotating outages due to a combination of favorable factors that included no major transmission outages, lower than typical generator outages, significant customer response to pleas for energy conservation, high imports from the Pacific Northwest despite unusually high loads, outstanding cooperation among western control area operators, and prompt response to fires that potentially threatened major interties. However, the event brought to light the vulnerability of the electric distribution system, as over 3,500 distribution transformers failed, leaving over two million customers without power at various times over the ten-day event, many for several hours and a small minority for up to three days.

In 2020, the state battled both extreme heat and wildfires. As a result of extreme heat, the CAISO declared a Stage 3 emergency. PG&E initiated rotating outages in August at the request of California's grid operator. The outages, which impacted 220,000 customers, occurred during periods of high heat. These rolling blackouts lasted less than a week.

Unintentional Disruptions

Unintentional or unplanned disruptions are outages that come with essentially no advance notice. This type of disruption can be the most problematic. The following are categories of unplanned disruptions:

- Accident by the utility, utility contractor, or others
- Malfunction or equipment failure
- Equipment overload (utility company or customer)
- Reduced capability (equipment that cannot operate within its design criteria)
- Tree contact other than from storms
- Vandalism or intentional damage
- Weather, including lightning, wind, earthquake, flood, and broken tree limbs taking down power lines
- Wildfire that damages transmission lines

Climate Change and Energy Shortage

Changing climate is expected to bring more frequent and intense natural disasters. Key climate parameters are starting to move outside of historically observed variability at a rate that makes historical data a poor predictor of future climate. For example, the warmest years on record in California occurred in 2014, 2015, 2016, and 2019. 2020 is on pace to be a remarkably hot year as well. In addition, the 2016-2017 year broke the record as the wettest ever recorded in the northern Sierra Nevada Mountains.

Changes in temperatures, precipitation patterns, extreme events, and sea level rise have the potential to decrease the efficiency of thermal power plants and substations, decrease the capacity of transmission lines, render hydropower less reliable, spur an increase in electricity demand, and put energy infrastructure at risk of flooding.

With climate warming, higher costs from increased demand for cooling in the summer are expected to outweigh the decreases in heating costs in the cooler seasons. Hotter temperatures in California will mean more energy (typically measured in "cooling-degree days") needed to cool homes and businesses both during heat waves and on a daily basis, during the daytime peak of the diurnal temperature cycle. During future heat waves, historically cooler coastal cities (e.g., San Francisco and Los Angeles) are projected to experience greater relative increases in temperature, such that areas that never before relied on air conditioning will experience new cooling demands.

Secondary impacts of energy shortages are most often felt by vulnerable populations. For example, those who rely on electric power for life-saving medical equipment, such as respirators, are extremely vulnerable to power outages. Also, during periods of extreme heat emergencies, the elderly and the very young are more vulnerable to the loss of cooling systems requiring power sources.

Additional impacts from a power disruption affect remote areas. This includes evacuation messaging and coordination difficulties, and a reduction in firefighting capabilities due to lack of water access in more remote areas (especially for those on wells).

Public Safety Power Shutoff (PSPS)

A new intentional disruption type of power shortage/failure event has recently occurred in California. In recent years, several wildfires have started as a result of downed power lines or electrical equipment. This was the case for the Camp Fire in 2018. As a result, California's three largest energy companies (including PG&E), at the direction of the California Public Utilities Commission (CPUC), are coordinating to prepare all Californians for the threat of wildfires and power outages during times of extreme weather. To help protect customers and communities during extreme weather events, electric power may be shut off for public safety in an effort to prevent a wildfire. This is called a Public Safety Power Shutoff (PSPS).

PSPS events have occurred in the County on June 8-9 of 2019; August 23-25 of 2019; September 23-24 of 2019; October 26, 2019, October 29, 2019; and November 20, 2019. Since the beginning of 2020, PG&E has changed the way it performs PSPS events by altering the way it routes power. Going forward, it will be rarer for Sutter County to have PSPS events. This was the case in 2020 where no PSPS events took place.

Public Safety Power Shutoff Criteria

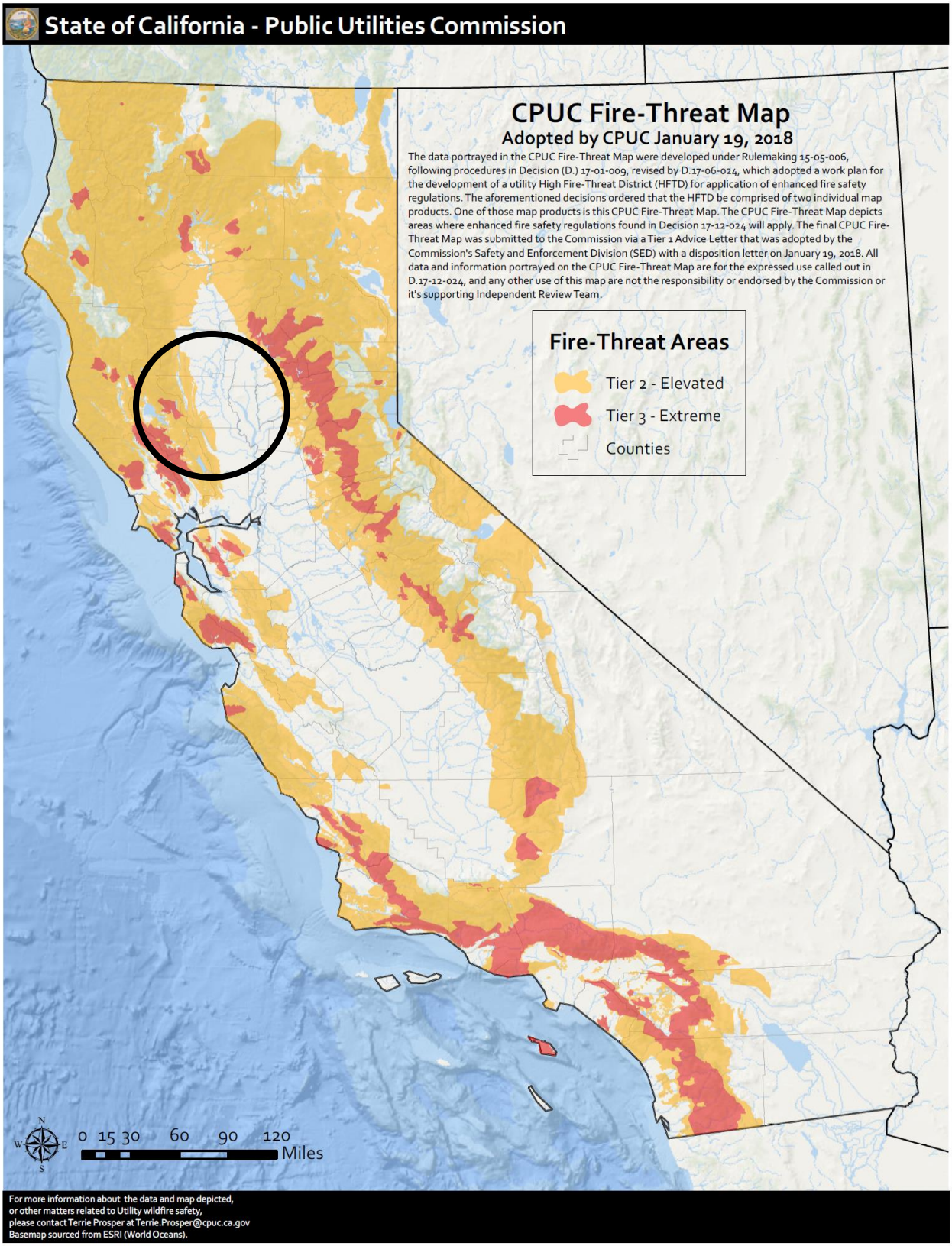
The Wildfire Safety Operations Center (WSOC) monitors fire danger conditions across PG&E service area and evaluates whether to turn off electric power lines in the interest of safety. While no single factor will drive a Public Safety Power Shutoff, some factors include:

- A Red Flag Warning declared by the National Weather Service
- Low humidity levels generally 20% and below

- Forecasted sustained winds generally above 25 mph and wind gusts in excess of approximately 45 mph, depending on location and site-specific conditions such as temperature, terrain and local climate
- Condition of dry fuel on the ground and live vegetation (moisture content)
- On-the-ground, real time observations from PG&E's WSOC and field observations from PG&E crews

The most likely electric lines to be considered for shutting off for safety will be those that pass through areas that have been designated by the CPUC as at elevated (Tier 2) or extreme (Tier 3) risk for wildfire (seen on Figure 4-22). This includes both distribution and transmission lines. The specific area and number of affected customers will depend on forecasted weather conditions and which circuits PG&E needs to turn off for public safety. Although a customer may not live or work in a high fire-threat area, their power may also be shut off if their community relies upon a line that passes through an area experiencing extreme fire danger conditions. This means that any customer who receives electric service from PG&E should be prepared for a possible PSPS.

Figure 4-22 State of California Tier 2 and 3 Areas



PG&E noted that extreme weather threats can change quickly. When possible, PG&E will provide customers with advance notice prior to turning off the power, as well as updates until power is restored. Timing of notifications (when possible) are:

- Approximately 48 hours before power is turned off
- Approximately 24 hours before power is turned off
- Just before power is turned off
- During the public safety outage
- Once power has been restored

Future Development

As the County shifts in demographics, more residents will become senior citizens. The residents of nursing homes and elder care facilities are especially vulnerable to extreme temperature events. It is encouraged that such facilities have emergency plans or backup power to address power failure during times of extreme heat and in the event of a PSPS. Low income residents and homeless populations are also vulnerable. Cooling centers for these populations should be utilized when necessary. Future development may also need to consider changes to both the length of wildfire season and the increasing hazards of wildfire (discussed in more detail in 4.3.14).

4.3.4. Severe Weather: Heavy Rains and Storms

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Storms in the Sutter County Planning Area are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. In the upper elevations, these storms can drop large amounts of snow (discussed in Section 4.3.2). Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the Sutter County area falls mainly in the fall, winter, and spring months.

The severe weather hazard is broken down in the following sections into:

- Heavy Rain and Storms
- Hail
- Lightning
- Wind

Heavy Rain and Storms

The NWS reports that storms and thunderstorms result from the rapid upward movement of warm, moist air. They can occur inside warm, moist air masses and at fronts. As the warm, moist air moves upward, it cools, condenses, and forms cumulonimbus clouds that can reach heights of greater than 35,000 ft. As the rising air reaches its dew point, water droplets and ice form and begin falling the long distance through the clouds towards earth's surface. As the droplets fall, they collide with other droplets and become larger. The falling droplets create a downdraft of air that spreads out at Earth's surface and causes strong winds associated with thunderstorms.

According to the HMPC, short-term, heavy storms can cause both widespread flooding as well as extensive localized drainage issues. As storms continue to increase in intensity, the limited drainage infrastructure has become an increasingly important issue. In addition to the flooding that often occurs during these storms, strong winds, when combined with saturated ground conditions, can down very mature trees and cause power outages

Cloudburst storms can be expected in the spring, summer, and fall. Cloudburst storms, sometimes lasting as long as 6 hours in the study areas, are high intensity storms that can produce floods characterized by high peak flows, short-duration flood flows, and small runoff volume.

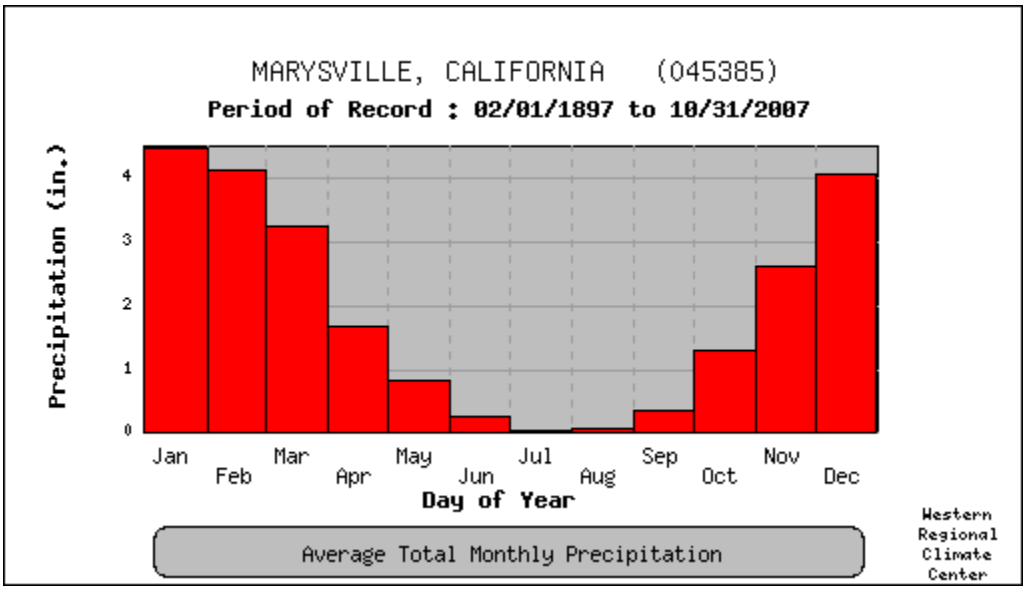
Location and Extent

Heavy rains in Sutter County vary by season and location. There is no scale by which heavy rains are measured – usually it is measured in terms of rainfall amounts. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of thunderstorms in California is often short, ranging from minutes to hours. Information from the WRCC weather station in Sutter County previously discussed in Section 4.3.1 is summarized below.

Sutter County—Marysville Weather Station, Period of Record 1897 to 2007

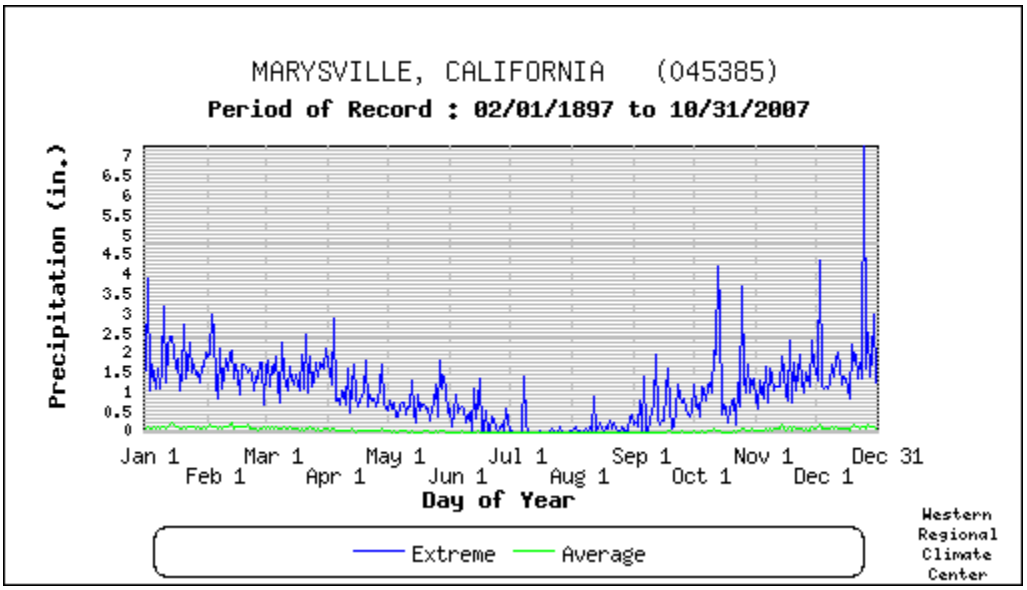
According to the WRCC, average annual precipitation in Sutter County is 20.96 inches per year. The highest recorded annual precipitation is 46.26 inches in 1983; the highest recorded precipitation for a 24-hour period is 7.29 inches on December 25, 1983. The lowest recorded annual precipitation was 7.41 inches in 1976. Average monthly precipitation for Sutter County is shown in Figure 4-23. Daily average and extreme precipitations are shown in Figure 4-24.

Figure 4-23 Sutter County—Monthly Average Total Precipitation



Source: Western Regional Climate Center, www.wrcc.dri.edu/

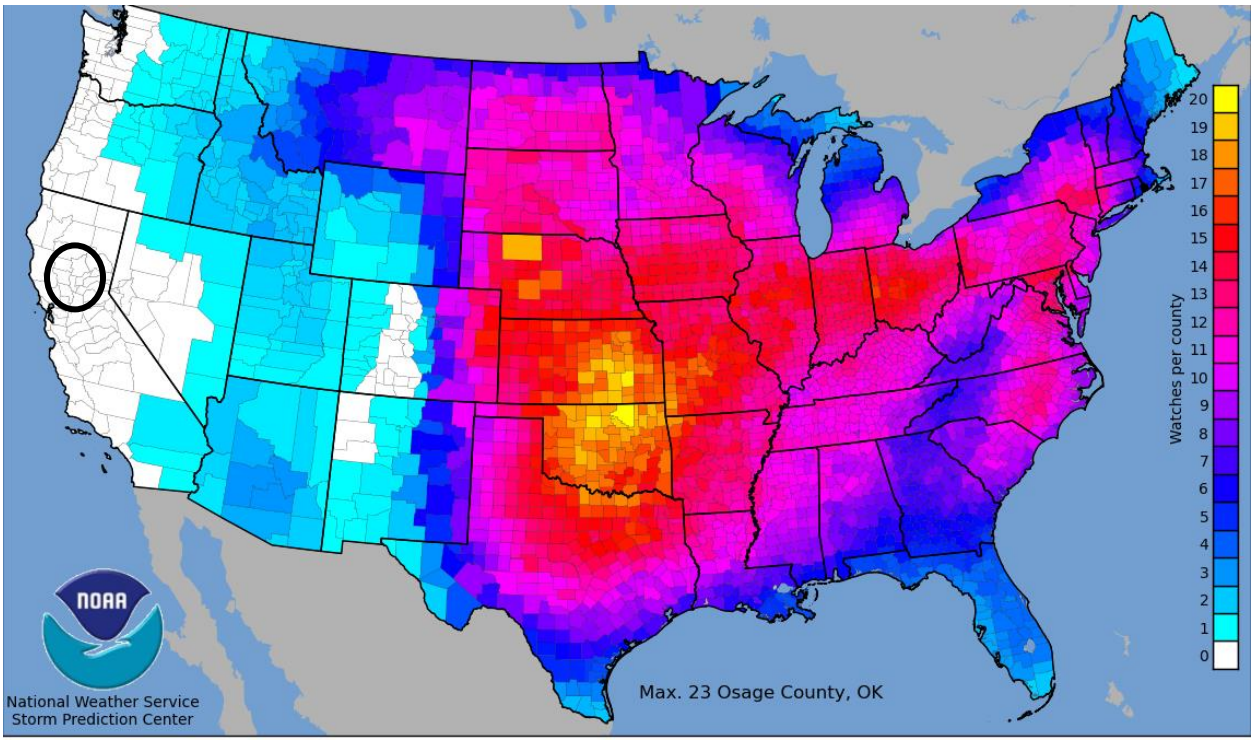
Figure 4-24 Sutter County—Daily Average and Extreme Precipitation



Source: Western Regional Climate Center, www.wrcc.dri.edu/

The NOAA Storm Prediction Center tracks thunderstorm watches on a county basis. Figure 4-25 shows thunderstorm watches in Sutter County and the United States for a 20-year period between 1993 and 2012, the most recent map available.

Figure 4-25 Sutter County – Average Thunderstorm Watches per Year (1993 to 2012)



Source: NOAA Storm Prediction Center, map retrieved 08/14/2020

Hail

Hail can occur throughout the Sutter County Planning Area during storm events, though it is rare. Hail is formed when water droplets freeze and thaw as they are thrown high into the upper atmosphere by the violent internal forces of thunderstorms. Hail is sometimes associated with severe storms within the Sutter County Planning Area. Hailstones are usually less than two inches in diameter and can fall at speeds of 120 miles per hour (mph). Severe hailstorms can be quite destructive, causing damage to roofs, buildings, automobiles, vegetation, and crops.

The National Weather Service classifies hail by diameter size, and corresponding everyday objects to help relay scope and severity to the population. Table 4-26 indicates the hailstone measurements utilized by the National Weather Service.

Table 4-26 Hailstone Measurements

Average Diameter	Corresponding Household Object
.25 inch	Pea
.5 inch	Marble/Mothball
.75 inch	Dime/Penny
.875 inch	Nickel
1.0 inch	Quarter

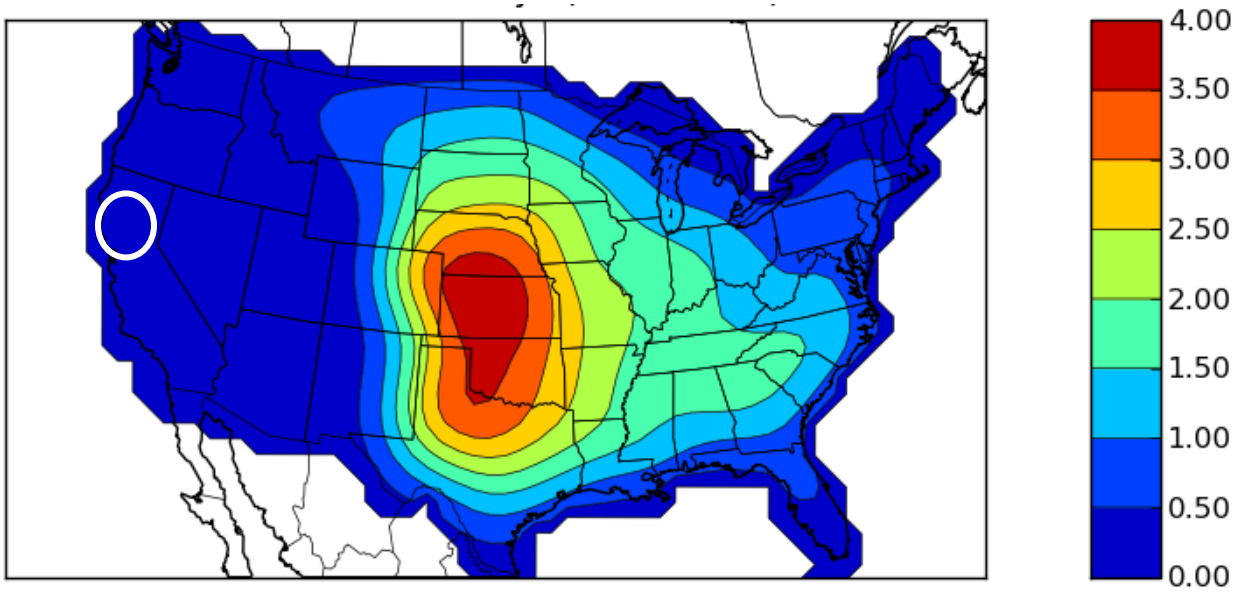
Average Diameter	Corresponding Household Object
1.5 inch	Ping-pong ball
1.75 inch	Golf-Ball
2.0 inch	Hen Egg
2.5 inch	Tennis Ball
2.75 inch	Baseball
3.00 inch	Teacup
4.00 inch	Grapefruit
4.5 inch	Softball

Source: National Weather Service

Location and Extent

Hail events can occur in any location of the County. All portions of the County are at risk to hail. There is no scale in which to measure hail, other than hail stone size as detailed above. The speed of onset of hail can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of thunderstorms that can cause hail in California is often short, ranging from minutes to hours. Hail events last shorter than the duration of the total thunderstorm. The National Weather Service tracks hail events. Figure 4-26 shows the average days each year where hail of greater than 1" in diameter occurred during a 20-year period from 1990 to 2009. The most recent map available.

Figure 4-26 Sutter County – Average Hail Days per Year (1990 to 2009)



Source: National Weather Service, map retrieved 8/14/2020

Lightning

Lightning can occur throughout the County both during and outside of storm events. Lightning is defined by the NWS as any and all of the various forms of visible electrical discharge caused by thunderstorms.

Thunderstorms and lightning are usually (but not always) accompanied by rain. Cloud-to-ground lightning can kill or injure people by direct or indirect means. Objects can be struck directly, which may result in an explosion, burn, or total destruction. Or, damage may be indirect, when the current passes through or near an object, which generally results in less damage.

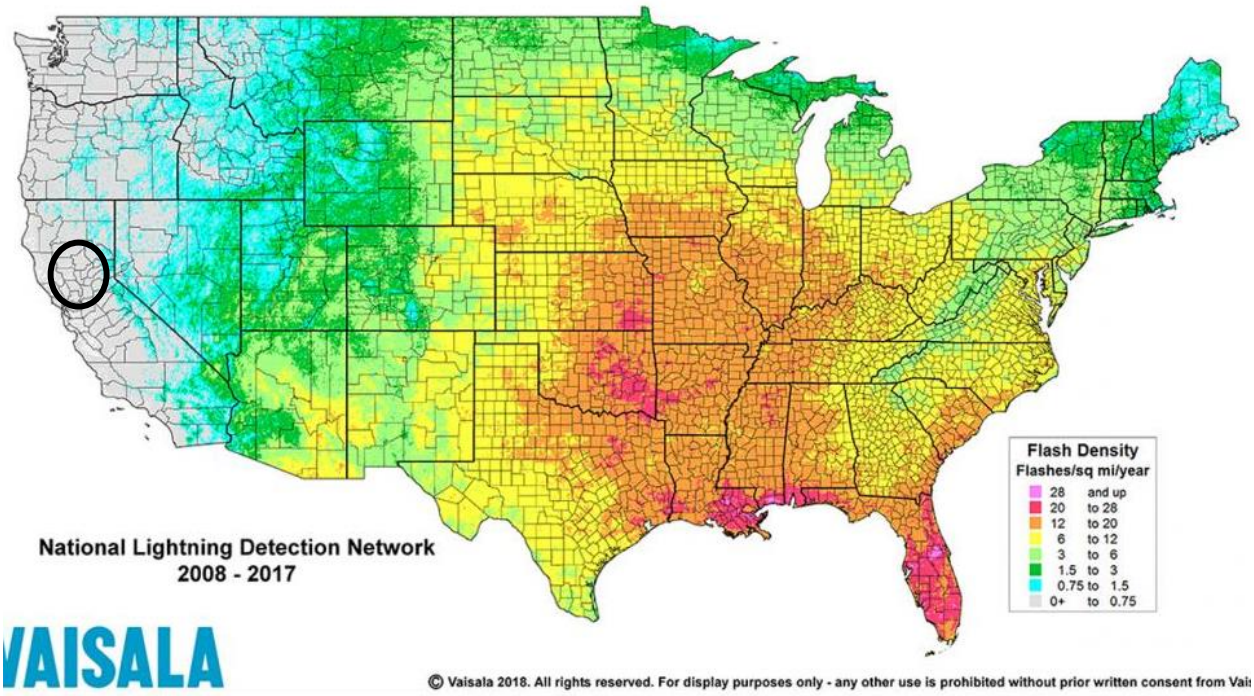
Intra-cloud lightning is the most common type of discharge. This occurs between oppositely charged centers within the same cloud. Usually it takes place inside the cloud and looks from the outside of the cloud like a diffuse brightening that flickers. However, the flash may exit the boundary of the cloud, and a bright channel, similar to a cloud-to-ground flash, can be visible for many miles.

Cloud-to-ground lightning is the most damaging and dangerous type of lightning, though it is also less common. Most flashes originate near the lower-negative charge center and deliver negative charge to earth. However, a large minority of flashes carry positive charge to earth. These positive flashes often occur during the dissipating stage of a thunderstorm's life. Positive flashes are also more common as a percentage of total ground strikes during the winter months. This type of lightning is particularly dangerous for several reasons. It frequently strikes away from the rain core, either ahead or behind the thunderstorm. It can strike as far as 5 or 10 miles from the storm in areas that most people do not consider to be a threat. Positive lightning also has a longer duration, so fires are more easily ignited. And, when positive lightning strikes, it usually carries a high peak electrical current, potentially resulting in greater damage. Lightning in the County is also a concern due to the number of fires that are started by lightning strikes. Wildfire is discussed in more detail in Section 4.3.14.

Location and Extent

Lightning events can occur in any location of the County and are often associated with thunderstorms. All portions of the County are at risk to lightning. Lightning tends to be rare in the County, as discussed in the extent section below. Lightning in the County can occur both during and outside of thunderstorms; the latter often referred to as dry lightning events. The speed of onset of thunderstorms that can cause lightning can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of thunderstorms in California is often short, ranging from minutes to hours. Thunderstorms and lightning are rare in the County. Vaisala maintains the National Lightning Detection Network. It tracks cloud to ground lightning incidences in the United States. Figure 4-27 shows lightning incidences in the County and the rest of the United States from 2008 to 2017, the most recent map date available.

Figure 4-27 Sutter County – Lightning Incidence Map 2008 to 2017



Source: Vaisala National Lightning Detection Network, map retrieved 8/14/2020

Wind

High winds, often accompanying severe storms and thunderstorms, can cause significant property and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss. High winds, as defined by the NWS glossary, are sustained wind speeds of 40 mph or greater lasting for 1 hour or longer, or winds of 58 mph or greater for any duration. These winds may occur as part of a seasonal climate pattern or in relation to other severe weather events such as thunderstorms.

Straight-line winds may also exacerbate existing weather conditions by increasing the effect on temperature and decreasing visibility due to the movement of particulate matters through the air, as in dust and snowstorms. The winds may also exacerbate fire conditions by drying out the ground cover, propelling fuel around the region, and increasing the ferocity of exiting fires. These winds may damage crops, push automobiles off roads, damage roofs and structures, and cause secondary damage due to flying debris.

Location and Extent

The entire Sutter County Planning Area is subject to significant, non-tornadic (straight-line), winds. Each area of the County is at risk to high winds. Magnitude of winds is measured often in speed and damages. These events are often part of a heavy rain and storm event, but can occur outside of storms. The speed of onset of winds can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of winds in California is often short, ranging from minutes to hours. The Beaufort scale is an empirical measure that relates wind speed to observed conditions at sea or on land. Its full name is the Beaufort wind force scale. Figure 4-28 shows the Beaufort wind scale.

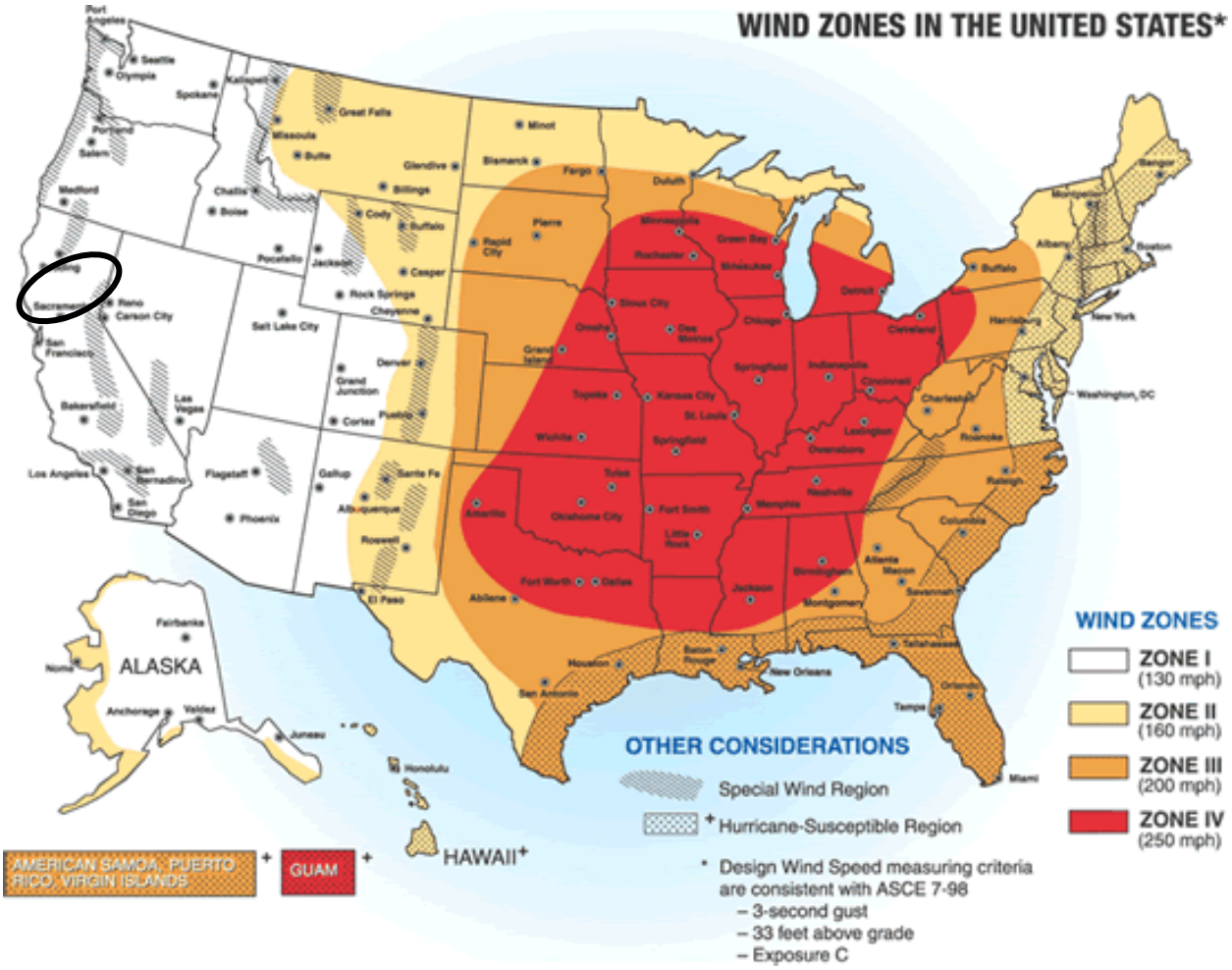
Figure 4-28 Beaufort Wind Scale

Beaufort Number	Wind Speed (miles/hour)	Wind Speed (km/hour)	Wind Speed (knots)	Description	Wind Effects on Land
0	< 1	< 1	< 1	Calm	Calm. Smoke rises vertically.
1	1-3	1-5	1-3	Light Air	Wind motion visible in smoke.
2	4-7	6-11	4-6	Light Breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	12-19	7-12	Gentle Breeze	Leaves and smaller twigs in constant motion.
4	13-18	20-28	11-16	Moderate Breeze	Dust and loose paper are raised. Small branches begin to move.
5	19-24	29-38	17-21	Fresh Breeze	Small trees begin to sway.
6	25-31	39-49	22-27	Strong Breeze	Large branches are in motion. Whistling is heard in overhead wires. Umbrella use is difficult.
7	32-38	50-61	28-33	Near Gale	Whole trees in motion. Some difficulty experienced walking into the wind.
8	39-46	62-74	34-40	Gale	Twigs and small branches break from trees. Cars veer on road.
9	47-54	75-88	41-47	Strong Gale	Larger branches break from trees. Light structural damage.
10	55-63	89-102	48-55	Storm	Trees broken and uprooted. Considerable structural damage.
11	64-72	103-117	56-63	Violent Storm	Widespread damage to structures and vegetation.
12	> 73	> 117	> 64	Hurricane	Considerable and widespread damage to structures and vegetation. Violence.

Source: National Weather Service

Figure 4-29 depicts wind zones for the United States. The map denotes that Sutter County falls into Zone I, which is characterized by high winds of up to 130 mph.

Figure 4-29 Wind Zones in the United States



Source: FEMA

Past Occurrences

Disaster Declaration History

A search of FEMA and Cal OES disaster declarations turned up multiple events. Heavy rains and storms have caused flooding in the County. Events where flooding resulted in a state or federal disaster declaration are shown in Table 4-27.

Table 4-27 Sutter County – Disaster Declarations from Heavy Rain and Storms (and Floods) 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: FEMA, Cal OES

Another database of disaster declarations comes from the USDA. This database was searched from 2012 to 2020, which showed three disaster declarations for Sutter County. This is shown on Table 4-28.

Table 4-28 Sutter County – USDA Disaster Declarations 2012-2020

Year	Declaration Number	Primary or Contiguous County	Disaster Type
2016	S4164	Primary	Severe weather including excessive rainfall and high winds
2016	S4170	Contiguous	Severe weather including excessive rainfall and high winds
2019	S4565	Contiguous	Excessive rain

Source: USDA

NCDC Events

The NCDC data recorded 91 hail, heavy rain, lightning, and wind incidents for Sutter County since 1950. A summary of these events is shown in Table 4-29. Additional events of heavy rain and storms are also discussed in the NCDC table in the flood profile in Section 4.3.10.

*Table 4-29 NCDC Hail, Heavy Rain, Lightning, and Wind Events in Sutter County 1950–4/30/2020**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Hail	4	0	0	0	0	$0	$0
Heavy Rain	4	0	0	0	0	$0	$0
High Wind	47	1	0	1	0	$15,457,000	$30,037,000
Strong Wind	25	0	1	2	2	$3,919,000	$0
Thunderstorm Wind	1	0	0	0	0	$0	$0
Total	**81**	**1**	**1**	**3**	**2**	**$19,376,000**	**$30,037,000**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Sutter County

Hazard Mitigation Planning Committee Events

The HMPC also noted the following events of heavy rains and storms:

2017 – heavy rains and storms from atmospheric rivers lead to DR4301, 4305, 4308.

2018 – January issues along Sac River in RD1660 and along LD1 on Feather River due to rains and increased flows from upstream dams. Homeless population evacuations in river bottoms due to rising water levels. On Sac River, closure of Lovies Landing RV park due to rising water and ingress/egress issues through the park.

2019 – localized flooding occurred throughout the County from heavy rains and storms.

Likelihood of Future Occurrence

Highly Likely – Based on NCDC data and HMPC input, 91 heavy rain and storm incidents over a 71-year period (1950-2020) equates to a severe storm event every year. As noted, this database likely doesn't capture all heavy rain, hail, and lightning events. Severe weather is a well-documented seasonal occurrence that will continue to occur often in the Sutter County Planning Area.

Climate Change and Heavy Rains and Storms

Climate change and its effect on rain and storms near the City has been discussed by two sources:

- CAS – 2014
- Cal-Adapt

CAS

According to the CAS, while average annual rainfall may increase or decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century. It is unlikely that hail will become more common in the County. The amount of lightning is not projected to change.

Cal Adapt

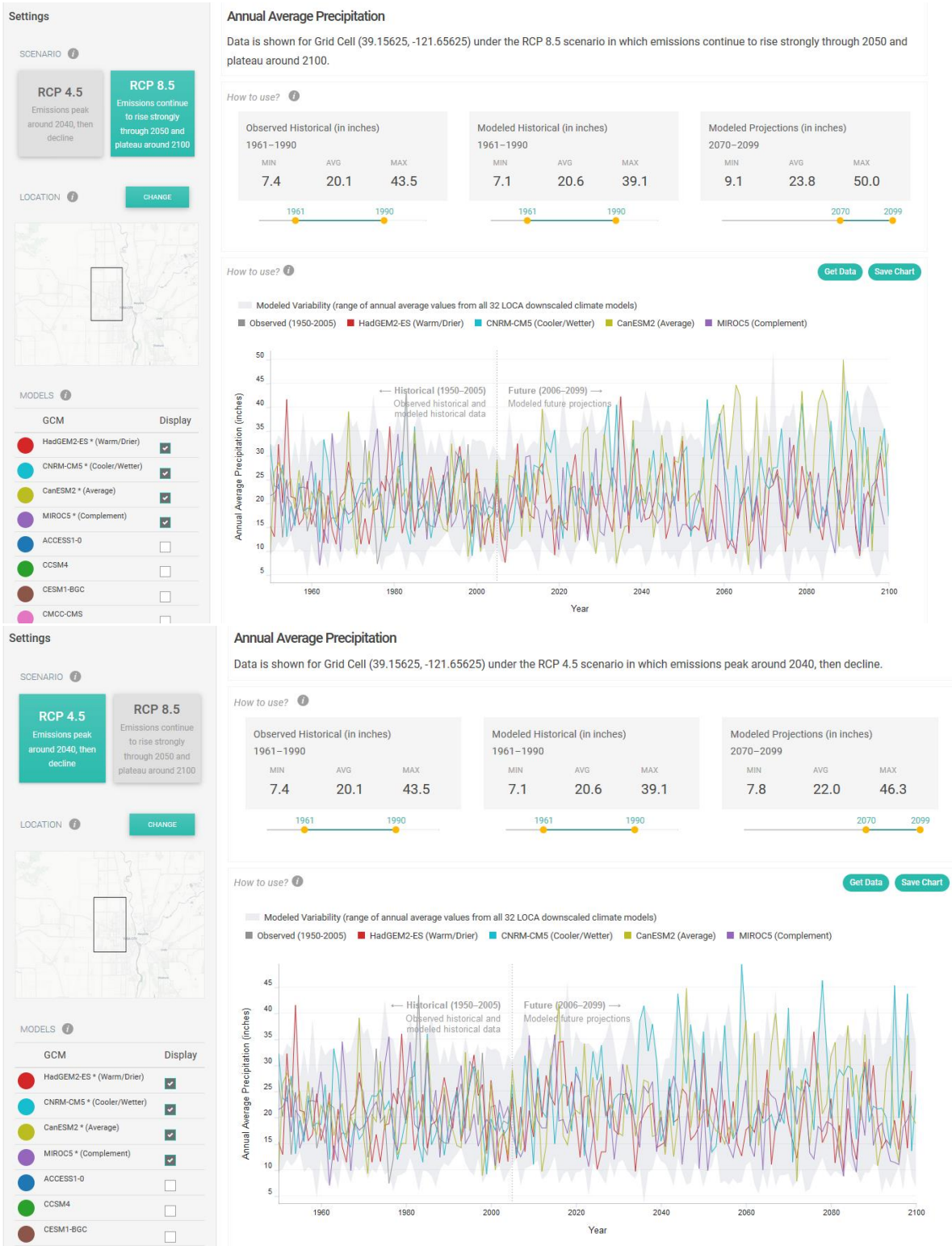
Cal-Adapt noted that, on average, the projections show little change in total annual precipitation in California. Furthermore, among several models, precipitation projections do not show a consistent trend during the next century. The Mediterranean seasonal precipitation pattern is expected to continue, with most precipitation falling during winter from North Pacific storms. One of the four climate models projects slightly wetter winters, and another projects slightly drier winters with a 10 to 20 percent decrease in total annual precipitation. However, even modest changes would have a significant impact because California ecosystems are conditioned to historical precipitation levels and water resources are nearly fully utilized.

These projections also differ depending on the time of year and the type of measurement (highs vs. lows), all of which have different potential effects to the state's ecosystem health, agricultural production, water use and availability, and energy demand. Future precipitation estimates from Cal-Adapt for the Sutter

County Planning (using the quad that contains Yuba City) are shown in Figure 4-30.. It shows the following:

- The upper chart shows annual averages of observed and projected precipitation values for the selected area on map under the RCP 8.5 scenario in which emissions continue to rise strongly through 2050 and plateau around 2100. The gray line (1950 – 2005) is observed data. The colored lines (2006 – 2100) are projections from 10 LOCA downscaled climate models selected for California. The light gray band in the background shows the least and highest annual average values from all 32 LOCA downscaled climate models.
- The lower chart shows annual averages of observed and projected Precipitation values for the selected area on map under the RCP 4.5 scenario in which emissions peak around 2040, then decline. The gray line (1950 – 2005) is observed data. The colored lines (2006 – 2100) are projections from 10 LOCA downscaled climate models selected for California. The light gray band in the background shows the least and highest annual average values from all 32 LOCA downscaled climate models.

Figure 4-30 Sutter County – Future Precipitation Estimates: High and Low Emission Scenarios



Source: Cal-Adapt – Precipitation: Decadal Averages Map

Vulnerability Assessment

Vulnerability—Medium

According to historical hazard data, heavy rains and storms are an annual occurrence in Sutter County. Impacts can be felt by both the population of the County as well as the structures that have been built in the County.

Impacts

Impacts from heavy rains and storms include damages to property and infrastructure. This includes: downed trees, damaged utility structures and infrastructures; power outages; road damages and blockages; hail damage to crops, buildings, and automobiles, and lightning damages to homes, critical infrastructure, and people. Winds can affect almond trees during certain periods of the year. However, actual damage associated with the primary effects of severe weather have been somewhat limited. It is the secondary hazards caused by severe weather, such as floods, fire, and agricultural losses that have had the greatest impact on the County. The risk and vulnerability associated with these secondary hazards are discussed in other sections of this plan (Section 4.3.10 Flood: 1%/0.2% Annual Chance, Section 4.3.11 Flood: Localized Stormwater, Section 4.3.7 Dam Failure, Section 4.3.12 Levee Failure, and Section 4.3.14 Wildfire).

Heavy Rains and Storms and Power Shortage/PSPS

During periods of heavy rains and storms, power outages can occur. These power outages can affect pumping stations and lift stations that help alleviate flooding. More information on power shortage and failure can be found in Section 4.3.3.

High Winds and Power Shortage/PSPS

During periods of high winds and dry vegetation, wildfire risk increases. High winds that occur during periods of extreme heat can cause PSPS events to be declared in the County. More information on PSPS can be found in Section 4.3.3.

Future Development

Homes built in the County are built to existing building codes that generally withstand heavy rains and storms. The County adopts and implements the State Building Code that is updated every three years and the County will continue to do so. New critical facilities such as communications towers and others should be built to withstand lightning, hail and thunderstorm winds. Backup power sources for all critical facilities should be incorporated into all new facilities. Properly located, designed, and constructed, future losses to new development should be minimal.

4.3.5. Aquatic Invasive Species

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how aquatic invasive species can affect this hazard.

Hazard/Problem Description

As of the December 2011 the California Department of Fish and Game survey, 257 invertebrates and algae have established populations in California. San Francisco Bay is the most invaded estuary in the United States. Only two other regions in the world, the eastern Mediterranean and the Hawaiian Islands, have comparable numbers of reported marine invasions. Sutter County is directly connected to the San Francisco Bay via the Sacramento and Feather River.

The introduction of nonnative species into County waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability.

Boats discharge ballast water that has been obtained from waters throughout the state, country, or the world. This water might include non-native organisms, untreated sewage, and other contaminants. Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. Examples include the zebra mussel infestation in the Great Lakes and the propagation of water hyacinth in the California Delta. Both the zebra mussel and the quagga mussel are concerns for California and Sutter County. These mussels have not affected the waters in Sutter County yet, but are still a cause for concern.

Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. Some of California's most serious weed problems occur in waterways, lakes and streams.

Aquatic Weeds

Some of California's and Sutter County's most serious weed problems occur in waterways, lakes and streams. The aquatic plant hydrilla is considered one of the most serious aquatic weed problems in the world and the California Department of Food and Agriculture (CDFA) maintains an intensive program to survey and eradicate this aquatic weed pest. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, while impeding water flow and delivery. Its rapid growth and ease of spread by boats makes it critical to detect early and eradicate.

Many varieties of non-native aquatic weeds compete for the entire water column and shoreline in Sutter County, crowding out native species and degrading the aquatic and riparian habitat.

- Water Hyacinth (*Eichhornia crassipes*) a floating plant native to Brazil, is among the most serious of weed problems occurring in the California Delta. If has invaded many waterways, lakes and streams. There is no known chemical free eradication method in the world for Water Hyacinth once a water course is completely occluded. It will jam rivers and lakes streams and ponds with uncounted thousands of tons of floating plant matter. The Sacramento-San Joaquin Delta and several of the rivers drained by this delta are heavily infested.
- Hydrilla (*Hydrilla verticillata*) is native to Asia, Europe, Africa, and highly resistant to salinity (>1-100000ppt) compared to many other freshwater aquatic plants. It is considered among the most serious aquatic weed problems in the world and California. It is the last remaining "funded" California Department of Food and Agriculture (CDFA) weed eradication program as of 2012, conducting eradication efforts in nine counties. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, impeding water flow and delivery in any conveyance. Its rapid growth and ease of spread makes it critical to detect early and eradicate. Past infestations have occurred in Sutter County. All have been eradicated. STILL TRUE?
- Giant reed: By far the greatest threat to the dwindling riparian resources of California is caused by three alien invasive species of giant reed known as: Arundo donax, Lythrum salicria, and Sesbania punicea (A.L.S). Over the last 40 years the riparian forests and waterways of northern California have become infested. A.L.S spread by flood-fragmentation and dispersal of vegetative and seed propagules. They dramatically alter the ecological/successional processes in riparian systems and ultimately degrade the riparian habitats towards pure stands of these noxious invasive species. The drainage is systematically impeded. Unchecked, ALS fills in all open areas and banks down to the waterline exacerbating flood prone areas. Presently no funded mitigation/control projects are in place in Sutter County. STILL TRUE?
- Parrot's feather (*Myriophyllum aquaticum*) is a stout aquatic perennial. Parrot's feather may compete with native aquatic plants, eliminating them or reducing their numbers in infested sites. It forms dense mats that can entirely cover the surface of the water in shallow lakes and other waterways. These mats clog waterways, making them unusable for navigation or recreation and causing flooding out of the channel. It can block irrigation pumps and water intakes, and it provides optimal habitat for mosquitoes. In California this species is becoming an increasing problem in irrigation and drainage canals. While parrot's feather may provide cover for some aquatic organisms, it can significantly alter the physical and chemical characteristics of lakes and streams. Infestations can alter aquatic ecosystems by shading out algae in the water column that serve as the basis of the aquatic food web. It also alters habitats for aquatic organisms, waterfowl, and other wildlife.
- Milfoil (*Myriophyllum spicatum*) – watermilfoil is a submersed, aquatic perennial that roots to the bottom of water bodies. It colonizes rivers, lakes, and other water bodies. It grows under a range of trophic conditions, but it is considered an indicator of eutrophic (low levels of dissolved oxygen, high levels of organic matter) conditions. The dense weed beds formed by watermilfoil have adverse effects on native aquatic vegetation that are important food sources for waterfowl and some mammals, and habitat for fish. The dense beds create habitat for disease-carrying insects, including mosquitoes, and parasites that cause swimmer's itch. The richness, diversity, and distribution of invertebrate species on lake bottoms are reduced where infestations occur.
- Water primrose (*Ludwigia Peploides*) is a species of flowering plant in the evening primrose family known by the common names floating primrose-willow and creeping water primrose. This species is well known as a troublesome aquatic noxious weed that invades water ecosystems and can clog waterways. This is perennial herb which grows in moist to wet to flooded areas. Water-primrose have

the ability to double their biomass from their broken particles between 15 and 90 days. This also allows this species to continue to thrive in habitat and regions where sexual reproduction cannot occur.

Aquatic and Non-Aquatic Species

The effects of nonnative fish on native fish are generally in the form of predation and competition for food and breeding sites. For example, many centrarchids (sunfish, crappie, and black basses) are voracious predators and are known to eat a variety of native invertebrate and fish species. Although no introduction of a nonnative fish species has unambiguously caused the extinction of a native species, it is thought that their introduction has contributed to the decline in native species. For example, smallmouth bass have been associated with the decline in the native hardhead in the plan area. Also, introductions of multiple species of centrarchids have been associated with the extirpation of Sacramento perch from the Sacramento River watershed, including the plan area.

There are also several non-fish, nonnative invasive species found in aquatic natural communities that can damage such communities. The introduced bullfrog is an important riparian invasive in the Planning Area. This species has been implicated as a primary driver of native ranid frog declines in Sutter County. Feral cats are also an important nonnative invasive that can impact many native bird species in wetland natural communities, for example the tricolored blackbird.

ADD QUAGGA MUSSELS?

Location and Extent

All freshwater lakes, streams, and rivers are potentially at risk from aquatic invasive species. There is no established scale for aquatic invasive species. Magnitude is measured by the presence and counts of aquatic invasive species in waterways in Sutter County. Speed of onset of these invasive species is short, as it only takes a careless boater to accidentally introduce an invasive species. However, the impacts associated with the introduction of a new invasive species can last years.

Past Occurrences

Disaster Declaration History

There have been no state or federal disaster declaration from aquatic invasive species as shown in Table 4-4. The County had no USDA disaster declarations since 2012 related to aquatic invasive species, as shown on Table 4-6.

NCDC Events

The NCDC does not track aquatic invasive species.

Hazard Mitigation Planning Committee Events

The County has ongoing issues with giant reed, creeping water primrose, and parrotfeather in canals and waterways that traverse the County.

Likelihood of Future Occurrences

Highly Likely – The rate of aquatic invasive species discoveries continues to increase. Due to the high number of incidents of invasive species in the Delta and Sacramento River, it is likely that future infestation of aquatic pests will occur in Sutter County.

Vulnerability Assessment

Vulnerability—Medium

Past occurrences of aquatic invasive species in the County are somewhat common in limited areas of the County. According to the HMPC, the areas of greatest concern is the Sutter Bypass.

Impacts

There are measurable past impacts to the County. In the Sutter Bypass, invasive species have plugged drains, contributing to greater flood impacts. The risk of aquatic invasive species exists and if a breakout occurs, there may be potentially large economic impacts. Thus there are always active weed management areas and aquatic weed control.

Future Development

Future development in the County is not likely to have an impact on or be directly impacted by aquatic invasive species in Sutter County. Indirect impacts on future development include greater risk of flooding.

4.3.6. Climate Change

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While the Earth's climate has cycled over its 4.5-billion-year age, these natural cycles have taken place gradually over millennia, and the Holocene, the most recent epoch in which human civilization developed, has been characterized by a highly stable climate – until recently.

This LHMP Update is concerned with human-induced climate change that has been rapidly warming the Earth at rates unprecedented in the last 1,000 years. Since industrialization began in the 19th century, the burning of fossil fuels (coal, oil, and natural gas) at escalating quantities has released vast amounts of carbon dioxide and other greenhouse gases responsible for trapping heat in the atmosphere, increasing the average

temperature of the Earth. Secondary impacts include changes in precipitation patterns, the global water cycle, melting glaciers and ice caps, and rising sea levels. According to the Intergovernmental Panel on Climate Change (IPCC), climate change will "increase the likelihood of severe, pervasive and irreversible impacts for people and ecosystems" if unchecked.

Through changes to oceanic and atmospheric circulation cycles and increasing heat, climate change affects weather systems around the world. Climate change increases the likelihood and exacerbates the severity of extreme weather – more frequent or intense storms, floods, droughts, and heat waves. Consequences for human society include loss of life and injury, damaged infrastructure, long-term health effects, loss of agricultural crops, disrupted transport and freight, and more. Climate change is not a discrete event but a long-term hazard, the effects of which communities are already experiencing.

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

In Sutter County, the HMPC noted that each year it seems to get a bit warmer. California's Adaptation Planning Guide (APG): Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. California's Adaptation Planning Guide: Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Sutter County falls within the Northern Central Valley Region characterized as an agricultural, inland region with over 3.7 million people, with substantial cities, the largest being the state capitol, Sacramento. Agriculture is the predominant economic activity. The agricultural operations in this region include rice, dairy, and nut trees (almond and walnut). The region's agricultural activity is one of the most productive in the nation. Table 4-30 provides a summary of Cal-Adapt Climate Projections for the North Central Valley Region.

Table 4-30 North Central Valley Region and Sutter County – Cal Adapt Climate Projections

Effect	Ranges
Temperature Change, 1990-2100	January increase in average temperature of 4°F to 6°F in 2050 and between 8°F and 12°F by 2100. July increase in average temperature of 6°F to 7°F in 2050 and 12°F to 15°F by 2100. (Modeled average temperatures; high emissions scenario)
Precipitation	Annual precipitation is projected to decline by approximately one to two inches by 2050 and three to six inches by 2100. (Community Climate System Model Version 3 (CCSM3) climate model; high carbon emissions scenario)
Heat wave	Heat wave is defined as five days over 102°F to 105°F, except in the mountainous areas to the east. Two to three more heat waves per year are expected by 2050 with five to eight more by 2100.

Effect	Ranges
Wildfire	By 2085, the north and eastern portions of the region will experience an increase in wildfire risk, more than 4 times current levels in some areas. (Geophysical Fluid Dynamics Laboratory (GFDL) climate model; high carbon emissions scenario)

Source: Cal-Adapt

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the County. There is no scale to measure the extent of climate change. Climate change exacerbates other hazard, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Disaster Declaration History

Climate change has never been directly linked to any declared disasters, as shown in Table 4-4. The County had no USDA disaster declarations since 2012 related to climate change, as shown on Table 4-6.

NCDC Events

The NCDC does not track climate change events.

Hazard Mitigation Planning Committee Events

While the HMPC noted that climate change is of concern, no specific impacts of climate change could be recalled. HMPC members noted that the strength of storms does seem to be increasing and the temperatures seem to be getting hotter. The HMPC also noted that the winter rains of 2017 and 2019 were more intense.

Likelihood of Future Occurrence

Likely – Climate change is virtually certain to continue without immediate and effective global action. According to NASA, 2017 and 2019 were two of the hottest years on record. Without significant global action to reduce greenhouse gas (GHG) emissions, the IPCC concludes in its Fifth Assessment Synthesis Report (2014) that average global temperatures are likely to exceed 1.5°C by the end of the 21st century, with consequences for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea level rise and storm surges.

Climate Scenarios

The United Nations IPCC developed several GHG emissions scenarios based on differing sets of assumptions about future economic growth, population growth, fossil fuel use, and other factors. The emissions scenarios range from "business-as-usual" (i.e., minimal change in the current emissions trends) to more progressive (i.e., international leaders implement aggressive emissions reductions policies). Each

of these scenarios leads to a corresponding GHG concentration, which is then used in climate models to examine how the climate may react to varying levels of GHGs. Climate researchers use many global climate models to assess the potential changes in climate due to increased GHGs.

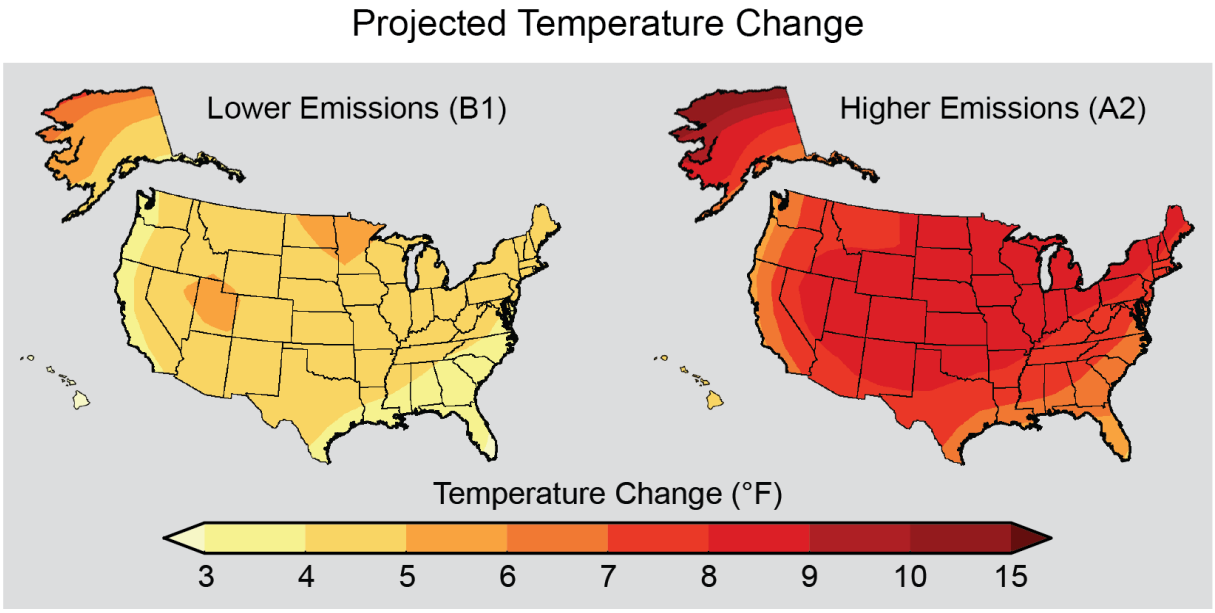
Key Uncertainties Associated with Climate Projections

- Climate projections and impacts, like other types of research about future conditions, are characterized by uncertainty. Climate projection uncertainties include but are not limited to:
  - ✓ Levels of future greenhouse gas concentrations and other radiatively important gases and aerosols,
  - ✓ Sensitivity of the climate system to greenhouse gas concentrations and other radiatively important gases and aerosols,
  - ✓ Inherent climate variability, and
  - ✓ Changes in local physical processes (such as afternoon sea breezes) that are not captured by global climate models.

Even though precise quantitative climate projections at the local scale are characterized by uncertainties, the information provided can help identify the potential risks associated with climate variability/climate change and support long term mitigation and adaptation planning.

Maps show projected change in average surface air temperature in the later part of this century (2071-2099) relative to the later part of the last century (1970-1999) under a scenario that assumes substantial reductions in heat trapping gases and a higher emissions scenario that assumes continued increases in global emissions. These are shown in Figure 4-31.

Figure 4-31 Projected Temperature Change – Lower and Higher Emissions Scenario



Source: National Climate Assessment

According to the California Natural Resource Agency (CNRA), climate change is already affecting California and is projected to continue to do so well into the foreseeable future. Current and projected changes include increased temperatures, sea level rise, a reduced winter snowpack altered precipitation patterns, and more frequent storm events. Over the long term, reducing greenhouse gases can help make these changes less severe, but the changes cannot be avoided entirely. Unavoidable climate impacts can result in a variety of secondary consequences including detrimental impacts on human health and safety, economic continuity, ecosystem integrity and provision of basic services.

The CNRA's 2014 CAS delineated how climate change may impact and exacerbate natural hazards in the future, including wildfires, extreme heat, floods, and drought:

- Climate change is expected to lead to increases in the frequency, intensity, and duration of extreme heat events and heat waves in Sutter County and the rest of California, which are likely to increase the risk of mortality and morbidity due to heat-related illness and exacerbation of existing chronic health conditions. Those most at risk and vulnerable to climate-related illness are the elderly, individuals with chronic conditions such as heart and lung disease, diabetes, and mental illnesses, infants, the socially or economically disadvantaged, and those who work outdoors.
- Higher temperatures will melt the Sierra snowpack earlier and drive the snowline higher, resulting in less snowpack to supply water to California users.
- Droughts are likely to become more frequent and persistent in the 21st century.
- Intense rainfall events, periodically ones with larger than historical runoff, will continue to affect California with more frequent and/or more extensive flooding.
- Storms and snowmelt may coincide and produce higher winter runoff from the landward side, while accelerating sea-level rise will produce higher storm surges during coastal storms. Together, these changes may increase the probability of floods and levee and dam failures, along with creating issues related to saltwater intrusion.
- Warmer weather, reduced snowpack, and earlier snowmelt can be expected to increase wildfire through fuel hazards and ignition risks. These changes can also increase plant moisture stress and insect populations, both of which affect forest health and reduce forest resilience to wildfires. An increase in wildfire intensity and extent will increase public safety risks, property damage, fire suppression and emergency response costs to government, watershed and water quality impacts, vegetation conversions and habitat fragmentation.

Vulnerability Assessment

Vulnerability—Medium

Climate change is the distinct change in measures of weather patterns over a long period of time, ranging from decades to millions of years. More specifically, it may be a change in average weather conditions such as temperature, rainfall, snow, ocean and atmospheric circulation, or in the distribution of weather around the average. While climate change on its own is a hazard, its effects on exacerbating other hazards is also a concern.

Sutter County Climate Change Impacts

The Sutter County Agriculture Commissioner noted that hot weather and extreme heat can worsen ozone levels and air quality as well as leading to drought conditions. Excessive heat and prolonged dry or drought conditions can impact agriculture by creating worker safety issues for farm field workers, severely damaging crops, and reducing availability of water and food supply for livestock. This section sources multiple documents that focus on Sutter County's climate change vulnerability:

- California Adaptation Planning Guide
- Proceedings of the National Academy of Sciences

California Adaptation Planning Guide

The APG prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change. The APG: Defining Local and Regional Impacts focuses on understanding the ways in which climate change can affect a community. According to this APG, climate change impacts (temperature, precipitation, sea level rise, ocean acidification, and wind) affect a wide range of community structures, functions and populations. These impacts further defined by regional and local characteristics are discussed by secondary impacts and seven sectors found in local communities: Public Health, Socioeconomic, and equity impacts; Ocean and Coastal Resources; Water Management; Forest and Rangeland; Biodiversity and Habitat; Agriculture; and Infrastructure.

The APG: Understanding Regional Characteristics identified the following impacts specific to the North Central Valley region in which the Sutter County Planning Area is part of:

- Temperature increases – particularly nighttime temperature
- Reduced precipitation
- Flooding – increase flows, snowmelt, levee failure in the Delta
- Reduced agricultural productivity (e.g., nut trees, dairy)
- Reduced water supply
- Wildfire in the Sierra foothills
- Public health and heat
- Reduced tourism

California's Adaptation Guide: Understanding Regional Characteristics provides input on adaptation considerations for the Northern Central Valley Region. As detailed in this guide, climate change has the potential to disrupt many features that characterize the region, including ecosystems health, snowpack, and the tourist economy. Specific regional impacts include the following:

Flooding. The eastern part of the Northern Central Valley contains the foothills of the Sierra Nevada mountain range. The mountainous areas of the state are projected to have less precipitation falling as snow and to be subject to rapid melt events. This will result in extreme, high-flow events and flooding in the Central Valley. Communities should evaluate local floodplains and recognize areas where a small increase in flood height would inundate large areas and potentially threaten structures, infrastructure, agricultural

fields, and/or public safety. As the rivers of the region flow toward San Francisco Bay, the land decreases in elevation and is protected by levees, many of which are vulnerable, particularly to seismic events.

Agriculture. The Northern Central Valley is one of the largest agricultural producing regions, not only in California, but in the United States. Between climate change impacts on water availability and seasonal temperature regimes, the health of livestock, and productivity of trees and crops are likely to be affected. Agriculture in this region is varied, with rice, nuts (almonds, walnuts, pistachios), and dairy being three of the most predominant products. Others include pears, cattle, wine grapes, chicken, sweet potatoes, and plums. Each crop is likely to react slightly differently to alteration in seasonal temperature regimes and water availability. Rice is projected to experience a moderate loss in productivity (less than 10%). In the case of nut trees, it is the reduction in nighttime cooling that may have the most impact. Jurisdictions reliant on almonds, walnuts, pistachios, or other nuts should specifically evaluate projected changes in daily low temperatures and/or loss of nighttime chill hours. It is difficult to specifically project the production impact on crops because this relates to many factors in addition to temperature and precipitation, including pest regimes, availability of imported or groundwater irrigation water, and management practices. As with crops, climate change impacts on dairy cows can occur and depend on a variety of factors.

The impact of climate change on agricultural productivity has the potential to alter a community's economic continuity, including its employment base.

Public Health, Socioeconomic, and Equity Impact. Increased temperatures and more frequent heat waves are expected in the region. Impervious surfaces are increasing in the Central Valley, increasing the potential impacts of heat islands. Farm employment or lodging and food services are among the top five employment sectors in several of the counties in this region. Agricultural workers and employees in the tourist industry are more susceptible to heat events. Regardless of their occupation, the poor are less likely to have the adaptive capacity to prevent and address impacts for reasons stated above.

Water Supply. Shorter rainfall events and rapid snowmelt will reduce the region's water supply by making water more difficult to capture in reservoirs or retain for groundwater recharge. Recreation and tourism in the region are also likely to suffer due to lower water levels in waterways and reservoirs and declining snowpack. Agriculture will also be impacted due to reduced or altered precipitation. Water supply (for irrigation) can alleviate some of the other climate stresses (altered temperature or precipitation) or, in the case of reduced water supply, exacerbate them. The challenge of climate change is that water supply is projected to be reduced and water that is available will be more costly for users. Employees of water-reliant industries such as agriculture may become more economically vulnerable because of unstable working conditions.

Fire. Fire risk is projected to increase in the foothills lining the eastern edge of the region. The areas northeast of Sacramento, due to population density and fire risk, are projected to have large property loss. Jurisdictions should pay careful attention to the wildland-urban interface and enforcement of mitigation measures such as residential vegetation and setbacks.

Proceedings of the National Academy of Sciences

In addition to the APG, a report from the Proceedings of the National Academy of Sciences (PNAS) states that some of the recent fire impacts may have been attributed to climate change. The PNAS report posits that climate influences wildfire potential primarily by modulating fuel abundance in fuel-limited environments, and by modulating fuel aridity in flammability-limited environments. Increased forest fire activity across the western United States in recent decades has contributed to widespread forest mortality, carbon emissions, periods of degraded air quality, and substantial fire suppression expenditures. Those most vulnerable to high levels of ozone and particulate matter include people who work or spend a lot of time outdoors, such as residents of this region who are employees of the tourist industry. Households eligible for energy utility financial assistance programs are an indicator of potential impacts. These households may be more at risk of not using cooling appliances, such as air conditioning, due to associated energy costs.

Future Development

Sutter County in general could see population fluctuations as a result of climate impacts relative to those experienced in other regions, and these fluctuations could be expected to impact demand for housing and other development. For example, sea level rise may disrupt economic activity and housing in coastal communities, resulting in migration to inland urban areas. Other interior western states may experience an exodus of population due to challenges in adapting to heat even more extreme than that which is projected to occur here. While there are currently no formal studies of specific migration patterns expected to impact the Sutter County region, climate-induced migration was recognized within the UNFCCC Conference of Parties Paris Agreement of 2015 and is expected to be the focus of future studies.

Climate change, coupled with shifting demographics and market conditions, could impact both the location of desired developments and the nature of development. Demand may increase for smaller dwellings that are less resource intensive, more energy efficient, easier to maintain and can be more readily adapted or even moved in response to changing conditions. Compact, mixed-use and infill developments that can help residents avoid long commutes and vulnerabilities associated with the transportation system will likely continue to grow in popularity. The value of open space and pressure to preserve it will likely increase, due in part to its restorative, recreational, environmental and habitat benefits but also for its ability to sequester carbon, help mitigate the accumulation of greenhouse gas in the atmosphere and slow down the global warming trend. Higher flood risks, especially if coupled with increased federal flood insurance rates, may decrease market demand for housing and other types of development in floodplains, while increased risk of wildfires may do the same for new developments in the urban-wildland interface. Flood risks may also inspire new development and building codes that elevate structures while maintaining streetscapes and neighborhood characteristics.

Climate change will stress water resources. Water is an issue in every region, but the nature of the potential impacts varies. Drought, related to reduced precipitation, increased evaporation, and increased water loss from plants, is an important issue in many U.S. regions, especially in the West. Floods, water quality problems, and impacts on aquatic ecosystems and species are likely to be amplified by climate change. Declines in mountain snowpack are important in Sutter County the Sierra Nevada Mountains and across the state, where snowpack provides vital natural water storage and supply. The ability to secure and

provide water for new development requires on-going monitoring and assurances. It is recommended that the ability to provide a reliable water supply from the appropriate water purveyor, continue to be in the conditions for project approval, and such assurances shall be verified and in place prior to issuing building permits.

Similarly, protecting and enhancing water supply will also need to be addressed. California's Sustainable Groundwater Management Act (SGMA) will contribute to addressing groundwater and aquifer recharge needs. Good groundwater management will provide a buffer against drought and climate change, and contribute to reliable water supplies regardless of weather patterns. California depends on groundwater for a major portion of its annual water supply, and sustainable groundwater management is essential to a reliable and resilient water system. Protection of critical recharge areas should be addressed across the County in the respective Groundwater Management Plans. Further, these plans should include provisions that guide development or curtail development in areas that would harm or compromise recharge areas.

Climate change will affect transportation. The transportation network is vital to the County and the region's economy, safety, and quality of life. While it is widely recognized that emissions from transportation have impacts on climate change, climate will also likely have significant impacts on transportation infrastructure and operations Examples of specific types of impacts include softening of asphalt roads and warping of railroad rails; damage to roads; flooding of roadways, rail routes, and airports from extreme events; and interruptions to flight plans due to severe weather. Climate change impacts considered in the plan include: extreme temperatures; increased precipitation, runoff and flooding; increased wildfires; and landslides. Although landslides are not a direct result of climate change, these events are expected to increase in frequency due to increased rainfall, runoff, and wildfire. These events have the potential to cause injuries or fatalities, environmental damage, property damage, infrastructure damage, and interruption of operations. During flood events, these trails serve as secondary transportation facilities when roadways are blocked or otherwise impassible. During Hurricane Sandy, bicycles were one of the primary modes used to deliver food and water to residents stranded in their homes due to flood. Including dual or multi-purpose facilities and amenities as part of all new development provides not just desirable community amenities but critical infrastructure for climate resiliency.

Climate change will affect land uses and planning. Climate change coupled with shifting demographics and market conditions, could impact both the location of desired developments and the nature of development. Demand may increase for smaller dwellings that are less resource intensive, more energy efficient, easier to maintain and can be more readily adapted or even moved in response to changing conditions. Compact, mixed-use and infill developments that can help residents avoid long commutes and vulnerabilities associated with the transportation system will likely continue to grow in popularity. The value of open space, urban greening, green infrastructure, tree canopy expansion and pressure to preserve it will likely increase, due in part to its restorative, recreational, environmental, and habitat, and physical and mental health benefits but also for its ability to sequester carbon and cool the surrounding environment.

Climate change will affect Utilities. California is already experiencing impacts from climate change such as an increased number of wildfires, sea level rise and severe drought. Utility efforts to deal with these impacts range from emergency and risk management protocols to new standards for infrastructure design and new resource management techniques. Utilities are just beginning to build additional resilience and redundancy into their infrastructure investments from a climate adaptation perspective, but have been doing

so from an overall safety and reliability perspective for decades. Significant efforts are also being made in those areas that overlap with climate change mitigation such as diversification of resources, specifically the addition of more renewables to the portfolio mix, as well as implementation of demand response efforts to curb peak demand. Efforts are also under way to upgrade the distribution grid infrastructure, which should add significant resilience to the grid as well. Next, they will issue a guidance document that expands upon the vulnerability assessments phase and includes plans for resilience solutions including cost/benefit analysis methodologies. The outcomes of this work will help to inform next steps on how infrastructure, the grid and other related operations will be modified to address climate change. New development will have to adapt and incorporate these new approaches as they evolve. Existing and new development will be affected from impacts that includes not only diminished capacity from all of the utility assets from generation to transmission and distribution, but also the cost consequences resulting from prevention, replacement, outage, and energy loss. These have the potential for greatly impacting not just residential development but commercial and industrial and all utility users.

4.3.7. Dam Failure

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

Dam failures can also result from any one or a combination of the following causes:

- Earthquake;
- Inadequate spillway capacity resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage, or piping or rodent activity;
- Improper design;
- Improper maintenance;
- Negligent operation; and/or
- Failure of upstream dams on the same waterway.

In general, there are three types of dams: concrete arch or hydraulic fill, earth and rockfill, and concrete gravity. Each type of dam has different failure characteristics. A concrete arch or hydraulic fill dam can fail almost instantaneously; the flood wave builds up rapidly to a peak then gradually declines. An earth-rockfill dam fails gradually due to erosion of the breach; a flood wave will build gradually to a peak and

then decline until the reservoir is empty. A concrete gravity dam can fail instantaneously or gradually with a corresponding buildup and decline of the flood wave.

Dams and reservoirs have been built throughout California to supply water for agriculture and domestic use, to allow for flood control, as a source of hydroelectric power, and to serve as recreational facilities. The storage capacities of these reservoirs range from a few thousand acre-feet to five million acre-feet. The water from these reservoirs eventually makes its way to the Pacific Ocean by way of several river systems.

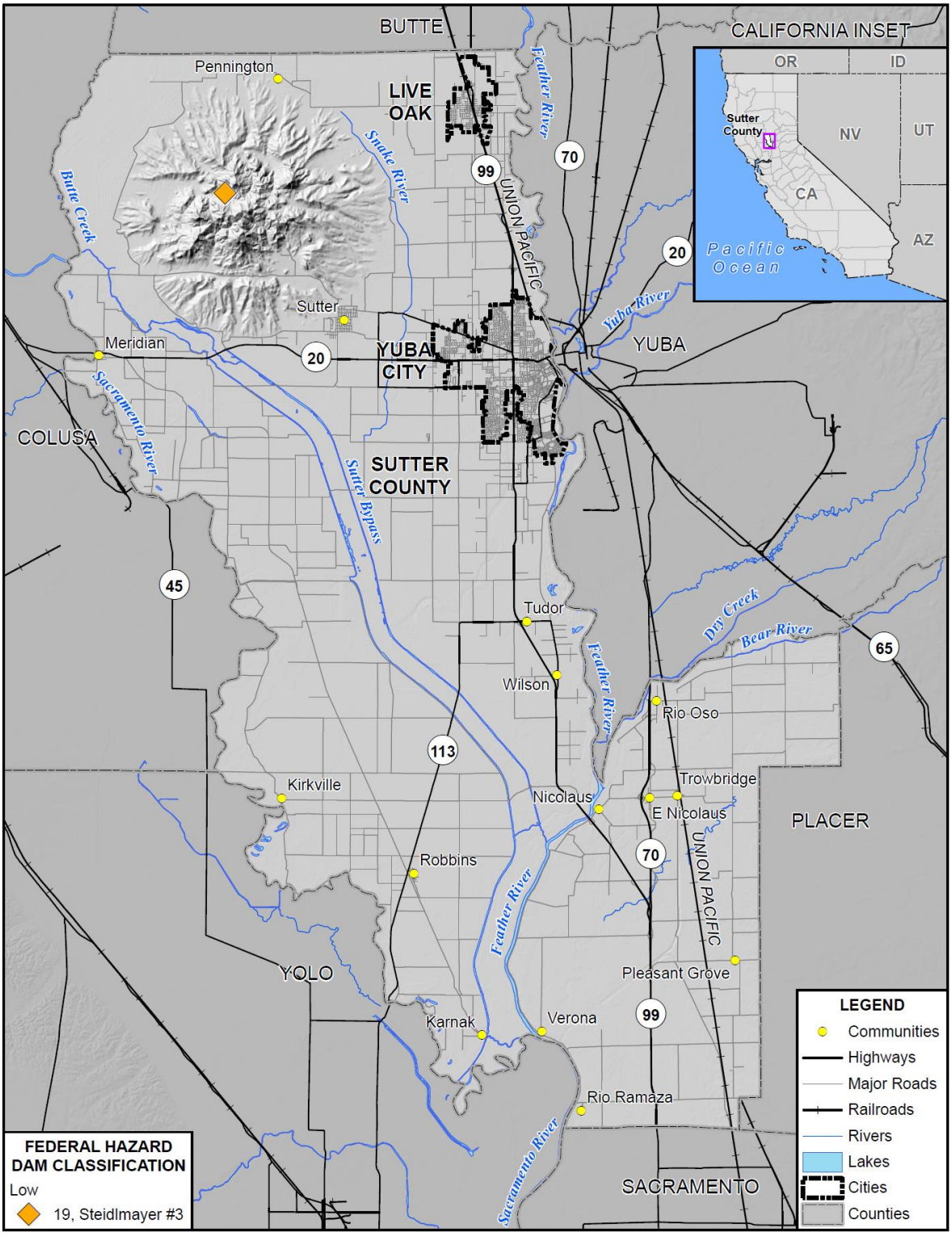
The California Department of Water Resources (CA DWR) Division of Safety of Dams (DSOD) has jurisdiction over impoundments that meet certain capacity and height criteria. Embankments that are less than six feet high and impoundments that can store less than 15 acre-feet are non-jurisdictional. Additionally, dams that are less than 25 feet high can impound up to 50 acre-feet without being jurisdictional. CA DWR, DOSD assigns hazard ratings to large dams within the State. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property:

- **Extremely High Hazard** – Expected to cause considerable loss of human life or would result in an inundation area with a population of 1,000 or more
- **High Hazard** – Expected to cause loss of at least one human life.
- **Significant Hazard** – No probable loss of human life but can cause economic loss, environmental damage, impacts to critical facilities, or other significant impacts.
- **Low Hazard** – No probable loss of human life and low economic and environmental losses. Losses are expected to be principally limited to the owner's property.

Location and Extent

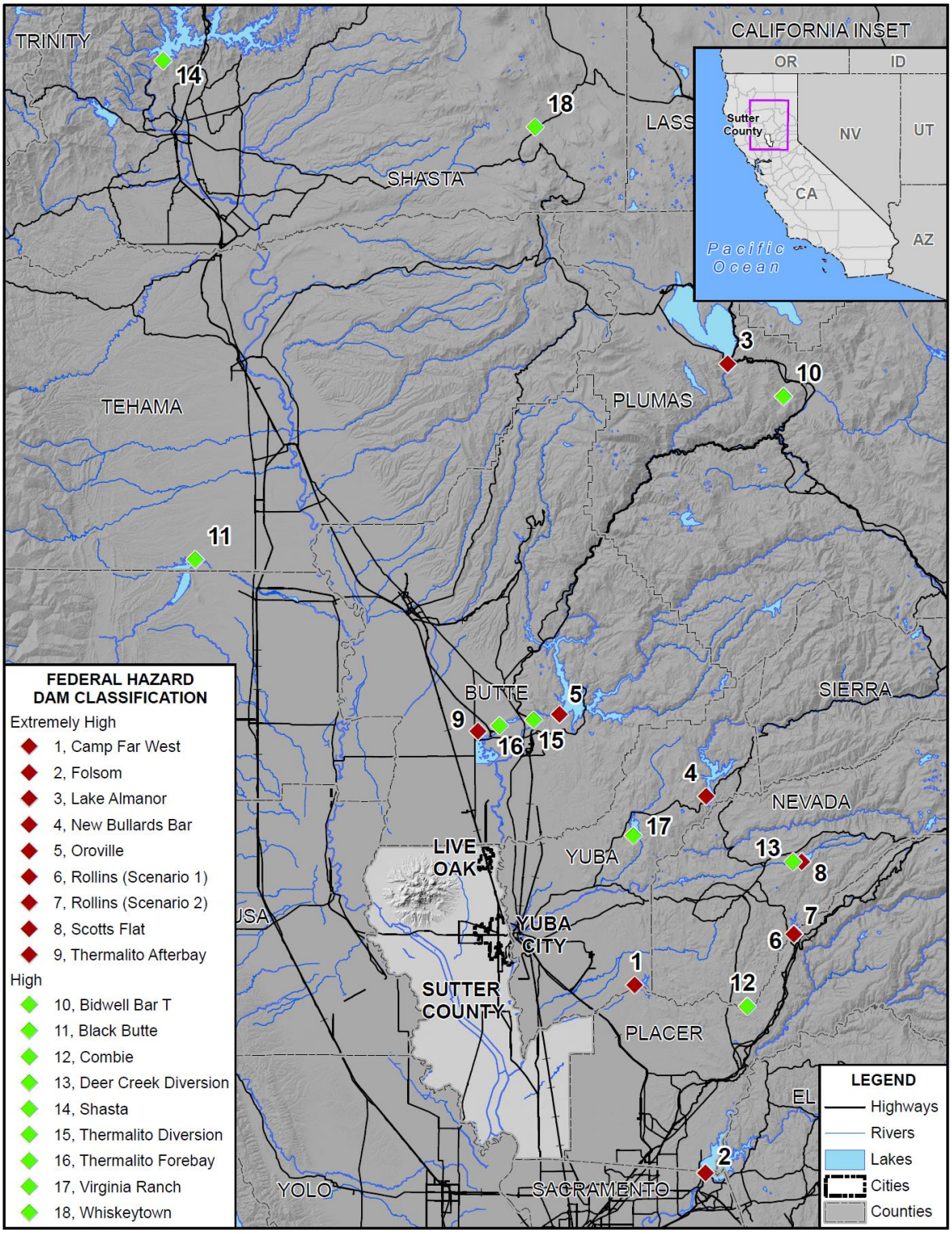
According to data provided by Sutter County, CA DWR, and Cal OES, there is 1 low hazard dam, the Steidlmayer dam as shown on Figure 4-32, in Sutter County that falls under the jurisdiction of the DSOD (jurisdictional dams described above). Figure 4-33 identifies the those extremely high and high hazard dams outside the County that threaten the County. Table 4-31 gives information on the 1 dam in the County that falls under DSOD jurisdiction. Table 4-32 shows the dams outside of Sutter County that could affect areas inside Sutter County, should they fail.

Figure 4-32 Sutter County Dam Inventory



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure 4-33 Sutter County – Dams of Concern Outside the County



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table 4-31 Sutter County – Inventory of Dams under DSOD Jurisdiction

Name	River/Stream	Hazard Classification	Owner	Dam Type	Capacity (acre-ft)	Structural Height (ft)	Year Built
Steidlmayer #3	Unnamed	Low	Private	Earth	82	49	1961

Source: Cal OES and the National Performance of Dams Program
*One Acre Foot=326,000 gallons

Table 4-32 Dams of Concern Outside Sutter County

Name	River/Stream	Hazard Classification	Owner	Dam Type	Capacity (acre-ft)	Structural Height (ft)	Year Built
Camp Far West	Bear River	Extremely High	South Sutter Water District	Earth Rockfill	104,500	185	1963
Folsom	American River	Extremely High	Dept. of Interior	Concrete Gravity	975,000	275	1945
Lake Almanor	Feather River	Extremely High	PG&E	Hydraulic Fill	1,308,000	130	1927
New Bullards Bar	North Yuba	Extremely High	Yuba County Water Agency	Variable Radius Arch	969,600	635	1970
Oroville	Feather River	Extremely High	CA DWR	Earth	3,537,577	742	1968
Rollins	Bear River	Extremely High	Nevada Irrigation District	Earth Rockfill	66,000	242	1965
Scotts Flat	Deer Creek	Extremely High	Nevada Irrigation District	Earth	49,000	175	1948
Thermalito Afterbay	Feather River	Extremely High	CA DWR	Earth	57,041	38	1967
Bidwell Bar T	Feather River	High	Indian Valley CSD	Earth Rockfill	5,200	35	1865
Black Butte	Stony Creek	High	USACE	Earth	173,700	156	1963
Combie	Bear River	High	Nevada Irrigation District	Variable Radius Arch	5,555	85	1928
Deer Creek Diversion	Deer Creek	High	Nevada Irrigation District	Variable Radius Arch	1,400	82	1928
Shasta	Sacramento River	High	US Bureau of Reclamation	Concrete Gravity	4,552,000	521	1945
Thermalito Diversion	Feather River	High	CA DWR	Concrete Gravity	13,328	128	1967
Thermalito Forebay	Feather River	High	CA DWR	Earth	11,768	75	1967

Name	River/Stream	Hazard Classification	Owner	Dam Type	Capacity (acre-ft)	Structural Height (ft)	Year Built
Virginia Ranch	Dry Creek	High	Browns Valley Irrigation District	Earth	57,000	152	1963
Whiskeytown	Clear Creek	High	CA DWR	Earth	297,400	282	1964

Source: Cal OES and the National Performance of Dams Program
*One Acre Foot=326,000 gallons

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, dam failure would most probably happen in consequence of the natural disaster triggering the event. However, DOSD assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail: Low, Significant, High, and Extremely High. There is no scale with which to measure dam failure. While a dam may fill slowly with runoff from winter storms, a dam break can have a very quick speed of onset. The duration of dam failure is not long – only as long as it takes to empty the reservoir of water the dam held back. Dam inundation flood geographic extents are discussed in Table 4-37 (for extremely high hazard dams) and Table 4-38 (for high hazard dams) in the flooded acres analysis in the vulnerability assessment of this section.

Past Occurrences

Disaster Declaration History

There has been one disaster declaration related to dam failure affecting Sutter County, as shown in Table 4-4 from the 2017 Oroville Dam incident. The County had no USDA disaster declarations since 2012 related to dam failure, as shown on Table 4-6.

NCDC Events

There have been no NCDC dam failure events in Sutter County.

National Performance of Dams Program Events

The National Performance of Dams Program at Stanford University tracks dam failures. A search of the National Performance of Dams Program database showed no past dam failure events in Sutter County.

Hazard Mitigation Planning Committee Events

The HMPC noted the following event:

February 2017 – A hazardous situation developed with the Oroville Dam emergency spillway in nearby Butte County. At approximately 4:30 pm on February 12, 2017, citizens were alerted on broadcast and social media by DWR that the Auxiliary Spillway at Oroville Dam was subject to imminent failure within 60 minutes. Failure of the emergency spillway structure would result in an uncontrolled release of flood

waters from Lake Oroville. In response to situation, DWR increased water releases to 100,000 cubic feet per second. Immediate evacuation from the low levels of Oroville and areas downstream were ordered. Sutter County opened their EOC during this event. Sutter County Office of Emergency Management ordered evacuation for Live Oak, Yuba City, Nicolaus and all communities along Feather River Yuba City basin. The HMPC noted that traffic was backed up on Hwy 99 southbound. Howlsey Rd exit on Hwy 99 backed up onto highway because of the stop sign. Over the next several hours, thousands of citizens from Butte County evacuated to the West and South (into Sutter County and surrounding counties). Shelters were opened in the County. For 48 hours, County staff and mutual aid resources were used to: maintain security in the communities; provide emergency response services for citizens remaining in the county; maintain key infrastructure such as water and wastewater; and, to patrol levees, monitor river levels, manage animal (small and large) services and support, and provide logistical support for employees. On the evening of Tuesday, February 14, 2017, the evacuation order was lifted in Sutter County. Local and mutual-aid law enforcement assisted with repopulation of the residents.

Likelihood of Future Occurrence

Occasional—No dam failure events have occurred in the County, but the County was affected by the Oroville Spillway incident. Thus, based on historical data and input from the HMPC, it is occasional that major dam failure event will occur affecting Sutter County.

Climate Change and Dam Failure

Increases in both precipitation and heat causing snow melt in areas upstream of dams could increase the potential for dam failure and uncontrolled releases in Sutter County.

Vulnerability Assessment

Vulnerability—High

Dam failure flooding can occur as the result of a partial or complete collapse of an impoundment. Dam failures often result from prolonged rainfall and flooding. An earthquake event can also contribute to a dam failure. The primary danger associated with dam failure is the high velocity flooding of those properties downstream of the dam. A dam failure can range from a small, uncontrolled release to a catastrophic failure. Vulnerability to dam failures is confined to the areas subject to inundation downstream of the facility. Secondary losses would include loss of the multi-use functions of the facility and associated revenues that accompany those functions. Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding.

Impacts

Water released by a failed dam generates tremendous energy and can cause a flood that is catastrophic to life and property. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could result as well as potentially catastrophic effects to roads, bridges, and homes. Electric generating facilities and transmission lines could also be damaged

and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality and health concerns could also be an issue. Factors that influence the potential severity of a full or partial dam failure are the amount of water impounded; the density, type, and value of development and infrastructure located downstream; and the speed of failure.

A major dam failure could have a devastating impact on the Sutter County Planning Area. Dam failure flooding presents a threat to life and property, including buildings, their contents, and their use. Large flood events can affect crops and livestock as well as lifeline critical utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, and the local and regional economies.

Flooding, including that from dam failure, causes many impacts to agricultural production, including water contamination, damage to crops, loss of livestock, increased susceptibility of livestock to disease, flooded farm machinery, and environmental damage to and from agricultural chemicals.

Dams of Concern

As detailed in Table 4-31, the County is most vulnerable to the following 17 dams:

Extremely High Hazard

- Camp Far West
- Folsom
- Lake Almanor
- New Bullards Bar
- Oroville
- Rollins (Scenarios 1 and 2)
- Scotts Flat
- Thermalito Afterbay

High Hazard

- Bidwell Bar T
- Black Butte
- Combie
- Deer Creek Diversion
- Shasta
- Thermalito Diversion
- Thermalito Forebay
- Virginia Ranch
- Whiskeytown

Available dam inundation maps show areas that lie within the potential dam failure inundation areas, as shown in Figure 4-34.

Values at Risk

Dam inundation areas were available for the dams of concern, as obtained from CA DWR, DSOD, and Cal OES, were used as the basis of this dam inundation analysis. Dams were grouped by hazard rating in order to perform analysis. The depth of flooding due to the failure of these dams is unknown.

Methodology and Results

The same methodology was used for both the extremely high hazard and high hazard dam analysis. Sutter County's 2020 Parcel/Assessor Data, obtained from Sutter County, were used for the County inventory of parcels and values. GIS was used to for analysis on the parcel layer. The dam inundation areas, obtained from Cal OES and DSOD, were then overlaid on the parcel layer. For the purposes of this analysis, if the dam inundation layer intersected any part of the parcel, the entire parcel was considered to be in the dam inundation area. The parcels were segregated and analyzed in this fashion for the entirety of Sutter County. Once completed, the parcel boundary layer was joined to the centroid layer and values were transferred based on the identification number in the Assessors database and the GIS parcel layer.

Also, it is important to keep in mind that these assessed values may be well below the actual market value of improved parcels located within the dam inundation areas due primarily to Proposition 13 and to a lesser extent properties falling under the Williamson Act.

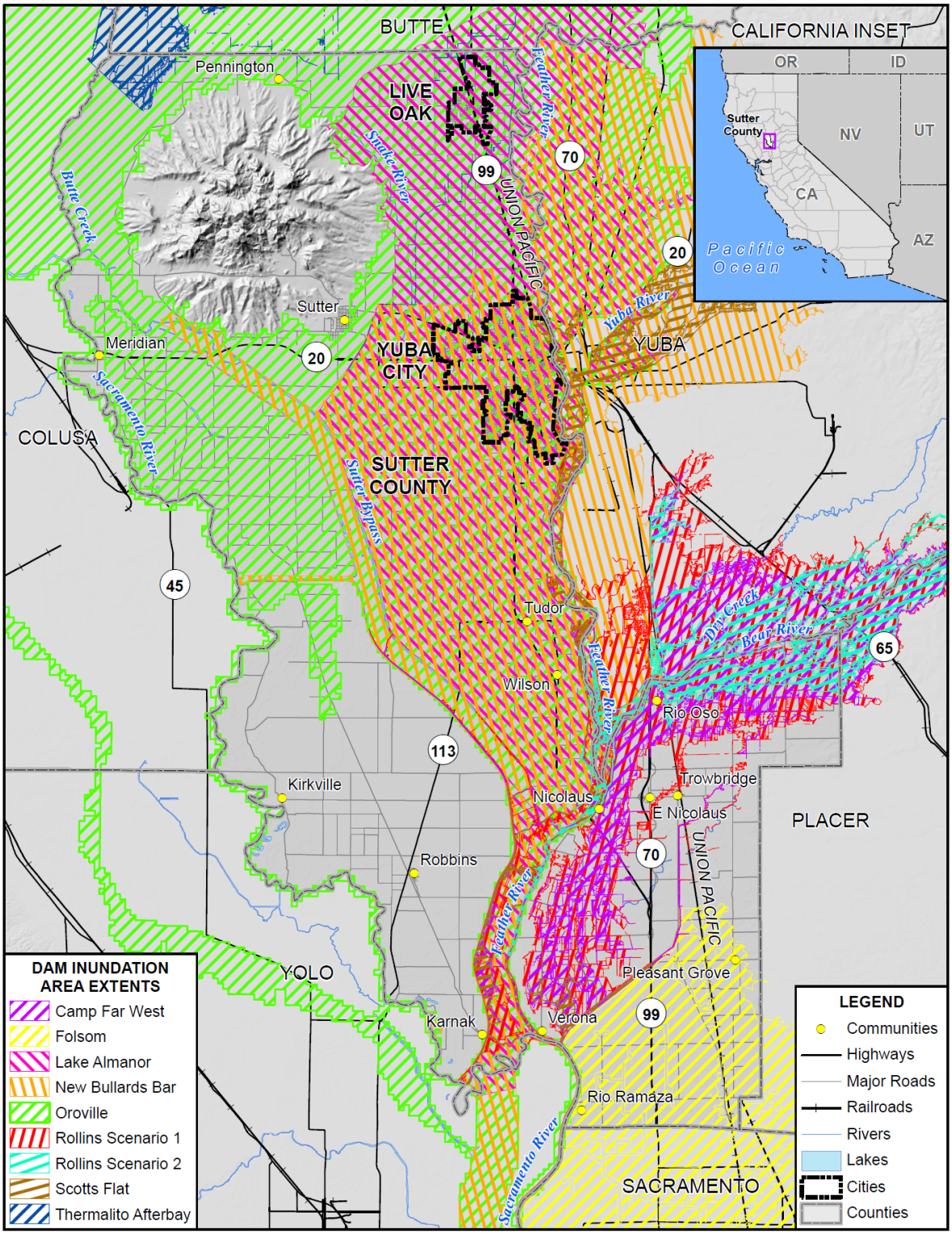
Extremely High Hazard Dams

Dam inundation analysis was performed for all 8 of the extremely high hazard dams of concern to the County. This includes Camp Far West, Folsom, Lake Almanor, New Bullards Bar, Oroville, Rollins (Scenarios 1 and 2), Scotts Flat, and Thermalito Afterbay. Figure 4-34 shows the extremely high dam inundation areas of these dams of concern for the County. The depth of flooding due to the failure of a dam is unknown. Table 4-33 the total parcel counts, improved parcel counts, their improved structure and land values in each extremely high hazard dam inundation areas in the Planning Area. Table 4-34 shows the property uses affected by each dam inundation area in unincorporated County. Tables showing the property uses affected by each dam inundation area for each jurisdiction in the County are shown in their respective annexes to this Plan Update.

For these tables it should be noted that:

- No dam/inundations originate within Sutter County.
- Point and Polygon tables will differ in the dam analysis because a dam is associated to an APN centroid at that point, whereas in the polygon, a dam touching the polygon is associated with the dam. If a centroid is in, then a polygon is in. If a centroid is not in the inundation area, there is the possibility that the polygon is. This is evident in the high dam Inundations and not in the extremely high inundations, specifically for Deer Creek Diversion and Virginia Ranch.
- Inundation cannot be summed as the inundations intersect in similar area coverage. By summing, duplication would occur.

Figure 4-34 Sutter County – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table 4-33 Sutter County Planning Area– Count and Value of Parcels in the Extremely High Hazard Dam Inundation Areas

Extremely High Dam Inundation Areas	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Camp Far West	535	403	$99,212,872	$55,571,505	$50,677,347	$205,461,724
Folsom	582	264	$154,395,828	$91,571,689	$113,210,550	$359,178,067
Lake Almanor	29,237	26,195	$2,583,287,488	$5,810,910,971	$3,886,904,584	$12,281,103,043
New Bullards Bar	25,175	22,875	$2,231,586,853	$5,254,674,674	$3,485,471,466	$10,971,732,993
Oroville	30,827	26,935	$2,912,973,728	$5,923,127,707	$3,985,730,076	$12,821,831,511
Rollins Scenario 1	762	550	$158,826,799	$73,671,274	$67,255,622	$299,753,695
Rollins Scenario 2	150	112	$25,847,228	$14,076,796	$12,961,454	$52,885,478
Scotts Flat	50	9	$7,233,241	$1,075,795	$1,075,795	$9,384,831
Thermalito Afterbay	15	7	$8,727,578	$1,778,512	$1,778,512	$12,284,602

Source: Sutter County 2020 Parcel/Assessor's Data, Cal OES

Table 4-34 Unincorporated Sutter County – Count and Value of Parcels in the Extremely High Hazard Dam Inundation Areas by Property Use

Extremely High Dam Inundation Areas/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Camp Far West						
Agricultural	395	322	$90,938,030	$37,798,914	$37,798,914	$166,535,858
Commercial	8	7	$1,289,538	$3,212,472	$3,212,472	$7,714,482
Industrial	3	3	$2,252,126	$2,372,977	$3,559,466	$8,184,569
Institutional	20	2	$180,667	$25,848	$25,848	$232,363
Miscellaneous	13	0	$0	$0	$0	$0
Residential	96	69	$4,552,511	$12,161,294	$6,080,647	$22,794,452
Camp Far West Total	**535**	**403**	**$99,212,872**	**$55,571,505**	**$50,677,347**	**$205,461,724**
Folsom						
Agricultural	359	199	$137,859,271	$28,811,905	$28,811,905	$195,483,081
Commercial	11	11	$2,718,622	$10,975,180	$10,975,180	$24,668,982
Industrial	13	12	$7,430,803	$47,421,959	$71,132,939	$125,985,701

Extremely High Dam Inundation Areas/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Institutional	125	4	$3,778,197	$218,408	$218,408	$4,215,013
Miscellaneous	11	0	$0	$0	$0	$0
Residential	63	38	$2,608,935	$4,144,237	$2,072,119	$8,825,291
Folsom Total	**582**	**264**	**$154,395,828**	**$91,571,689**	**$113,210,550**	**$359,178,067**
Lake Almanor						
Agricultural	3,192	2,203	$792,405,827	$357,497,352	$357,497,352	$1,507,400,531
Commercial	102	84	$19,806,153	$50,115,876	$50,115,876	$120,037,905
Industrial	95	60	$17,271,377	$54,008,734	$81,013,101	$152,293,212
Institutional	209	58	$16,229,232	$47,323,444	$47,323,444	$110,876,120
Miscellaneous	50	0	$0	$0	$0	$0
Residential	3,017	2,931	$158,134,519	$458,824,942	$229,412,471	$846,371,932
Lake Almanor Total	**6,665**	**5,336**	**$1,003,847,108**	**$967,770,348**	**$765,362,244**	**$2,736,979,700**
New Bullards Bar						
Agricultural	2,127	1,490	$578,537,699	$240,792,005	$240,792,005	$1,060,121,709
Commercial	89	72	$17,984,492	$48,041,190	$48,041,190	$114,066,872
Industrial	72	45	$12,474,506	$34,220,108	$51,330,162	$98,024,776
Institutional	269	50	$15,751,144	$36,146,295	$36,146,295	$88,043,734
Miscellaneous	53	0	$0	$0	$0	$0
Residential	2,755	2,697	$148,845,545	$430,932,955	$215,466,478	$795,244,978
New Bullards Bar Total	**5,365**	**4,354**	**$773,593,386**	**$790,132,553**	**$591,776,130**	**$2,155,502,069**
Oroville						
Agricultural	4,220	2,599	$1,087,891,423	$399,805,420	$399,805,420	$1,887,502,263
Commercial	141	121	$27,940,441	$58,983,815	$58,983,815	$145,908,071
Industrial	148	79	$20,735,094	$70,715,962	$106,073,943	$197,524,999
Institutional	341	65	$22,861,774	$48,167,228	$48,167,228	$119,196,230
Miscellaneous	80	0	$0	$0	$0	$0
Residential	3,325	3,212	$174,104,616	$502,314,659	$251,157,330	$927,576,605
Oroville Total	**8,255**	**6,076**	**$1,333,533,348**	**$1,079,987,084**	**$864,187,736**	**$3,277,708,168**
Rollins Scenario 1						
Agricultural	546	430	$148,565,518	$52,447,162	$52,447,162	$253,459,842
Commercial	11	10	$1,356,602	$3,277,702	$3,277,702	$7,912,006
Industrial	3	3	$2,252,126	$2,372,977	$3,559,466	$8,184,569
Institutional	45	8	$1,031,846	$369,151	$369,151	$1,770,148

Extremely High Dam Inundation Areas/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Miscellaneous	19	0	$0	$0	$0	$0
Residential	138	99	$5,620,707	$15,204,282	$7,602,141	$28,427,130
Rollins Scenario 1 Total	**762**	**550**	**$158,826,799**	**$73,671,274**	**$67,255,622**	**$299,753,695**
Rollins Scenario 2						
Agricultural	115	99	$24,895,126	$11,832,005	$11,832,005	$48,559,136
Commercial	**0**	0	$0	$0	$0	$0
Industrial	1	1	$6,793	$7,053	$10,580	$24,426
Institutional	4		$120,500	$0	$0	$120,500
Miscellaneous	10	0	$0	$0	$0	$0
Residential	20	12	$824,809	$2,237,738	$1,118,869	$4,181,416
Rollins Scenario 2 Total	**150**	**112**	**$25,847,228**	**$14,076,796**	**$12,961,454**	**$52,885,478**
Scotts Flat						
Agricultural	26	8	$5,596,211	$1,060,795	$1,060,795	$7,717,801
Commercial	**0**	0	$0	$0	$0	$0
Industrial	**0**	0	$0	$0	$0	$0
Institutional	17	**0**	$423,722	**$0**	**$0**	$423,722
Miscellaneous	5	0	$0	$0	$0	$0
Residential	**0**	0	$0	$0	$0	$0
Scotts Flat Total	**48**	**8**	**$6,019,933**	**$1,060,795**	**$1,060,795**	**$8,141,523**
Thermalito Afterbay						
Agricultural	11	6	$7,895,270	$1,711,368	$1,711,368	$11,318,006
Commercial	**0**	**0**	$0	$0	$0	$0
Industrial	**0**	**0**	$0	$0	$0	$0
Institutional	4	1	$832,308	$67,144	$67,144	$966,596
Miscellaneous	**0**	**0**	$0	$0	$0	$0
Residential	**0**	**0**	$0	$0	$0	$0
Thermalito Afterbay Total	**15**	**7**	**$8,727,578**	**$1,778,512**	**$1,778,512**	**$12,284,602**

Source: Sutter County 2020 Parcel/Assessor's Data, Cal OES

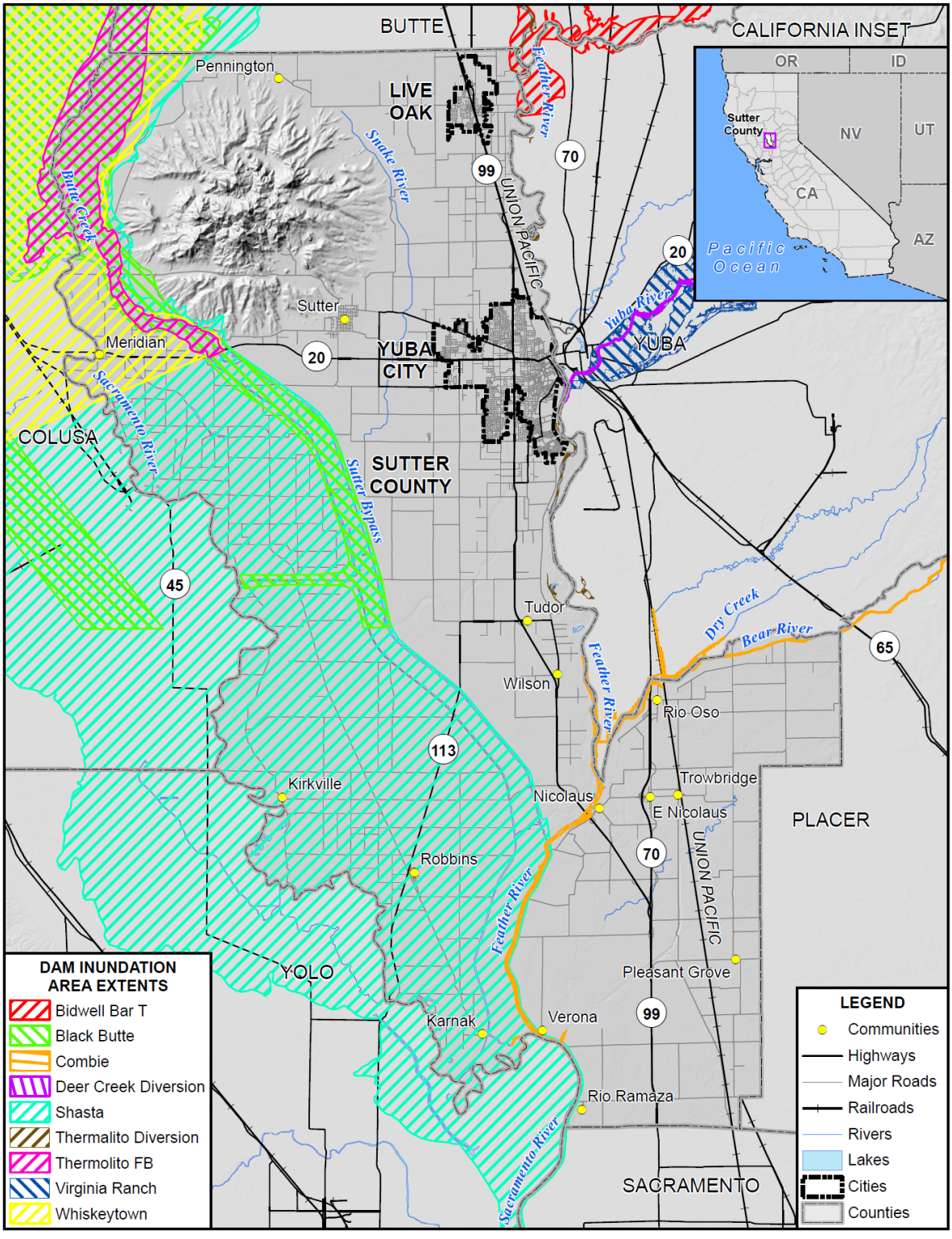
High Hazard Dams

Dam inundation analysis was performed for the 9 mapped high hazard dams that could affect the County. This includes Bidwell Bar T, Black Butte, Combie, Deer Creek Diversion, Shasta, Thermalito Diversion, Thermalito Forebay, Virginia Ranch, and Whiskeytown. Figure 4-35 shows the dam inundation areas of these dams of concern for the County. The depth of flooding due to the failure of a dam is unknown.

Table 4-35 the total parcel counts, improved parcel counts, their improved structure and land values in each high hazard dam inundation areas in the Sutter County Planning Area. Table 4-36 shows the property uses affected by each dam inundation area in unincorporated County. Tables showing the property uses affected by each dam inundation area for each jurisdiction in the County are shown in their respective annexes to this Plan Update. For these tables it should be noted that:

- No dam/inundations originate within Sutter County.
- Point and Polygon tables will differ in the dam analysis because a dam is associated to an APN centroid at that point, whereas in the polygon, a dam touching the polygon is associated with the dam. If a centroid is in, then a polygon is in. If a centroid is not in the inundation area, there is the possibility that the polygon is. This is evident in the high dam inundations and not in the extremely high, specifically for Deer Creek Diversion and Virginia Ranch.
- Inundation cannot be summed as the inundations intersect in similar area coverage. By summing, duplication would occur.

Figure 4-35 Sutter County – High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table 4-35 Sutter County Planning Area – Summary Count and Value of Parcels in the High Hazard Dam Inundation Areas

High Dam Inundation Areas	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Bidwell Bar T	8	5	$1,401,058	$282,283	$282,283	$1,965,624
Black Butte	245	58	$58,656,035	$9,403,918	$9,837,651	$77,897,604
Combie	1	0	$0	$0	$0	$0
Deer Creek Diversion	0	0	$0	$0	$0	$0
Shasta	2,283	852	$576,496,256	$122,857,007	$118,475,151	$817,828,414
Thermalito Diversion	6	1	$405,819	$4,300	$4,300	$414,419
Thermolito Forebay	66	14	$31,421,545	$3,232,298	$3,232,298	$37,886,141
Virginia Ranch	0	0	$0	$0	$0	$0
Whiskeytown	494	284	$85,416,147	$30,978,440	$27,531,815	$143,926,402

Source: Sutter County 2020 Parcel/Assessor's Data, Cal OES

Table 4-36 Unincorporated Sutter County – Count and Value of Parcels in the High Hazard Dam Inundation Areas by Property Use

High Dam Inundation Areas/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Bidwell Bar						
Agricultural	8	5	$1,401,058	$282,283	$282,283	$1,965,624
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
Bidwell Bar Total	**8**	**5**	**$1,401,058**	**$282,283**	**$282,283**	**$1,965,624**
Black Butte						
Agricultural	155	49	$53,215,353	$7,795,516	$7,795,516	$68,806,385
Commercial	0	0	$0	$0	$0	$0
Industrial	5	2	$13,570	$1,199,862	$1,799,793	$3,013,225
Institutional	60	2	$4,806,278	$76,144	$76,144	$4,958,566
Miscellaneous	19	0	$0	$0	$0	$0
Residential	6	5	$620,834	$332,396	$166,198	$1,119,428

High Dam Inundation Areas/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Black Butte Total	**245**	**58**	**$58,656,035**	**$9,403,918**	**$9,837,651**	**$77,897,604**
Combie						
Agricultural	**0**	0	$0	$0	$0	$0
Commercial	**0**	0	$0	$0	$0	$0
Industrial	**0**	0	$0	$0	$0	$0
Institutional	1	0	$0	$0	$0	$0
Miscellaneous	**0**	0	$0	$0	$0	$0
Residential	**0**	0	$0	$0	$0	$0
Combie Total	**1**	**0**	**$0**	**$0**	**$0**	**$0**
Deer Creek Diversion						
Agricultural	**0**	0	$0	$0	$0	$0
Commercial	**0**	0	$0	$0	$0	$0
Industrial	**0**	0	$0	$0	$0	$0
Institutional	1	**0**	$175,050	$0	$0	$175,050
Miscellaneous	**0**	0	$0	$0	$0	$0
Residential	**0**	0	$0	$0	$0	$0
Deer Creek Diversion Total	**1**	**0**	**$175,050**	**$0**	**$0**	**$175,050**
Shasta						
Agricultural	1,559	481	$541,990,495	$44,489,139	$44,489,139	$630,968,773
Commercial	48	42	$6,438,220	$8,001,974	$8,001,974	$22,442,168
Industrial	76	24	$4,606,428	$30,549,597	$45,824,396	$80,980,421
Institutional	191	12	$6,429,299	$502,988	$502,988	$7,435,275
Miscellaneous	75	**0**	$0	$0	$0	$0
Residential	334	293	$17,031,814	$39,313,309	$19,656,655	$76,001,778
Shasta Total	**2,283**	**852**	**$576,496,256**	**$122,857,007**	**$118,475,151**	**$817,828,414**
Thermalito Diversion						
Agricultural	3	1	$329,319	$4,300	$4,300	$337,919
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	3	0	$76,500	$0	$0	$76,500
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0

High Dam Inundation Areas/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Thermalito Diversion Total	**6**	**1**	**$405,819**	**$4,300**	**$4,300**	**$414,419**
Thermalito Forebay						
Agricultural	58	12	$26,640,257	$3,156,154	$3,156,154	$32,952,565
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	8	2	$4,781,288	$76,144	$76,144	$4,933,576
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
Thermalito Forebay Total	**66**	**14**	**$31,421,545**	**$3,232,298**	**$3,232,298**	**$37,886,141**
Virginia Ranch						
Agricultural	0	0	$0	$0	$0	$0
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
Virginia Total	**0**	**0**	**$0**	**$0**	**$0**	**$0**
Whiskeytown						
Agricultural	304	139	$73,737,120	$16,397,550	$16,397,550	$106,532,220
Commercial	14	13	$2,215,296	$1,008,653	$1,008,653	$4,232,602
Industrial	14	7	$480,985	$3,176,431	$4,764,647	$8,422,063
Institutional	26	9	$4,844,381	$326,125	$326,125	$5,496,631
Miscellaneous	7	0	$0	$0	$0	$0
Residential	129	116	$4,138,365	$10,069,681	$5,034,841	$19,242,887
Whiskeytown Total	**494**	**284**	**$85,416,147**	**$30,978,440**	**$27,531,815**	**$143,926,402**

Source: Sutter County 2020 Parcel/Assessor's Data, Cal OES

Dam Inundation - Flooded Acres

In addition to the centroid analysis used to obtain numbers of parcels and values at risk to the dam failure hazard, parcel boundary analysis was performed to obtain total acres and flooded acres by dam inundation area. The following is an analysis of inundated or flooded acres associated with dam failures and inundation areas in the County.

Methodology

GIS was used to calculate acres flooded by each Cal OES and DWR DSOD dam inundation area. The parcel layer was intersected with the dam inundation area data to obtain the acres inundated by dam. The Sutter County parcel layer and inundation areas were intersected, and each segment divided by the intersection of inundation area and parcels was calculated for acres.

Limitations

One limitation created by this type of analysis is that with respect to the improved acres analysis, improvements are uniformly found throughout the parcel, while in reality, only portions of the parcel are improved, and improvements may or may not fall within the inundated portion of a parcel; thus, areas of improvements inundated, calculated through this method, may be higher or lower than those actually seen in a similar real-world event.

Analysis Results

The following tables represent a summary and detailed analysis of total acres for each dam inundation area in the Planning Area. Table 4-37 shows the flooded acres of the Sutter County Planning Area in the inundation areas of each extremely high hazard dam. Table 4-38 shows the flooded acres of the Sutter County Planning Area in the inundation areas of each high hazard dam

Table 4-37 Sutter County – Flooded Acres from Extremely High Hazard Dams

Extremely High Dam Inundation Areas	Jurisdiction	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Camp Far West	Unincorporated Sutter County	15,411.00	3.9562%	12,603.78	3.24%	2,807.23	0.7206%
Folsom	Unincorporated Sutter County	22,605.89	5.8031%	12,112.25	3.11%	10,493.64	2.6938%
Lake Almanor	City of Live Oak	1,828.46	0.4694%	1,037.26	0.27%	791.20	0.2031%
Lake Almanor	City of Yuba City	8,043.90	2.0649%	6,660.11	1.71%	1,383.79	0.3552%
Lake Almanor	Unincorporated Sutter County	111,345.85	28.5835%	69,252.53	17.78%	42,093.33	10.8058%
New Bullards Bar	City of Yuba City	7,995.95	2.0526%	6,641.25	1.70%	1,354.70	0.3478%
New Bullards Bar	Unincorporated Sutter County	91,725.45	23.5468%	52,415.35	13.46%	39,310.10	10.0913%
Oroville	City of Live Oak	1,828.46	0.4694%	1,037.26	0.27%	791.20	0.2031%
Oroville	City of Yuba City	8,043.90	2.0649%	6,660.11	1.71%	1,383.79	0.3552%

Extremely High Dam Inundation Areas	Jurisdiction	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Oroville	Unincorporated Sutter County	187,146.79	48.0424%	100,867.26	25.89%	86,279.53	22.1488%
Rollins Scenario 1	Unincorporated Sutter County	28,847.78	7.4055%	21,338.47	5.48%	7,509.32	1.9277%
Rollins Scenario 2	Unincorporated Sutter County	3,446.67	0.8848%	2,856.97	0.73%	589.70	0.1514%
Scotts Flat	City of Yuba City	90.73	0.0233%	86.63	0.02%	4.11	0.0011%
Scotts Flat	Unincorporated Sutter County	2,042.17	0.5242%	441.82	0.11%	1,600.35	0.4108%
Thermalito Afterbay	Unincorporated Sutter County	1,570.65	0.4032%	1,130.15	0.29%	440.51	0.1131%

Source: Cal OES

Table 4-38 Sutter County – Flooded Acres from High Hazard Dams

Extremely High Dam Inundation Areas	Jurisdiction	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Bidwell Bar T	Unincorporated Sutter County	293.11	0.0752%	218.47	0.06%	74.64	0.0192%
Black Butte	Unincorporated Sutter County	20,631.65	5.2963%	5,808.02	1.49%	14,823.63	3.8054%
Combie	Unincorporated Sutter County	1.42	0.0004%			1.42	0.0004%
Deer Creek Diversion	Unincorporated Sutter County	0.77	0.0002%			0.77	0.0002%
Deer Creek Diversion	City of Yuba City	0.40	0.0001%			0.40	0.0001%
Shasta	Unincorporated Sutter County	136,939.59	35.1537%	42,169.56	10.83%	94,770.03	24.3284%
Thermalito Diversion	City of Yuba City	2.81	0.0007%	1.95	0.00%	0.86	0.0002%
Thermalito Diversion	Unincorporated Sutter County	56.34	0.0145%	23.89	0.01%	32.45	0.0083%
Thermolito Forebay	Unincorporated Sutter County	9,295.41	2.3862%	3,125.78	0.80%	6,169.62	1.5838%
Virginia Ranch	City of Yuba City	0.75	0.0002%			0.75	0.0002%
Whiskeytown	Unincorporated Sutter County	19,619.31	5.0365%	9,656.89	2.48%	9,962.42	2.5574%

Source: Cal OES

Population at Risk

A separate analysis was performed to determine population in dam inundation areas for identified dams of concern. Using GIS, the dam inundation area dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect an inundation area were counted and multiplied by the Census Bureau average household size for Sutter County and its jurisdictions. Table 4-39 shows the populations at risk to dam failure flooding for extremely high hazard dams. It is unlikely that all dams that could affect Sutter County would fail at the same time.

Table 4-39 Sutter County Planning Area – Residential Population at Risk in Extremely High Hazard Dam Inundation Area

	City of Live Oak		City of Yuba City		Unincorporated Sutter County	
Dam	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Camp Far West	0	0	0	0	69	201
Folsom	0	0	0	0	38	111
Lake Almanor	2,188	5,667	17,115	51,174	2,931	8,529
New Bullards Bar	0	0	17,113	51,169	2,697	7,848
Oroville	2,188	5,667	17,115	51,174	3,212	9,347
Rollins (Scenario 1)	0	0	0	0	99	288
Rollins (Scenario 2)	0	0	0	0	12	36
Scotts Flat	0	0	0	0	0	0
Thermalito Afterbay	0	0	0	0	0	0

Source: Cal OES Dam Inundation Data, US Census Bureau Average Household Sizes: City of Live Oak (2.59); City of Yuba City (2.99); unincorporated Sutter County (2.91)

Table 4-40 shows the populations at risk to dam failure flooding for high hazard dams. It is unlikely that all dams that could affect Sutter County would fail at the same time.

Table 4-40 Sutter County Planning Area – Residential Population at Risk in High Hazard Dam Inundation Area

	City of Live Oak		City of Yuba City		Unincorporated Sutter County	
Dam	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Bidwell Bar T	0	0	0	0	0	0
Black Butte	0	0	0	0	5	15
Combie	0	0	0	0	0	0
Deer Creek Diversion	0	0	0	0	0	0

Dam	City of Live Oak		City of Yuba City		Unincorporated Sutter County	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Shasta	0	0	0	0	293	853
Thermalito Diversion	0	0	0	0	0	0
Thermalito Forebay	0	0	0	0	0	0
Virginia Ranch	0	0	0	0	0	0
Whiskeytown	0	0	0	0	116	338

Source: Cal OES Dam Inundation Data, US Census Bureau Average Household Sizes: City of Live Oak (2.59); City of Yuba City (2.99); unincorporated Sutter County (2.91)

Critical Facilities at Risk

INSERT

Overall Community Impact

Dam failure floods and their impacts vary by location and severity of any given dam failure event and will likely only directly affect certain areas of the Sutter County Planning Area during specific times. Based on the risk assessment, it is evident that dam failure floods have the potential for devastating life safety, property, environmental, and economic impacts to certain areas of the County. Impacts that are not always quantified, but can be anticipated in a large dam failure event, include:

- Injury and loss of life;
- Impacts to agricultural;
- Commercial and residential structural and property damage;
- Disruption of and damage to critical infrastructure and services;
- Health hazards associated with mold and mildew, contamination of drinking water, etc.;
- Damage to roads/bridges resulting in loss of mobility;
- Significant economic impact (jobs, sales, tax revenue) to the community;
- Negative impact on commercial and residential property values; and
- Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.
- Impact on the overall mental health of the community.

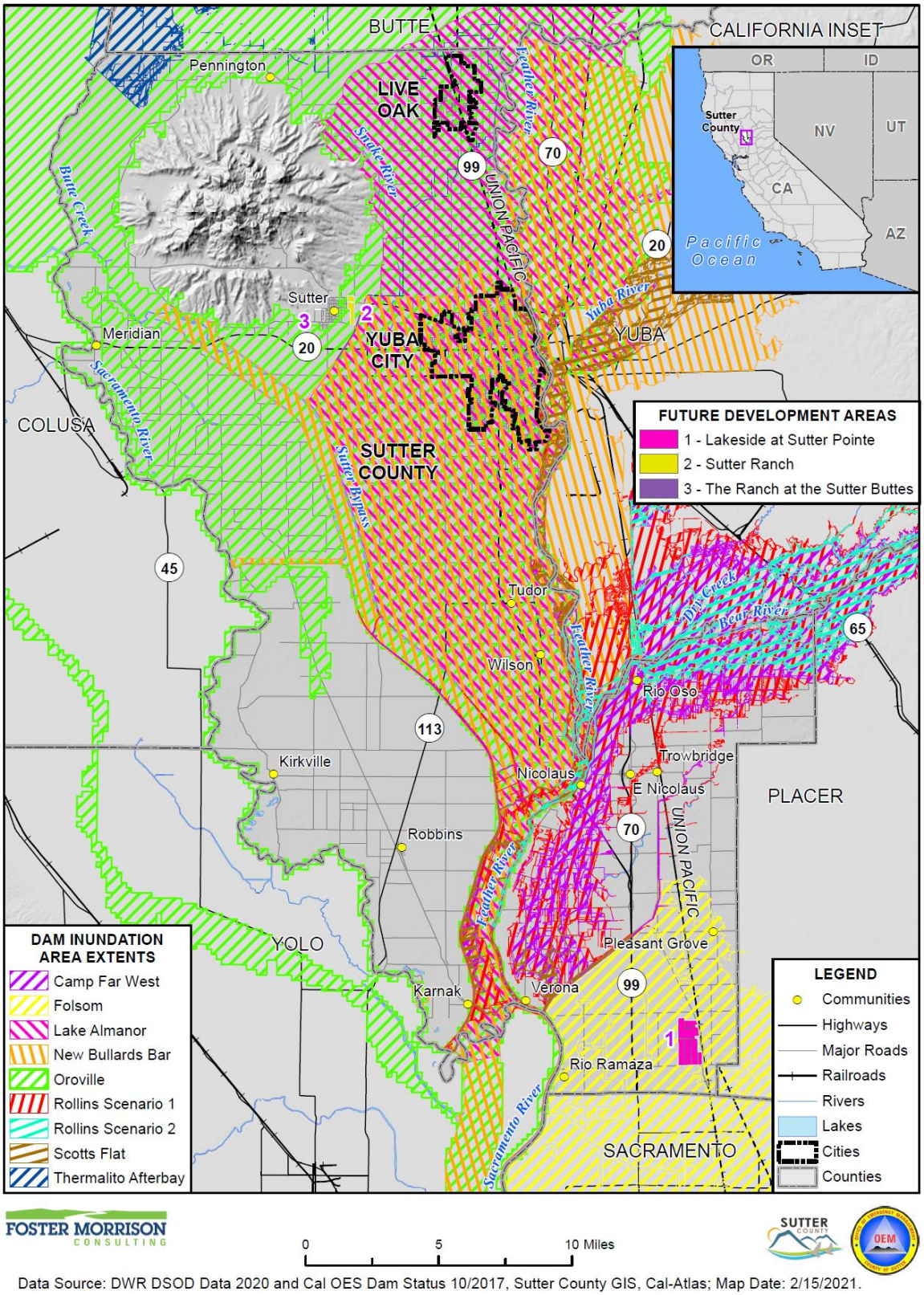
Future Development

Although new growth and development corridors would fall in the area flooded by a dam failure, given the limited potential of total dam failure and the large area that a dam failure would affect, development in the dam inundation area will continue to occur.

Future Development GIS Analysis

In order to ascertain if future development areas fall in dam inundation areas, a GIS analysis was performed. Using GIS, the following methodology was used in determining parcel counts and values associated with future development in the unincorporated Sutter County Planning Area. Sutter County's 2020 Parcel/Assessor's data and data from the County planning department were used as the basis for the unincorporated County's inventory of parcels and acres of future development areas. Using the GIS parcel spatial file and the APNs, the three future development projects were mapped, and overlayed on the Cal OES and DSOD dam inundation areas. This can be seen on Figure 4-36 and detailed in Table 4-41 for extremely high hazard dam inundation areas. It should be note that no high hazard dam inundation areas intersect the future development areas. As such, no maps or tabular analysis are presented here. Maps of future development and dam inundation areas in Live Oak and Yuba City are presented in their respective annexes to this Plan Update.

Figure 4-36 Unincorporated Sutter County – Future Development in Extremely High Hazard Dam Inundation Areas



FOSTER MORRISON CONSULTING

Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table 4-41 Unincorporated Sutter County – Future Development Parcels and Acres in Extremely High Hazard Dam Inundation Areas

Dam Inundation Area/ Future Development	Total Parcel Count	Improved Parcel Count	Total Acres
Folsom Dam Inundation Area			
Lakeside at Sutter Pointe	4	3	659.7
Unincorporated Sutter County Total	**4**	**3**	**659.7**
Oroville Dam Inundation Area			
Sutter Ranch	2	1	137.4
Unincorporated Sutter County Total	**2**	**1**	**137.4**

Source: Cal OES, DSOD, Sutter County GIS

4.3.8. Drought and Water Shortage

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard. NEED REGIONAL WATER MANAGEMENT PLAN WHEN DONE EARLY IN 2021. WILL ADD HERE.

Hazard/Problem Description

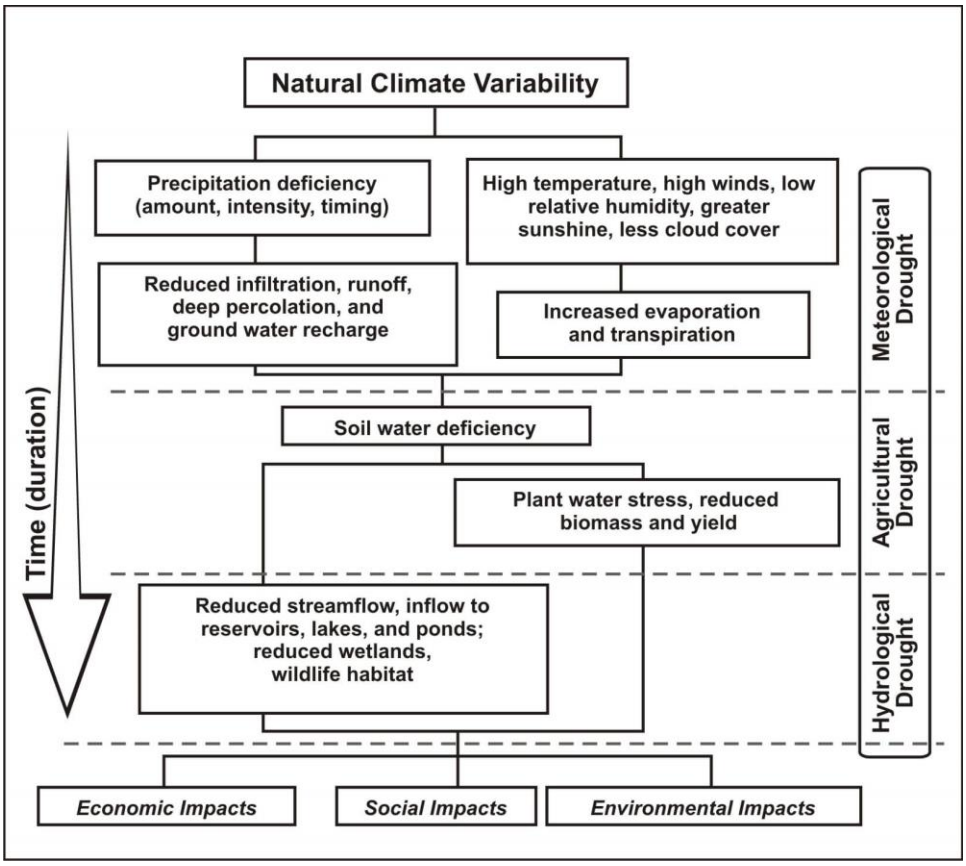
Drought

Drought is a gradual phenomenon. Although droughts are sometimes characterized as emergencies, they differ from typical emergency events. Most natural disasters, such as floods or forest fires, occur relatively rapidly and afford little time for preparing for disaster response. Droughts occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Water districts normally require at least a 10-year planning horizon to implement a multiagency improvement project to mitigate the effects of a drought and water supply shortage.

Drought is a complex issue involving (see Figure 4-37) many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects:

- **Meteorological drought** is usually defined by a period of below average water supply.
- **Agricultural drought** occurs when there is an inadequate water supply to meet the needs of the state's crops and other agricultural operations such as livestock.
- **Hydrological drought** is defined as deficiencies in surface and subsurface water supplies. It is generally measured as streamflow, snowpack, and as lake, reservoir, and groundwater levels.
- **Socioeconomic drought** occurs when a drought impacts health, well-being, and quality of life, or when a drought starts to have an adverse economic impact on a region.

Figure 4-37 Causes and Impact of Drought



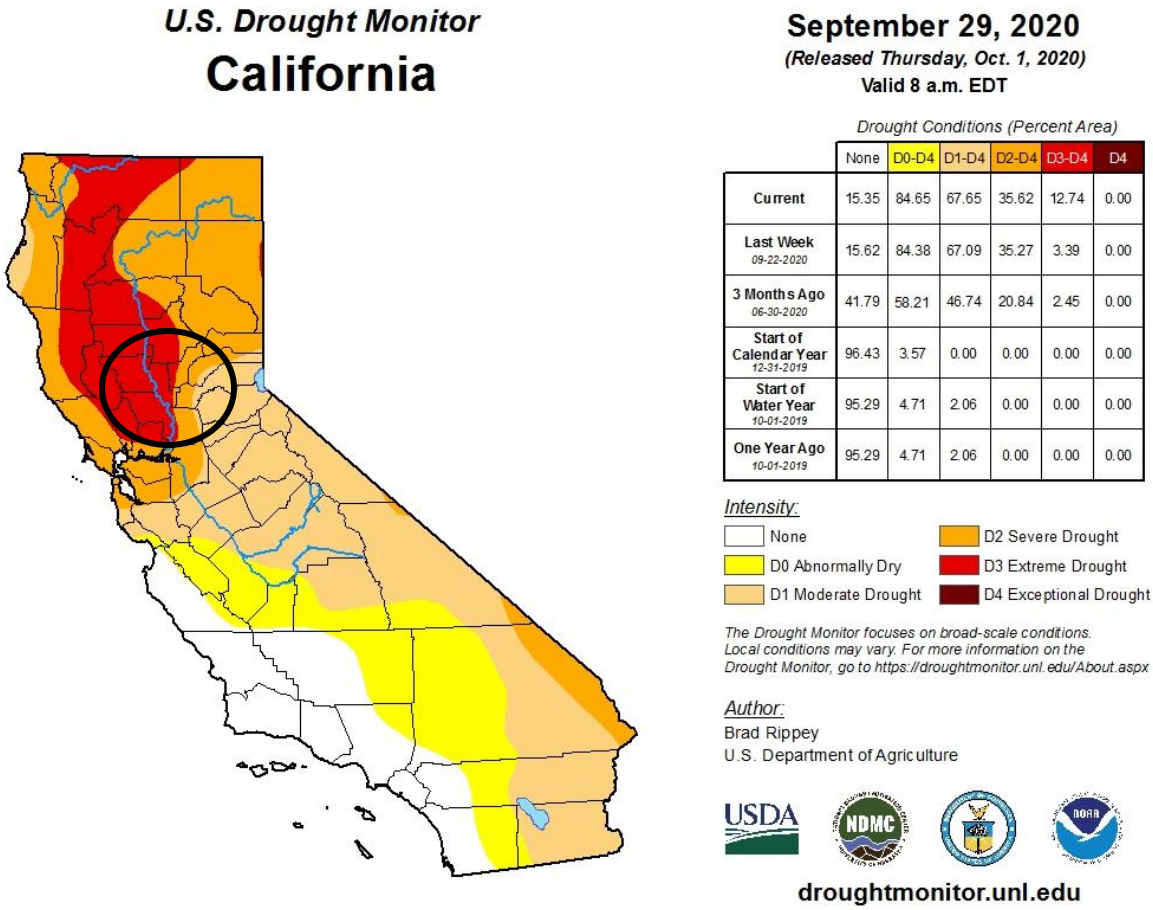
Source: National Drought Mitigation Center (NDMC)

The HMPC noted that drought can cause increased wildfire risk, discussed in Section 4.3.14. During periods of drought, subsidence can also occur.

Location and Extent

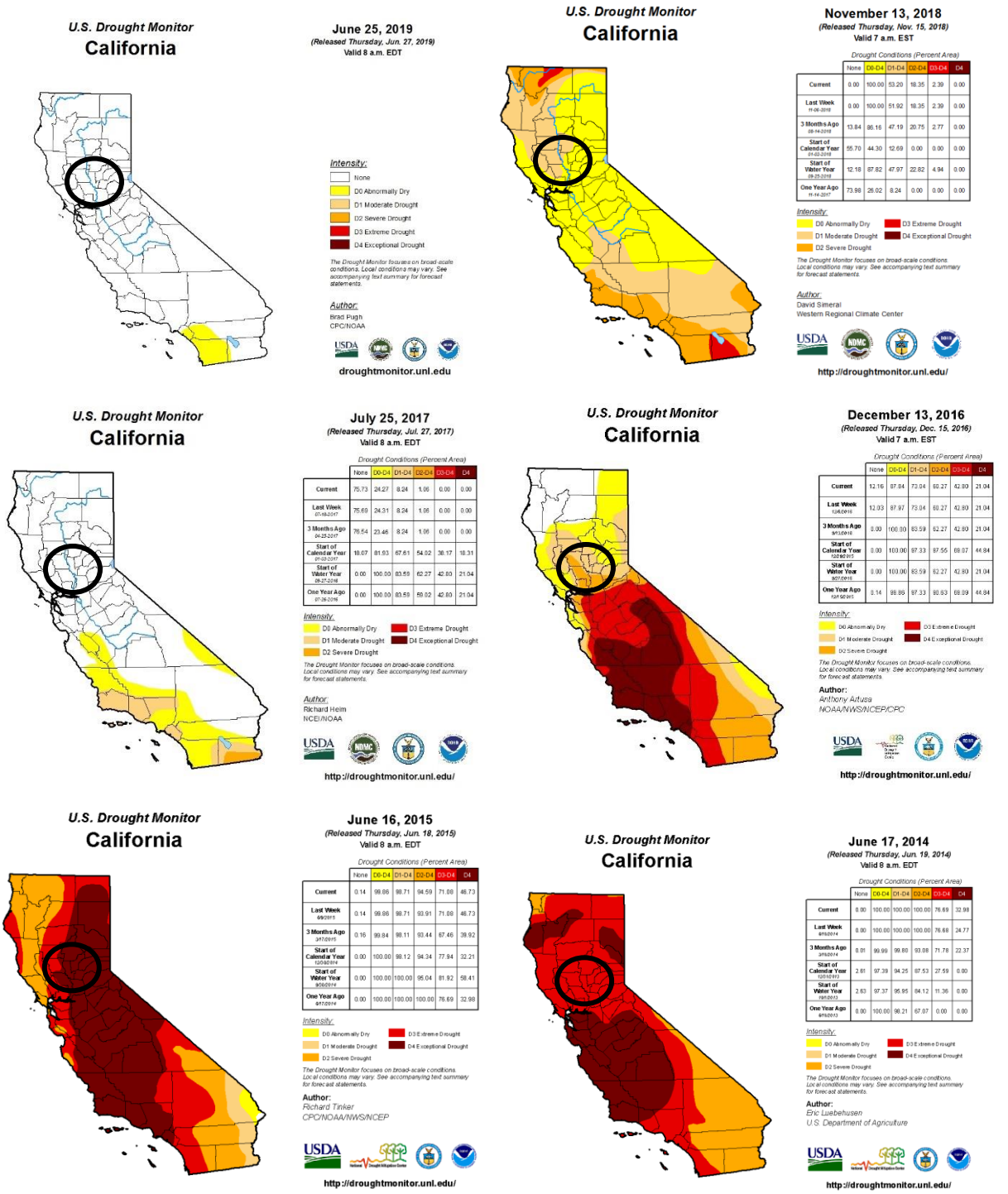
Since drought is a regional phenomenon, it affects the whole of the County. Speed of onset of drought is slow, while the duration varies from short (months) to long (years) Drought in the United States is monitored by the National Integrated Drought Information System (NIDIS). A major component of this portal is the U.S. Drought Monitor. The Drought Monitor concept was developed jointly by the NOAA's Climate Prediction Center, the NDMC, and the USDA's Joint Agricultural Weather Facility in the late 1990s as a process that synthesizes multiple indices, outlooks and local impacts, into an assessment that best represents current drought conditions. The final outcome of each Drought Monitor is a consensus of federal, state, and academic scientists who are intimately familiar with the conditions in their respective regions. A snapshot of the drought conditions in California and Sutter County (2020) can be found in Figure 4-38. Snapshots from 2014 through 2019 is shown in Figure 4-39.

Figure 4-38 Sutter County – Current Drought Status



Source: US Drought Monitor

Figure 4-39 Previous Drought Status in Sutter County



Source: US Drought Monitor

CA DWR says the following about drought:

One dry year does not normally constitute a drought in California. California's extensive system of water supply infrastructure—its reservoirs, groundwater basins, and inter-regional conveyance facilities—mitigates the effect of short-term dry periods for most water users. Defining when a drought begins is a function of drought impacts to water users. Hydrologic conditions constituting a drought for water users in one location may not constitute a drought for water users elsewhere, or for water users having a different water supply. Individual water suppliers may use criteria such as rainfall/runoff, amount of water in storage, or expected supply from a water wholesaler to define their water supply conditions.

The drought issue in California is further compounded by water rights. Water is a commodity possessed under a variety of legal doctrines. The prioritization of water rights between farming and federally protected fish habitats in California contributes to this issue.

As shown on the previous figures, drought is tracked by the US Drought Monitor. The Drought Monitor includes a scale to measure drought intensity:

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)

Water Shortage

Northern Sacramento Valley counties, including Sutter County, generally have sufficient groundwater and surface water supplies to mitigate even the severest droughts of the past century. Many other areas of the State, however, also place demands on these water resources during severe drought. For example, Northern California agencies, including those from Sutter County, were major participants in the Governor's Drought Water Bank of 1991, 1992 and 1994. Water supply has not been significant issues in Sutter County in years past due to the extensive surface and groundwater supplies in the region; the County's senior water rights; and their ability to maximize water resources through conjunctive use.

Location and Extent

Since water shortage happens on a regional scale, the entirety of the County is at risk. There is no established scientific scale to measure water shortage. The speed of onset of water shortage tends to be lengthy. The duration of water shortage can vary, depending on the severity of the drought that accompanies it.

Past Occurrences

Disaster Declaration History

There has been one federal disaster related to drought and water shortage in Sutter County issued in 1976. There have been two state disasters related to drought and water shortage in Sutter County issued in 1976 and 2014. This can be seen in Table 4-42.

Table 4-42 Sutter County – Disaster Declarations from Drought 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Drought	2	1976, 2014	1	1976

Source: FEMA, Cal OES

Another database of disaster declarations comes from the USDA. This database shows agricultural disasters that result from natural hazards like drought. This database was searched from 2012 to 2020, and the results for drought for Sutter County are shown on Table 4-44.

Table 4-43 Sutter County – USDA Disaster Declarations 2012-2020

Year	Declaration Number	Primary or Contiguous County	Disaster Type
2012	S3268	Primary	Drought-FAST TRACK
2012	S3379	Primary	Drought
2012	S3452	Primary	Drought
2013	S3569	Primary	Drought-FAST TRACK
2014	S3626	Contiguous	Drought-FAST TRACK
2014	S3637	Primary	Drought-FAST TRACK
2014	S3743	Contiguous	Drought
2014	S3797	Primary	Drought
2015	S3784	Primary	Drought-FAST TRACK
2016	S3952	Primary	Drought-FAST TRACK
2017	S4163	Contiguous	Drought-FAST TRACK
2020	S4691	Contiguous	Drought-FAST TRACK
2020	S4697	Primary	Drought-FAST TRACK

Source: USDA

NCDC Events

There have been 29 NCDC drought events in Sutter County, related to events in the 2014 to 2016 drought. No deaths, injuries, or property damages were reported to the NCDC from these events.

*Table 4-44 NCDC Drought Events for Sutter County 1996-4/30/2020**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Drought	29	0	0	0	0	$0	$0

Source: NCDC

*Note: Losses reflect totals for all impacted areas, some of which fell outside of Sutter County

CA DWR and Hazard Mitigation Planning Committee Events

Historically, California has experienced multiple severe droughts. According to the DWR, droughts exceeding three years are relatively rare in Northern California, the source of much of the State's developed water supply. The 1929-34 drought established the criteria commonly used in designing storage capacity and yield of large northern California reservoirs. Table 4-45 compares the 1929-34 drought in the Sacramento and San Joaquin Valleys to the 1976-77, 1987-92, and 2007-09 droughts. Figure 4-40 depicts California's Multi-Year Historical Dry Periods, 1850-2000.

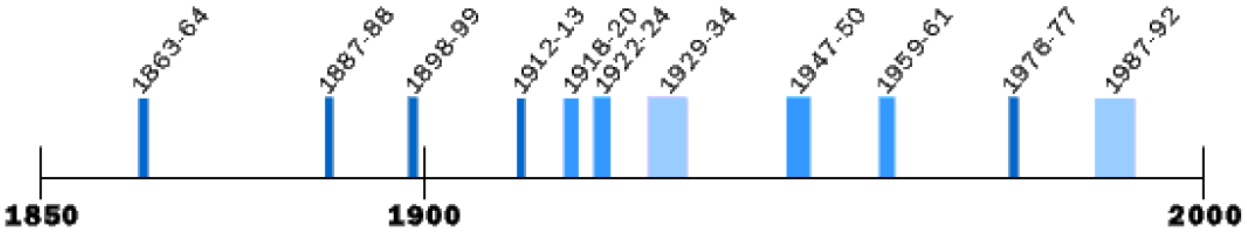
Table 4-45 Severity of Extreme Droughts in the Sacramento and San Joaquin Valleys

Drought Period	Sacramento Valley Runoff		San Joaquin Valley Runoff	
	(maf*/yr)	(percent Average 1901-96)	(maf*/yr)	(percent Average 1906-96)
1929-34	9.8	55	3.3	57
1976-77	6.6	37	1.5	26
1987-92	10.0	56	2.8	47
2007-09	11.2	64	3.7	61

Source: California's Drought of 2007-2009, An Overview. State of California Natural Resources Agency, California Department of Water Resources.

*maf=million acre feet

Figure 4-40 California's Multi-Year Historical Dry Periods, 1850-2000

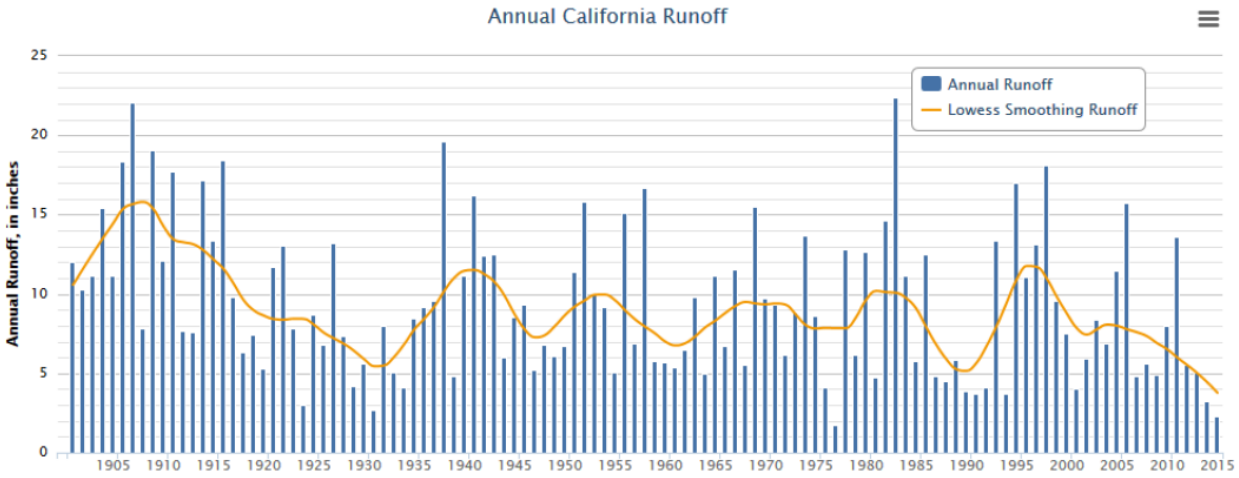


Source: California Department of Water Resources, www.water.ca.gov/

Notes: Dry periods prior to 1900 estimated from limited data; covers dry periods of statewide or major regional extent

Figure 4-41 depicts runoff for the State from 1900 to 2015. This gives a historical context for the 2014-2015 drought to compare against past droughts.

Figure 4-41 Annual California Runoff –1900 to 2015



Source: California DWR

The 2018 California State Hazard Mitigation Plan fleshed out the major droughts from 1900 to 2017. This discussion below appends to the tables and figures above.

The 1975-1977 Drought

From November 1975 through November 1977, California experienced one of its most severe droughts. Although people in many areas of the state are accustomed to very little precipitation during the growing season (April to October), they expect it in the winter. In 1976 and 1977, the winters brought only one-half and one-third of normal precipitation, respectively. Most surface storage reservoirs were substantially drained in 1976, leading to widespread water shortages when 1977 turned out to be even drier. 31 counties were affected, resulting in $2.67 billion in crop damages.

The 1987-1992 Drought

From 1987 to 1992, California again experienced a serious drought due to low precipitation and run-off levels. The hardest-hit region was the Central Coast, roughly from San Jose to Ventura. In 1988, 45 California counties experienced water shortages that adversely affected about 30 percent of the state's population, much of the dry-farmed agriculture, and over 40 percent of the irrigated agriculture. Fish and wildlife resources suffered, recreational use of lakes and rivers decreased, forestry losses and fires increased, and hydroelectric power production decreased. In February 1991, DWR and Cal OES surveyed drought conditions in all 58 California counties and found five main problems: extremely dry rangeland, irrigated agriculture with severe surface water shortages and falling groundwater levels, widespread rural areas where individual and community supplies were going dry, urban area water rationing at 25 to 50 percent of normal usage, and environmental impacts.

Storage in major reservoirs had dropped to 54 percent of average, the lowest since 1977. The shortages led to stringent water rationing and severe cutbacks in agricultural production, including threats to survival of permanent crops such as trees and vines. Fish and wildlife resources were in critical shape as well. Not since the 1928-1934 drought had there been such a prolonged dry period. In response to those conditions,

the Governor established the Drought Action Team. This team almost immediately created an emergency drought water bank to develop a supply for four critical needs: municipal and industrial uses, agricultural uses, protection of fish and wildlife, and carryover storage for 1992. The large-scale transfer program, which involved over 800,000 acre-feet of water, was implemented in less than 100 days with the help and commitment of the entire water community and established important links between state agencies, local water interests, and local governments for future programs.

The 2007-2009 Drought

Water years 2007-2009 were collectively the 15th driest three-year period for DWR's eight-station precipitation index, which is a rough indicator of potential water supply availability to the State Water Project (SWP) and Central Valley Project (CVP). Water year 2007 was the driest single year of that drought, and fell within the top 20 percent of dry years based on computed statewide runoff. In June 2008, a state emergency proclamation was issued due to water shortage in selected Central Valley counties. In February 2009, for the first time in its history, the State of California proclaimed a statewide drought. The state placed unprecedented restrictions on CVP and SWP diversions from the Delta to protect listed fish species, a regulatory circumstance that exacerbated the impacts of the drought for water users.

The greatest impacts of the 2007–2009 drought were observed in the CVP service area on the west side of the San Joaquin Valley, where hydrologic conditions combined with reduced CVP exports resulted in substantially reduced water supplies (50 percent supplies in 2007, 40 percent in 2008, and 10 percent in 2009) for CVP south-of Delta agricultural contractors. Small communities on the west side highly dependent on agricultural employment were especially affected by land fallowing due to lack of irrigation supplies, as well as by factors associated with current economic recession. The coupling of the drought and economic recession necessitated emergency response actions related to social services, such as food banks and unemployment assistance.

The 2012-2017 Drought

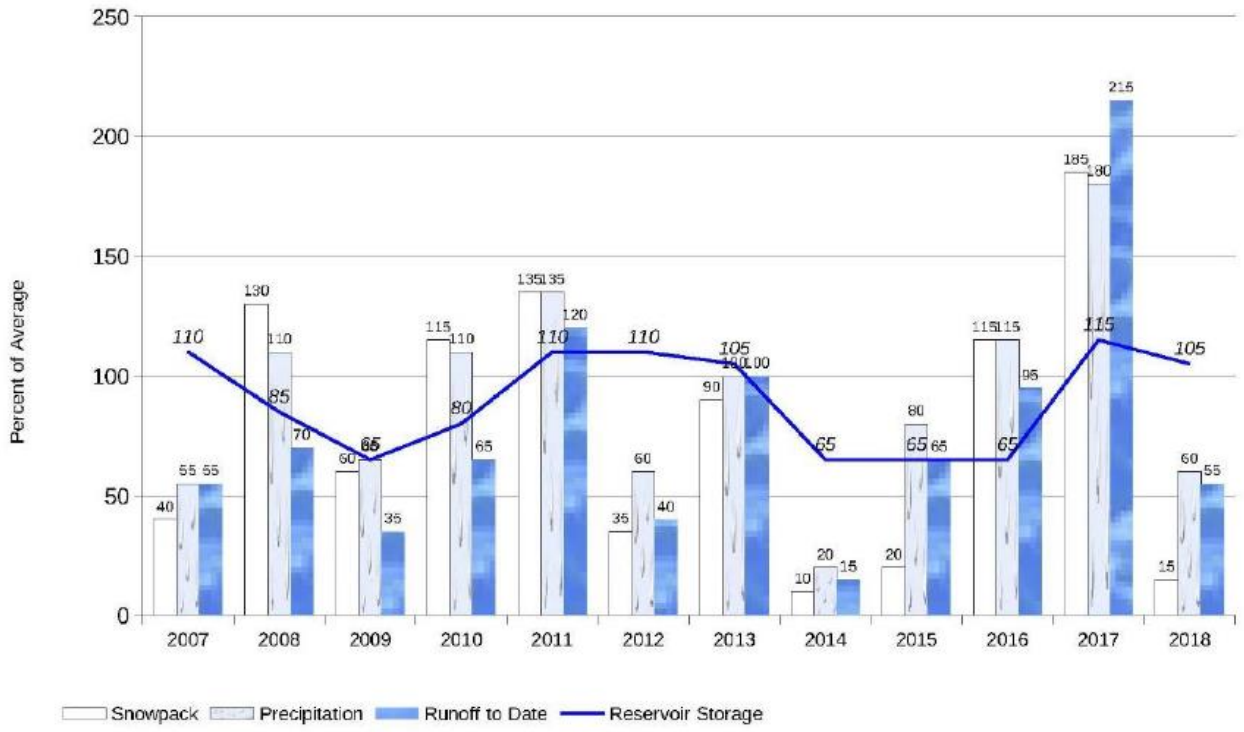
The statewide drought of 2012-2017 will be remembered as one of the most severe and costliest droughts of record in California. The drought that spanned water years 2012 through 2017 included the driest four-year statewide precipitation on record (2012-2015) and the smallest Sierra-Cascades snowpack on record (2015, with 5 percent of average). It was marked by extraordinary heat: 2014, 2015, and 2016 were (at the time) California's first, second, and third warmest years in terms of statewide average temperatures. By the time the drought was declared officially over in April 2017, the state had expended $6.6 billion in drought response and mitigation programs, and had been declared a federal disaster area. The immediate cause of California's 2014 drought can be traced to the altered route of atmospheric water vapor, which is necessary for strong winter precipitation in the state. Ordinarily, water evaporates from the ocean in the warm Tropical Pacific Ocean and winds carry that water vapor to the U.S. west coast. However, in 2014 the water vapor transport split into two branches and ended up going either north or south of California. In March of 2015, Yuba City noted that there was a possibility that water demand may exceed supply. The City's Public Works Director spelled out the City's options to the Yuba City City Council and recommended the City continue to implement mandatory water use restrictions for the rest of the year. At that time, the worst case scenario showed that demand could exceed supply by an estimated 1,000 acre-feet. Conservation measures were put into place in the City and the County which reduced use by 28 to 35

percent. The HMPC noted that RD 1500 had only 25% of water availability during the deepest periods of this drought. Companies with junior water rights in the County were affected greatly, with some water companies in the County having their supplies completely curtailed.

Water Shortage

Figure 4-42 illustrates several indicators commonly used to evaluate water conditions in California. The percent of average values are determined by measurements made in each of the ten major hydrologic regions. The chart describes water conditions in California between 2007 and 2018. The chart illustrates the cyclical nature of weather patterns in California.

Figure 4-42 Water Supply Conditions, 2007 to 2018



Source: 2018 State of California Hazard Mitigation Plan

Beginning in 2012, snowpack levels in California dropped dramatically. 2015 estimates placed snowpack as 5 percent of normal levels. Snowpack measurements have been kept in California since 1950 and nothing in the historic record comes close to 2015's severely depleted level. The previous record for the lowest snowpack level in California, 25 percent of normal, was set both in 1976-77 and 2013-2014. In "normal" years, the snowpack supplies about 30 percent of California's water needs, according to the California Department of Water Resources. Snowpack levels began to increase in 2016, and in 2017 snowpack increased to the largest in 22 years, according to the State Department of Water Resources. In late 2017 and early 2018, drought conditions began to return to California but were dampened by periods of above average rainfall in the first part of 2019. Sutter County has been in and out of drought conditions since 2019.

Likelihood of Future Occurrence

Drought

Likely—Historical drought data for the Sutter County Planning Area and region indicate there have been 5 significant droughts in the last 85 years. This equates to a drought every 17 years on average or a 5.9 percent chance of a drought in any given year. However, based on this data and given the multi-year length and cyclical nature of droughts, the HMPC determined that future drought occurrences in the Planning Area are likely.

Water Shortage

Occasional — Recent historical data for water shortage indicates that Sutter County may at some time be at risk to both short and prolonged periods of water shortage. Based on this it is possible that water shortages will affect the County in the future during extreme drought conditions. Water supply has not been significant issues in Sutter County in years past due to the extensive surface and groundwater supplies in the region; the County's senior water rights; and their ability to maximize water resources through conjunctive use.

Climate Change and Drought and Water Shortage

Climate scientists studying California find that drought conditions are likely to become more frequent and persistent over the 21st century due to climate change. The experiences of California during recent years underscore the need to examine more closely the state's water storage, distribution, management, conservation, and use policies. The 2014 CAS stresses the need for public policy development addressing long term climate change impacts on water supplies. The CAS notes that climate change is likely to significantly diminish California's future water supply, stating that: California must change its water management and uses because climate change will likely create greater competition for limited water supplies needed by the environment, agriculture, and cities.

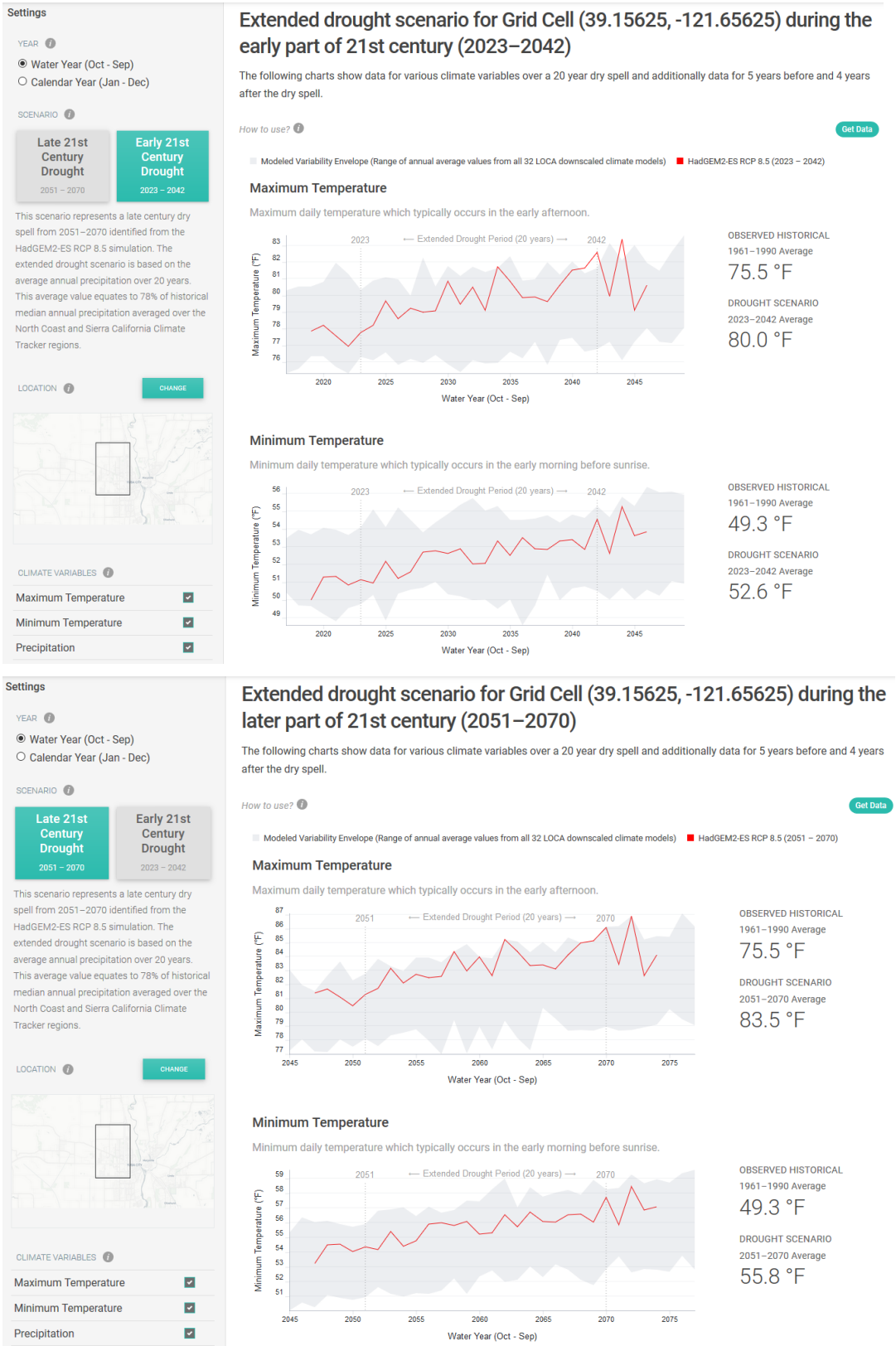
A report from the Public Policy Institute of California noted that thousands of Californians – mostly in rural, small, disadvantaged communities – already face acute water scarcity, contaminated groundwater, or complete water loss. Climate change would make these effects worse.

Cal-Adapt has modeled future risk of drought. Recent research suggests that extended drought occurrence ("mega-drought") could become more pervasive in future decades. This tool explores data for two 20-year drought scenarios (using the quad that contains the City of Yuba City) derived from LOCA downscaled meteorological and hydrological simulations (Figure 4-43) – one for the earlier part of the 21st century, and one for the latter part:

- The upper chart represents a mid-century dry spell from 2023-2042 identified from the HadGEM2-ES RCP 8.5 simulation. The extended drought scenario is based on the average annual precipitation over 20 years. This average value equates to 78% of historical median annual precipitation averaged over the North Coast and Sierra California Climate Tracker regions.
- The lower chart represents a late century dry spell from 2051–2070 identified from the HadGEM2-ES RCP 8.5 simulation. The extended drought scenario is based on the average annual precipitation over

20 years. This average value equates to 78% of historical median annual precipitation averaged over the North Coast and Sierra California Climate Tracker regions.

Figure 4-43 Sutter County – Future Extended Drought Scenarios



Source: Cal Adapt – Extended Drought Scenarios

Vulnerability Assessment

Vulnerability—High

Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue for agricultural, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water. In the populated areas of the County, community service districts provide water and sewer services. In some of the rural areas, wells and septic systems are more prevalent.

Impacts

Based on historical information, the occurrence of drought in California, including Sutter County, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. The vulnerability of Sutter County to drought is countywide, but impacts may vary and may include reduction in water supply, agricultural losses, and an increase in dry fuels. Due to the high amount of agricultural production in the County, significant impacts from drought are expected to affect the agricultural industry and the County.

The most significant qualitative impacts associated with drought in the Planning Area are those related to water intensive activities such as agriculture, wildfire protection, municipal usage, commerce, tourism, recreation, and wildlife preservation. The HMPC noted that drought can impact habitat and wildfire areas in the County. Mandatory conservation measures are typically implemented during extended droughts. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

With a reduction in water, water supply issues based on water rights becomes more evident. Some agricultural uses are severely impacted through limited water supply, especially those with livestock. Other impacts include decreased crop yields, impact to feed and forage, altered plant populations and tree mortality. Drought and water supply issues will continue to be a concern to the Planning Area. The drawdown of the groundwater table is one factor that has been recognized to occur during repeated dry years. Lowering of groundwater levels results in the need to deepen wells, which subsequently lead to increased pumping costs. These costs are a major consideration for residents relying on domestic wells and agricultural producers that irrigate with groundwater and/or use it for frost protection. Land subsidence can also occur when the groundwater table is depleted.

Drought Impact Monitor

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. Tracking drought impacts can be difficult. The Drought Impact Reporter from the NDMC is a useful reference tool that compiles reported drought impacts nationwide. Table 4-46 show drought impacts for the Sutter County

Planning Area from 1850 to August 2020. The data represented is skewed, with the majority of these impacts from records within the past ten years.

Table 4-46 Sutter County Drought Impacts

Category	Number of Impacts
Agriculture	414
Business and Industry	104
Energy	13
Fire	261
Plants & Wildlife	366
Relief, Response, and Restrictions	633
Society and Public Health	418
Tourism and Recreation	126
Water Supply and Quality	921

Source: National Drought Mitigation Center, 1/1/1850-8/1/2020

CA DWR Impacts

Recently, a draft report by CA DWR (titled Small Water Suppliers and Rural Communities at Risk of Drought and Water Shortage Vulnerability and Recommendations and Guidance to Address the Planning Needs of these Communities), sought to quantify the drought and water shortage vulnerability to rural counties, like Sutter County, in the State of California. Included in the draft report is the methodology for developing relative risk assessment scores that show where small water systems rank on an index of drought and water shortage vulnerability and recommendations on drought and water shortage vulnerability for small water systems. It is important to note that the primary benefit of this scoring exercise is to offer local and regionally-specific information to assist with drought and water shortage planning.

DWR developed a tool to rate drought and water shortage risk by water provider. To develop the tool, DWR used statewide datasets to estimate risk of drought and water shortage for small water suppliers and rural communities. DWR was only able to calculate relative risk scores for small water systems that had a digital service area boundary, with data available from the Water Board. DWR is working with the Water Board to create a process to obtain service areas boundaries for the remaining small water systems. Table 4-47 was extracted from the Excel table from the report, and shows the systems in Sutter County that were reviewed and their risk score for drought and water shortage.

Table 4-47 Sutter County – Drought and Water Shortage Risk Factors for Small Water Suppliers

System Name	Risk Score
Blue Angel Apartments WS	80
City of Live Oak	76
National American CORP. LP-Lake Minden	22

System Name	Risk Score
Sutter Community SD	15
Sutter County WWD #1 (Robbins)	89
Sysco Food Service of Sacramento	59
Tierra Buena MHP #1	57
Wildwood East Mutual	47

Source: CDAG Report
Note: It is important to note that the primary benefit of this scoring exercise is to offer local and regionally specific information to assist with drought and water shortage planning.
0 is the lowest risk and 100 is highest risk, compared to other small water suppliers

Drought and Power Shortage/PSPS

During periods of drought, vegetation can dry out which increases fire risk. Drought that occurs during periods of extreme heat and high winds can cause PSPS events to be declared in the County. More information on PSPS can be found in Section 4.3.3.

Future Development

Water supply has not been significant issues in Sutter County in years past due to the extensive surface and groundwater supplies in the region; the County's senior water rights; and their ability to maximize water resources through conjunctive use. Population in the County in the future is expected to increase (see Table 4-18), which increases pressure on water companies during periods of drought and water shortage. Water companies will need to continue to plan for and add infrastructure capacity to replace aging systems and accommodate additional users.

4.3.9. Earthquake

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design,

type, and quality of building construction. This section briefly discusses issues related to types of seismic hazards.

Ground Shaking

Ground shaking is motion that occurs as a result of energy released during faulting. The damage or collapse of buildings and other structures caused by ground shaking is among the most serious seismic hazards. Damage to structures from this vibration, or ground shaking, is caused by the transmission of earthquake vibrations from the ground to the structure. The intensity of shaking and its potential impact on buildings is determined by the physical characteristics of the underlying soil and rock, building materials and workmanship, earthquake magnitude and location of epicenter, and the character and duration of ground motion.

Actual ground breakage generally affects only those buildings directly over or nearby the fault. Ground shaking generally has a much greater impact over a greater geographical area than ground breakage. The amount of breakage and shaking is a function of earthquake magnitude, type of bedrock, depth and type of soil, general topography, and groundwater.

Seismic Structural Safety

Older buildings constructed before building codes were established, and even newer buildings constructed before earthquake-resistance provisions were included in the codes, are the most likely to be damaged during an earthquake. Buildings one or two stories high of wood-frame construction are considered to be the most structurally resistant to earthquake damage. Older masonry buildings without seismic reinforcement (unreinforced masonry buildings [URM]) and soft story buildings are the most susceptible to the type of structural failure that causes injury or death.

The susceptibility of a structure to damage from ground shaking is also related to the underlying foundation material. A foundation of rock or very firm material can intensify short-period motions which affect low-rise buildings more than tall, flexible ones. A deep layer of water-logged soft alluvium can cushion low-rise buildings, but it can also accentuate the motion in tall buildings. The amplified motion resulting from softer alluvial soils can also severely damage older masonry buildings.

Other potentially dangerous conditions include, but are not limited to: building architectural features that are not firmly anchored, such as parapets and cornices; roadways, including column and pile bents and abutments for bridges and overcrossings; and above-ground storage tanks and their mounting devices. Such features could be damaged or destroyed during strong or sustained ground shaking.

Liquefaction Potential

Liquefaction, which can occur in earthquakes with strong ground shaking, is mostly found in areas with sandy soil or fill and a high water table located 50 feet or less below the ground surface. Liquefaction can cause damage to property with the ground below structures liquefying making the structure unstable causing sinking or other major structural damage. Evidence of liquefaction may be observed in "sand boils," which are expulsions of sand and water from below the surface due to increased pressure below the surface.

Liquefaction during an earthquake requires strong shaking and is not likely to occur in the County due to the relatively low occurrence of seismic activity in the area; however, the clean sandy layers paralleling the Sacramento River, Feather River, and Bear River have lower soil densities and high overall water table, and are potentially a higher risk area if major seismic activity were to occur. Areas of bedrock, including the Sutter Buttes have high density compacted soils and contain no liquefaction potential, although localized areas of valley fill alluvium can have moderate to high liquefaction potential.

Settlement

Settlement can occur in poorly consolidated soils during ground shaking. During settlement, the soil materials are physically rearranged by the shaking to result in a less stable alignment of the individual minerals. Settlement of sufficient magnitude to cause significant structural damage is normally associated with rapidly deposited alluvial soils or improperly founded or poorly compacted fill. These areas are known to undergo extensive settling with the addition of irrigation water, but evidence due to ground shaking is not available.

Location and Extent

California is seismically active because it sits on the boundary between two of the earth's tectonic plates. Most of the state - everything east of the San Andreas Fault - is on the North American Plate. The cities of Monterey, Santa Barbara, Los Angeles, and San Diego are on the Pacific Plate, which is constantly moving northwest past the North American Plate. The relative rate of movement is about two inches per year. The San Andreas Fault is considered the boundary between the two plates, although some of the motion is taken up on faults as far away as central Utah.

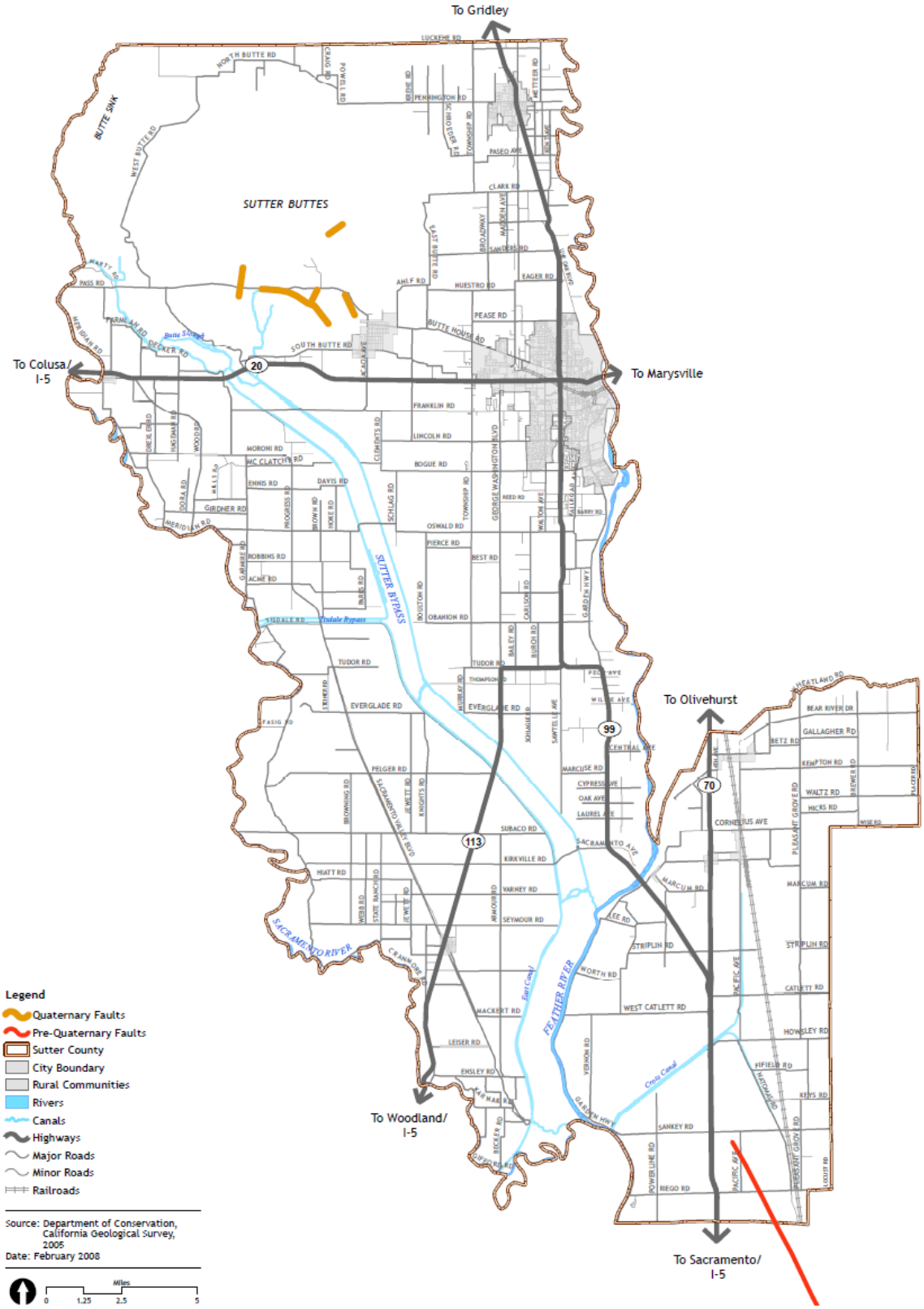
Faults

A fault is defined as "a fracture or fracture zone in the earth's crust along which there has been displacement of the sides relative to one another." For the purpose of planning there are two types of faults, active and inactive. Active faults have experienced displacement in historic time, suggesting that future displacement may be expected. Inactive faults show no evidence of movement in recent geologic time, suggesting that these faults are dormant. This does not mean, however, that faults having no evidence of surface displacement within the last 11,000 years are necessarily inactive. For example, the 1975 Oroville earthquake, the 1983 Coalinga earthquake, and the 1987 Whittier Narrows earthquake occurred on faults not previously recognized as active. Potentially active faults are those that have shown displacement within the last 1.6 million years (Quaternary). An inactive fault shows no evidence of movement in historic (last 200 years) or geologic time, suggesting that these faults are dormant.

Two types of fault movement represent possible hazards to structures in the immediate vicinity of the fault: fault creep and sudden fault displacement. Fault creep, a slow movement of one side of a fault relative to the other, can cause cracking and buckling of sidewalks and foundations even without perceptible ground shaking. Sudden fault displacement occurs during an earthquake event and may result in the collapse of buildings or other structures that are found along the fault zone when fault displacement exceeds an inch or two. The only protection against damage caused directly by fault displacement is to prohibit construction in the fault zone.

The faults identified in Sutter County include the Quaternary Faults, located in the northern section of the County within the Sutter Buttes, and the Pre Quaternary Fault, located in the southeastern corner of the Planning Area, just east of where Highway 70 enters in to the County (Figure 4-44). Both faults are listed as non active faults, but still have the potential for seismic activity.

Figure 4-44 Faults in and near Sutter County



Source: Sutter County General Plan Technical Background Report

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales. One of the first was the Richter Scale, developed in 1932 by the late Dr. Charles F. Richter of the California Institute of Technology. The Richter Magnitude Scale is used to quantify the magnitude or strength of the seismic energy released by an earthquake. Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface (see Table 4-48). Seismic shaking is typically the greatest cause of losses to structures during earthquakes.

Table 4-48 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors; by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, and great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: Multi-Hazard Identification and Risk Assessment, FEMA 1997

Table 4-49 provides the most recent regional seismic activity for Sutter County.

Table 4-49 Local and Regional Faults Shaking in or near Sutter County

Fault	Most Recent Significant Earthquake Year; Richter Scale Magnitude
Sutter Buttes	Quaternary
Dunnigan Hills (near Arbuckle)	Holocene
Foothills Suture Zone Cleveland Hill Swain Ravine-Spenceville	1975; M 5.7
Midland	Quaternary

Fault	Most Recent Significant Earthquake Year; Richter Scale Magnitude
Unnamed(1892 epicenters between Vacaville and Winters)	1892; M 6.7 1892; M 6.5
Green Valley-Concord-Calaveras	1984; M 6.1 1979; M 5.9
Rodgers Creek-Hayward	1968; M 6.8 1936; M 7.0
San Andreas	1989; M 7.1 (Loma Prieta) 1906; M 8.3
Eastern Sierra Nevada Sulphur Creek Stampede Valley Genoa Sulphur Creek	1875 1966 Holocene

Source: Sutter County General Plan/Environmental Science Associates, Proposed Ash Landfill EIR, 1992

Past Occurrences

Disaster Declaration History

There have been no disaster declarations in the County related to earthquakes, as shown on Table 4-4. The County had no USDA disaster declarations since 2012 related to earthquake, as shown on Table 4-6.

NCDC Events

Earthquake events are not tracked by the NCDC database.

USGS Events

The USGS National Earthquake Information Center database contains data on earthquakes in the Sutter County area. Table 4-50 shows the approximate distances earthquakes can be felt away from the epicenter. According to the USGS data, a magnitude 5.0 earthquake could be felt up to 90 miles away. The USGS database was searched for magnitude 5.0 or greater on the Richter Scale within 90 miles of the City of Yuba City in Sutter County. There are 40 events that are detailed in Table 4-51.

Table 4-50 Approximate Relationships between Earthquake Magnitude and Intensity

Richter Scale Magnitude	Maximum Expected Intensity*	Distance Felt (miles)
2.0 - 2.9	I – II	0
3.0 - 3.9	II – III	10
4.0 - 4.9	IV – V	50
5.0 - 5.9	VI – VII	90
6.0 - 6.9	VII – VIII	135
7.0 - 7.9	IX – X	240
8.0 - 8.9	XI – XII	365

*Modified Mercalli Intensity Scale.

Source: United State Geologic Survey, Earthquake Intensity Zonation and Quaternary Deposits, Miscellaneous Field Studies Map 9093, 1977.

*Table 4-51 Magnitude 5.0 Earthquakes or greater within 90 Miles of Sutter County**

Date	Richter Magnitude	Location
12/14/2016	5.01	8km NW of The Geysers, California
8/10/2016	5.09	20km NNE of Upper Lake, California
8/24/2014	6.02	South Napa
5/24/2013	5.69	10km WNW of Greenville, California
8/10/2001	5.2	Northern California
11/28/1980	5.1	Northern California
1/24/1980	5.1	San Francisco Bay area, California
1/24/1980	5.8	San Francisco Bay area, California
8/2/1975	5.2	Northern California
8/2/1975	5.1	Northern California
8/1/1975	5.7	0km WSW of Palermo, California
10/2/1969	5.1	Northern California
4/29/1968	5	Northern California
9/12/1966	5.91	Northern California
6/6/1962	5.2	Northern California
4/1/1959	5.6	Northern California
10/24/1955	5.4	San Francisco Bay area, California
9/26/1953	5.3	Nevada
3/22/1953	5	Northern California
3/20/1950	5.5	Lassen Peak area, California
12/29/1948	6	Northern California
3/30/1943	5.3	Northern California
2/8/1940	5.7	Northern California
6/23/1909	5.7	Northern California
3/3/1909	5	Northern California
5/19/1902	5.4	Northern California
3/31/1898	6.2	San Francisco Bay area, California
8/9/1893	5.1	Northern California
4/30/1892	5.5	Northern California
4/21/1892	6.2	Northern California
4/19/1892	6.4	Northern California
10/12/1891	5.5	Northern California
5/19/1889	6	San Francisco Bay area, California
4/29/1888	5.9	Northern California
1/7/1881	5.6	Near Red Bluff, California

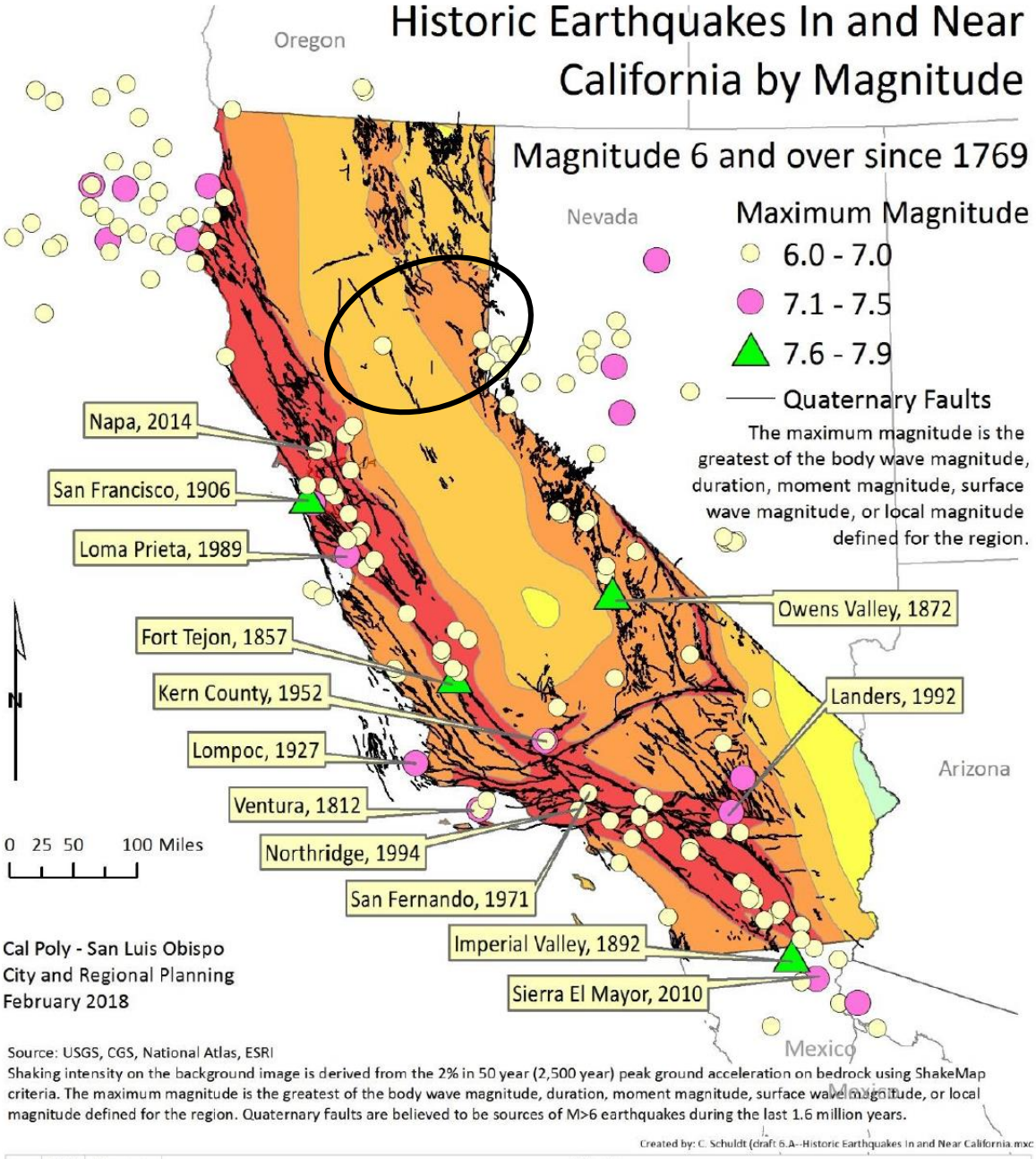
Date	Richter Magnitude	Location
7/10/1877	5.5	Lake Tahoe area, California-Nevada border
4/2/1870	5.8	Near Berkeley, California
10/8/1869	5.6	Near Ukiah, California
9/3/1857	6	California-Nevada Border east of Truckee
1/25/1855	5.5	Sierra County, California

Source: USGS

*Search dates 1/1/1850 – 8/1/2020

Figure 4-45 shows major historical earthquakes in California from 1769 to 2017.

Figure 4-45 Historic Earthquakes in California 1769 to 2017



	MMI	Damage	Effects
	X	Very Heavy	Some well-built, wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
	IX	Heavy	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
	VIII	Moderate to Heavy	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
	VII	Moderate	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly-built or badly designed structures; some chimneys broken.
	VI	Light	Felt by all, many frightened. Some heavy furniture moved; a few instance of fallen plaster. Damage slight.
	V	Very Light	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

Source: 2018 State of California Multi-Hazard Mitigation Plan

Hazard Mitigation Planning Committee Events

Although the County has felt ground shaking from earthquakes with epicenters located elsewhere, no major earthquakes have been recorded within the County. Notable regional earthquake events include those detailed below. It is unknown whether damages occurred within the Sutter County Planning Area or to what extent these events were actually felt by County residents.

- A potential earthquake source is the Midland Fault Zone on the western side of Sacramento Valley, where in 1892 an earthquake centered between the cities of Vacaville and Winters caused minor damage in surrounding areas.
- An estimated 4.0+ Richter magnitude earthquake occurred between Auburn and Folsom in nearby Placer County in 1908 with an epicenter possibly associated with the Bear Mountain fault.
- To the east in Nevada, there are several faults associated with a series of earthquakes in 1954, especially the major (7.1 Richter magnitude) December 16, 1954 Fairview Peak event (about 100 miles east of Carson City). These events caused no damage in Reno, but there was some damage in Sacramento, probably because of the soft soil conditions.
- A recently active fault in the western Sierra Nevada foothills is the Cleveland Hills fault. This fault was the source of the 1975 Oroville earthquake (Richter Magnitude: 5.7), which was felt strongly in neighboring areas, including Sutter County
- According to the HMPC, the 1989 San Francisco earthquake was felt in the Sutter County Planning Area.
- On May 24, 2013 a 5.7 magnitude earthquake struck 80 miles northeast of Yuba City near Canyondam, California. Residents reported seismic shaking in the County but there were no reports of damage within the Planning Area. This earthquake was felt as far south as Stockton, California.

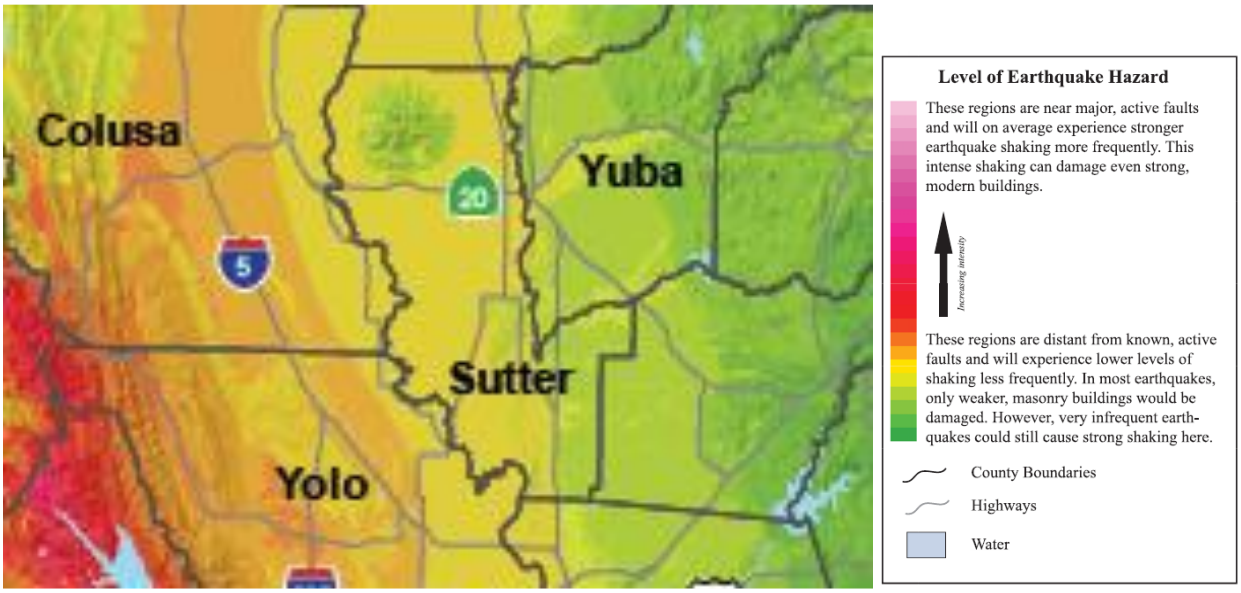
Likelihood of Future Occurrence

Unlikely (major earthquake); Likely (minor earthquake)— A few sizeable earthquakes have occurred within 90 miles of the County. The possibility of an earthquake is an ever-present phenomenon in California and Sutter County. The combination of plate tectonics and associated California coastal mountain range building geology essentially guarantees earthquake as a result of the periodic release of tectonic stresses.

Mapping of Future Occurrences

Maps indicating the maximum expectable intensity of ground shaking for the County are available through several sources. Figure 4-46, prepared by the California Division of Mines and Geology, shows the expected relative intensity of ground shaking and damage in California from anticipated future earthquakes. The shaking potential is calculated as the level of ground motion that has a 2% chance of being exceeded in 50 years, which is the same as the level of ground-shaking with about a 2,500-year average repeat time. This data shows that Sutter County falls within an area of mostly low seismic risk.

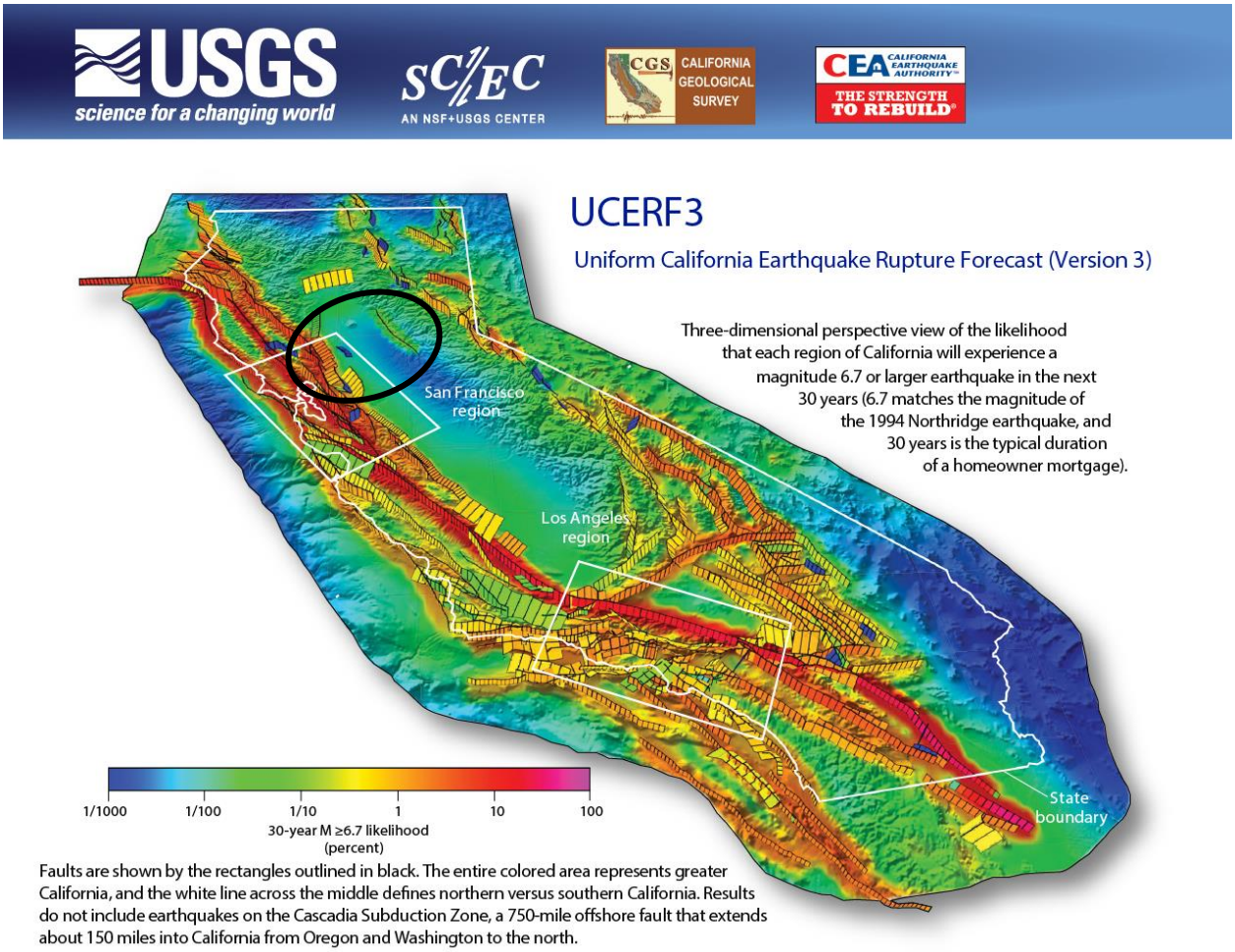
Figure 4-46 Maximum Expectable Earthquake Intensity – 2% Chance in 50 Years



Source: California Division of Mines and Geology

In 2014, the USGS and the California Geological Survey (CGS) released the time-dependent version of the Uniform California Earthquake Rupture Forecast (UCERF III) model. The UCERF III results have helped to reduce the uncertainty in estimated 30-year probabilities of strong ground motions in California. The UCERF map is shown in Figure 4-47 and indicates that Sutter County has a low to moderate risk of earthquake occurrence, which coincides with the likelihood of future occurrence rating of occasional.

Figure 4-47 Probability of Earthquake Magnitudes Occurring in 30 Year Time Frame



Source: United States Geological Survey Open File Report 2015-3009

Climate Change and Earthquake

Climate changes is unlikely to increase earthquake frequency or strength.

Vulnerability Assessment

Vulnerability—Medium

Earthquake vulnerability is primarily based on population and the built environment. Urban areas in high seismic hazard zones are the most vulnerable, while uninhabited areas are less vulnerable. The primary impacts of concern are life safety and property damage. Although several faults are within and near the County, seismic hazard mapping indicates that the County has low seismic hazard potential. Additionally, the County is not located within a delineated Alquist-Priolo Earthquake Fault Zone. The risks associated with earthquakes, such as surface fault rupture, within the County are considered low.

Seismic events can have particularly negative effects on older buildings constructed of URM, including materials such as brick, concrete and stone. The Uniform Building Code (UBC) identifies four seismic zones in the United States. The zones are numbered one through four, with Zone 4 representing the highest level of seismic hazard. The UBC establishes more stringent construction standards for areas within Zones 3 and 4. All of California lies within either Zone 3 or Zone 4. Sutter County is within the less hazardous Zone 3. IS THERE A URM INVENTORY?

Impacts

Impacts to the County would include damages to infrastructure (roads, bridges, railroad tracks, etc.), damages and loss of services to utilities and critical infrastructure, damages to residential and commercial buildings, and possible loss of life and injuries. Earthquakes, though rare in Sutter County, can strike without warning and cause dramatic changes to the landscape of an area that can have devastating impacts on agricultural production and the environment. These impacts could include loss of harvest or livestock and destruction of irrigation systems and other agricultural infrastructure.

The HMPC noted that overall, the County is not significantly vulnerable to earthquake, but would expect some settlement and repairs due to an earthquake event.

NEED THE SBFCA VULNERABILITY ANALYSIS FOR THE FEATHER RIVER WEST LEVEE WHEN IT IS COMPLETE. WILL ADD THAT INFO HERE AND IN THE LEVEE SECTION

Estimating Potential Losses

Earthquake losses will vary across the Sutter County Planning Area depending on the source and magnitude of the event. To further evaluate potential losses associated with earthquake activity in the Planning Area, one HAZUS-MH earthquake scenarios were run for this 2021 LHMP Update:

- A probabilistic 7.0 earthquake event

These events were chosen from data gathered from the General Plan Safety Element. It should be noted that the deterministic events are chosen based on actual events that have occurred. The fault's distance to the County is taken into account when analyzing earthquake shake hazards on the County. The probabilistic event is a "worst case" event, and assumes an earthquake takes place on an unknown fault that lies inside the County.

2021 Earthquake Scenario

Probabilistic 7.0 Earthquake Event

HAZUS-MH 4.2 was utilized to model earthquake losses for the County. Specifically, the probabilistic magnitude used for Sutter County utilized a 7.0 magnitude earthquake. Level 1 analyses were run, meaning that only the default data was used and not supplemented with local building inventory or hazard data. There are certain data limitations when using the default data, so the results should be interpreted accordingly; this is a planning level analysis. The represents a "worst case" scenario.

The methodology for running the probabilistic earthquake scenario used seismic hazard contour maps developed by the U.S. Geological Survey (USGS) for the 2002 update of the National Seismic Hazard Maps that are included with HAZUS-MH. The USGS maps provide estimates of potential ground acceleration and spectral acceleration at periods of 0.3 second and 1.0 second, respectively. The 2,500-year return period analyzes ground shaking estimates with a 2 percent probability of being exceeded in 50 years, from the various seismic sources in the area. The International Building Code uses this level of ground shaking for building design in seismic areas and is more of a worst-case scenario.

- The results of the probabilistic scenario are captured in Table 4-52 and shown on Figure 4-48. Key losses included the following:
- Total economic loss estimated for the earthquake was $2,919.51 million, which includes building losses and lifeline losses based on the HAZUS-MH inventory.
- Building-related losses, including direct building losses and business interruption losses, totaled $2,780,81 million.
- 11,003 buildings in the County were at least moderately damaged. 1,534 buildings were completely destroyed.
- Over 41 percent of the building- and income-related losses were residential structures.
- 15 percent of the estimated losses were related to business interruptions.
- The mid-day earthquake had the highest number of casualties at 237
- 22,608 households experienced a loss of potable water the first day after the earthquake.
- 4,225 households experienced a loss of electricity the first day after the earthquake.

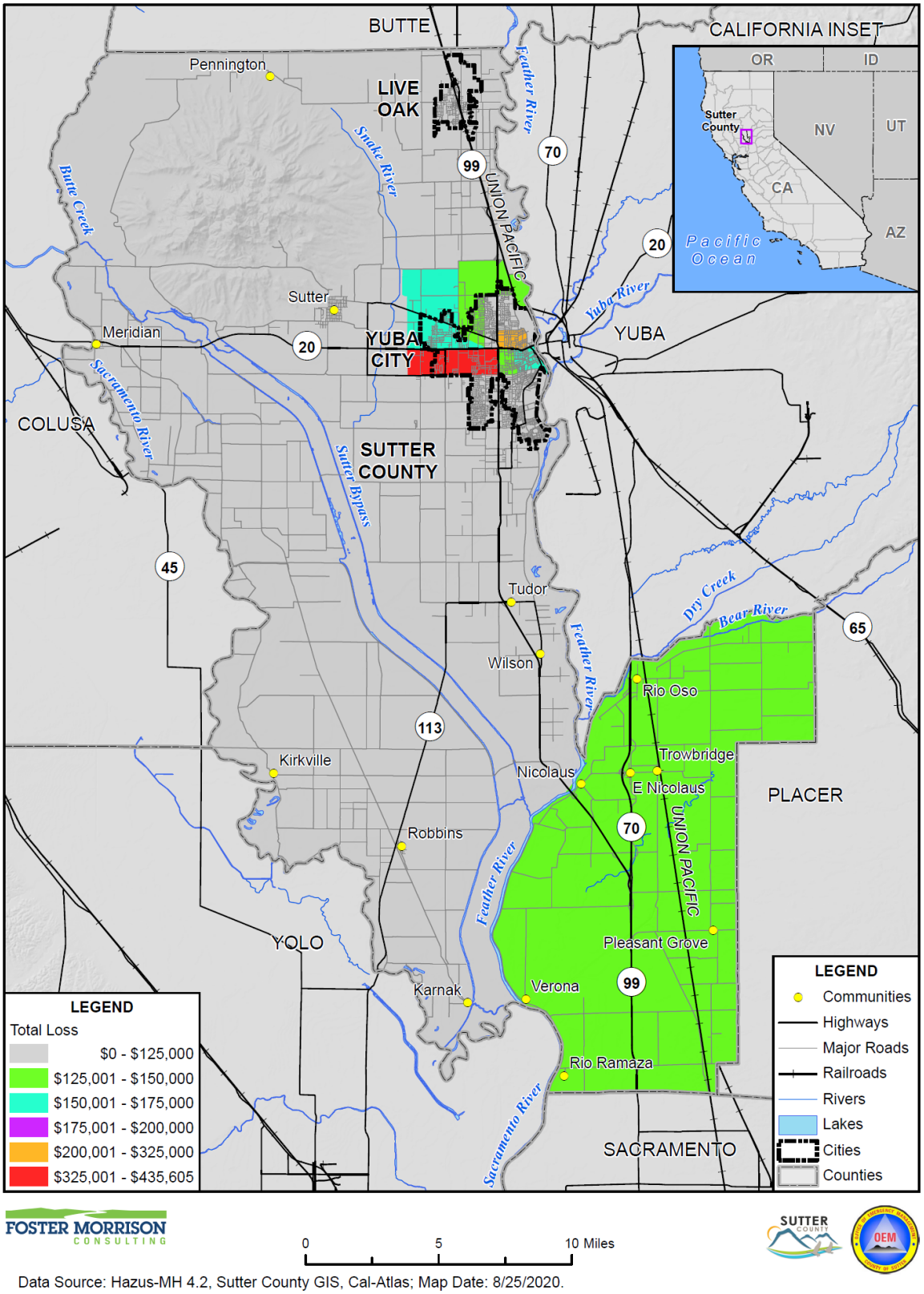
Table 4-52 HAZUS-MH Earthquake Loss Estimation Probabilistic 2,500-Year Scenario Results

Type of Impact	Impacts to County from 7.0 Probabilistic San Andreas Earthquake
Total Buildings Damaged (based on 30,000 buildings)	Slight: 9870 Moderate: 6,858 Extensive: 2,611 Complete: 1,534
Building and Income Related Losses	$2,780,810,000
Total Economic Losses (Includes building, income and lifeline losses)	$2,919,510,000
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 362 Requiring hospitalization: 88 Life threatening: 12 Fatalities: 23
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 2,187 Requiring hospitalization: 697 Life threatening: 121 Fatalities: 237
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 1,369 Requiring hospitalization: 430 Life threatening: 80 Fatalities: 143
Damage to Transportation Systems	14 highways and 1 airport with at least moderate damage

Type of Impact	Impacts to County from 7.0 Probabilistic San Andreas Earthquake	
Damage to Essential Facilities	1 hospital with at least moderate damage	
Damage to Utility Systems	8 facilities with at least moderate damage 709 potable water line breaks, 356 wastewater line breaks, and 122 natural gas line breaks	
Households without Power/Water Service (Based on 31,437 total households)	Power loss, Day 1: 4,225 Power loss, Day 3: 2,262 Power loss, Day 7: 748 Power loss, Day 30: 117 Power loss, Day 90: 7	Water loss, Day 1: 22,608 Power loss, Day 3: 21,639 Power loss, Day 7: 19,297 Water loss, Day 30: 0 Water loss, Day 90: 0
Displaced Households	1,783 displaced households	
Shelter Requirements	1,347 persons	
Debris Generation	655,000 tons	

Source: HAZUS-MH 4.2, 2020

Figure 4-48 Sutter County – Total Loss Map from 7.0 Magnitude Probabilistic Hazus Earthquake Scenario



Data Source: Hazus-MH 4.2, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Future Development

Although new growth and development corridors would fall in the area affected by earthquake, given the small chance of major earthquake and the building codes in effect, development in the earthquake area will continue to occur.

4.3.10. Flood: 1%/0.5%/0.2% Annual Chance

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Flooding is the rising and overflowing of a body of water onto normally dry land. History clearly highlights floods as one of the primary natural hazards impacting Sutter County. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. The Sutter County Planning Area is susceptible to various types of flood events as described below.

- **Riverine flooding** – Riverine flooding, defined as when a watercourse exceeds its "bank-full" capacity, generally occurs as a result of prolonged rainfall, or rainfall that is combined with already saturated soils from previous rain events. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include one or more independent river basins. The onset and duration of riverine floods may vary from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation amount, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface due to urbanization. In the Sutter County Planning Area, riverine flooding is largely caused by heavy and continued rains, sometimes combined with snowmelt, and heavy flow from tributary streams. These intense storms can overwhelm the local waterways as well as the integrity of flood control structures. The warning time associated with slow rise floods assists in life and property protection.
- **Flash flooding** – Flash flooding describes localized floods of great volume and short duration. This type of flood usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the winter and spring. Flash floods often require immediate evacuation within the hour and thus early threat identification and warning is critical for saving lives.
- **Localized/Stormwater flooding** – Localized flooding problems are often caused by flash flooding, severe weather, or an unusual amount of rainfall. Flooding from these intense weather events usually occurs in areas experiencing an increase in runoff from impervious surfaces associated with development and urbanization as well as inadequate storm drainage systems. More on localized flooding can be found in Section 4.3.11.
- **Dam failure flooding** – Flooding from failure of one or more upstream dams is also a concern to the Sutter County Planning Area. A catastrophic dam failure could easily overwhelm local response capabilities and require mass evacuations to save lives. Impacts to life safety will depend on the warning time and the resources available to notify and evacuate the public. Major loss of life could

result, and there could be associated health concerns as well as problems with the identification and burial of the deceased. Dam failure is further addressed in Section 4.3.7 Dam Failure.

Streambank Erosion

In addition to the damages to people and property from the above flooding issues, there can be issues along Sutter County's waterways related to streambank erosion. Stream bank erosion is a natural process, but acceleration of this natural process, such as during high water or flood events, leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss and other adverse effects. Stream bank erosion processes, although complex, are driven by two major components: stream bank characteristics (erodibility) and hydraulic/gravitational forces. Many land use activities can affect both of these components and lead to accelerated bank erosion. The vegetation rooting characteristics can protect banks from fluvial entrainment and collapse, and also provide internal bank strength. When riparian vegetation is changed from woody species to annual grasses and/or forbs, the internal strength is weakened, causing acceleration of mass wasting processes. Stream bank aggradation or degradation is often a response to stream channel instability. Since bank erosion is often a symptom of a larger, more complex problem, the long-term solutions often involve much more than just bank stabilization. Numerous studies have demonstrated that stream bank erosion contributes a large portion of the annual sediment yield.

Determining the cause of accelerated streambank erosion is the first step in solving the problem. When a stream is straightened or widened, streambank erosion increases. Accelerated streambank erosion is part of the process as the stream seeks to re-establish a stable size and pattern. Damaging or removing streamside vegetation to the point where it no longer provides for bank stability can cause a dramatic increase in bank erosion. A degrading streambed results in higher and often unstable, eroding banks. When land use changes occur in a watershed, such as clearing land for agriculture or development, runoff increases. With this increase in runoff the stream channel will adjust to accommodate the additional flow, increasing streambank erosion. Addressing the problem of streambank erosion requires an understanding of both stream dynamics and the management of streamside vegetation.

As farmers settled the valleys, the Gold Rush drew prospectors to the hills. Hydraulic gold mining in the northern Sierra Nevada foothills produced 1.1 billion cubic meters of sediment. As a result, the enormous amounts of silt deposited in the riverbeds of the Central Valley increased flood risk. These low-lying, unconsolidated deposits reside below all dams and reservoirs and are largely between modern levees.

During the 1870's and 1880's, valuable farmland in Sutter County was lost to the silting up of the rivers caused by hydraulic gold mining in the Sierras. Local farmers formed the Anti-Debris Association, and in 1884, they won a landmark suit halting the practice of hydraulic mining. As a remedy to these rising riverbeds, levees were built very close to the river channels to keep water velocity high and thereby scour away the sediment. However, the design of these narrow channels has been too successful. While the Gold Rush silt is long gone, the erosive force of the constrained river continues to eat away at the levee system. Streambank erosion increases the sediment that a stream must carry, results in the loss of fertile bottomland and causes a decline in the quality of habitat on land and in the stream.

Location and Extent

The Sutter County Planning Area is located in the east-central part of the Sacramento Valley. The Sutter County Operational Area EOP describes the Sacramento Valley as forming the northern half of the Central Valley, which surrounded by mountains, creates a "bathtub effect, with the Sacramento Valley, San Joaquin Delta, and San Francisco Bay forming the drain to the ocean. The lowest areas of the Central Valley, which includes Sutter County, are at the bottom of the bathtub and generally receive the brunt of any flooding.

More specifically, the topography of the Sutter County Planning Area is a relatively flat alluvial plain with the exception of the Sutter Buttes and the surrounding rolling terrain. The eastern part of the county is an alluvial terrace with elevations of 35 to 80 feet. This terrace generally drains to the southwest into the lower Sutter and American Basins, which are at 10-40 feet in elevation. Flooding is a common occurrence in areas adjacent to and in the lowlands of waterways in the Sutter County Planning Area.

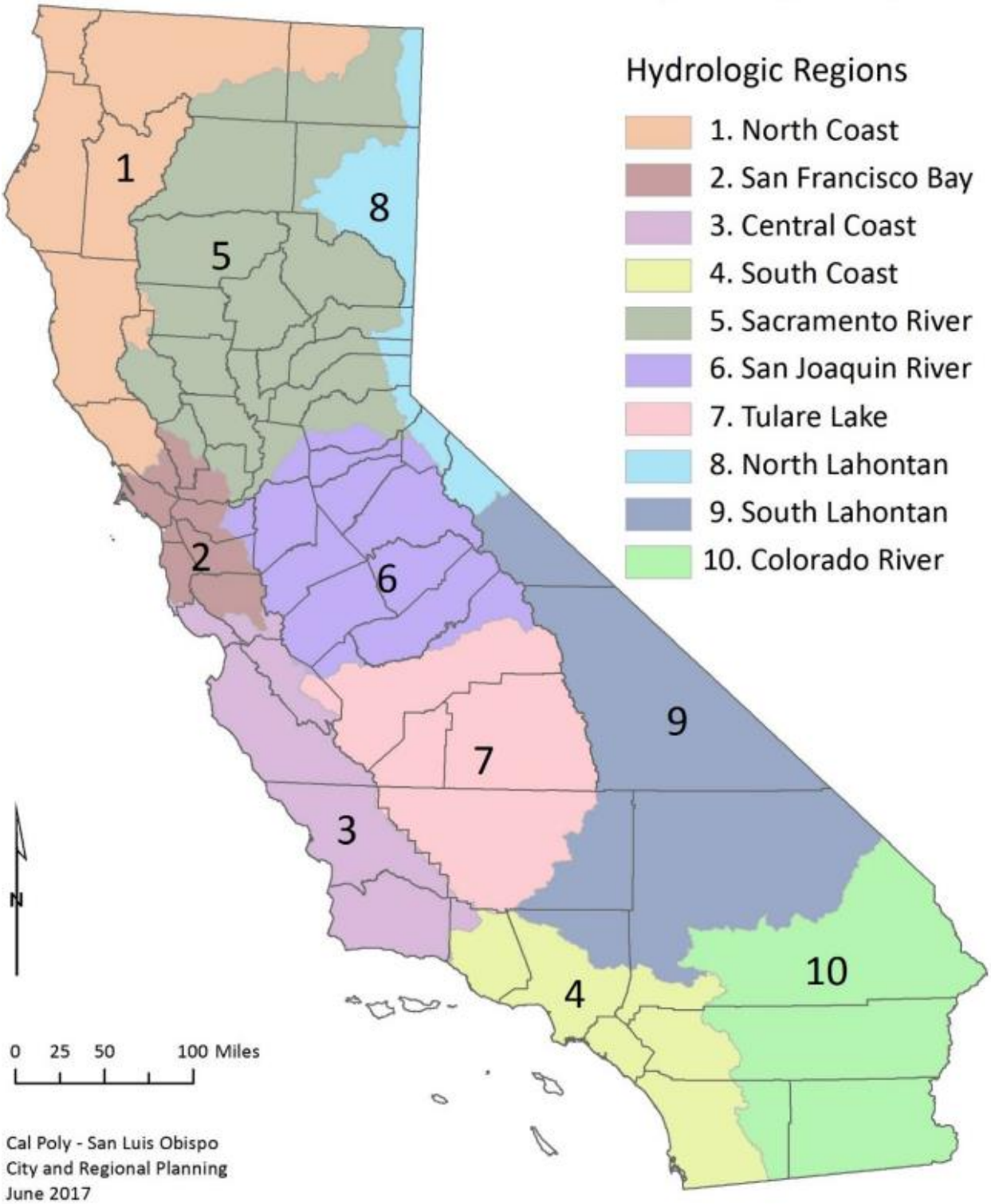
Historically, the Sutter County Planning Area has always been at risk to flooding because of its high annual percentage of rainfall, the watercourses that bound the County, and the location of development adjacent to flood-prone areas. Drainage and stormwater runoff, in addition to natural and manmade waterways, all contribute to potential flooding in the Sutter County Planning Area.

Major Sources of Flooding

California has 10 hydrologic regions. Sutter County sits in the Sacramento hydrologic region. The Sacramento River hydrologic region covers approximately 17.4 million acres (27,200 square miles). The region includes all or large portions of Modoc, Siskiyou, Lassen, Shasta, Tehama, Glenn, Sutter, Butte, Colusa, Sutter, Yuba, Sierra, Nevada, Placer, Sacramento, El Dorado, Yolo, Solano, Lake, and Napa counties. Small areas of Alpine and Amador counties are also within the region. Geographically, the region extends south from the Modoc Plateau and Cascade Range at the Oregon border, to the Sacramento-San Joaquin Delta. The Sacramento Valley, which forms the core of the region, is bounded to the east by the crest of the Sierra Nevada and southern Cascades and to the west by the crest of the Coast Range and Klamath Mountains. The Sacramento metropolitan area and surrounding communities form the major population center of the region. With the exception of Redding, cities and towns to the north, while steadily increasing in size, are more rural than urban in nature, being based in major agricultural areas.

A map of the California's hydrological regions is provided in Figure 4-49.

Figure 4-49 California Hydrologic Regions

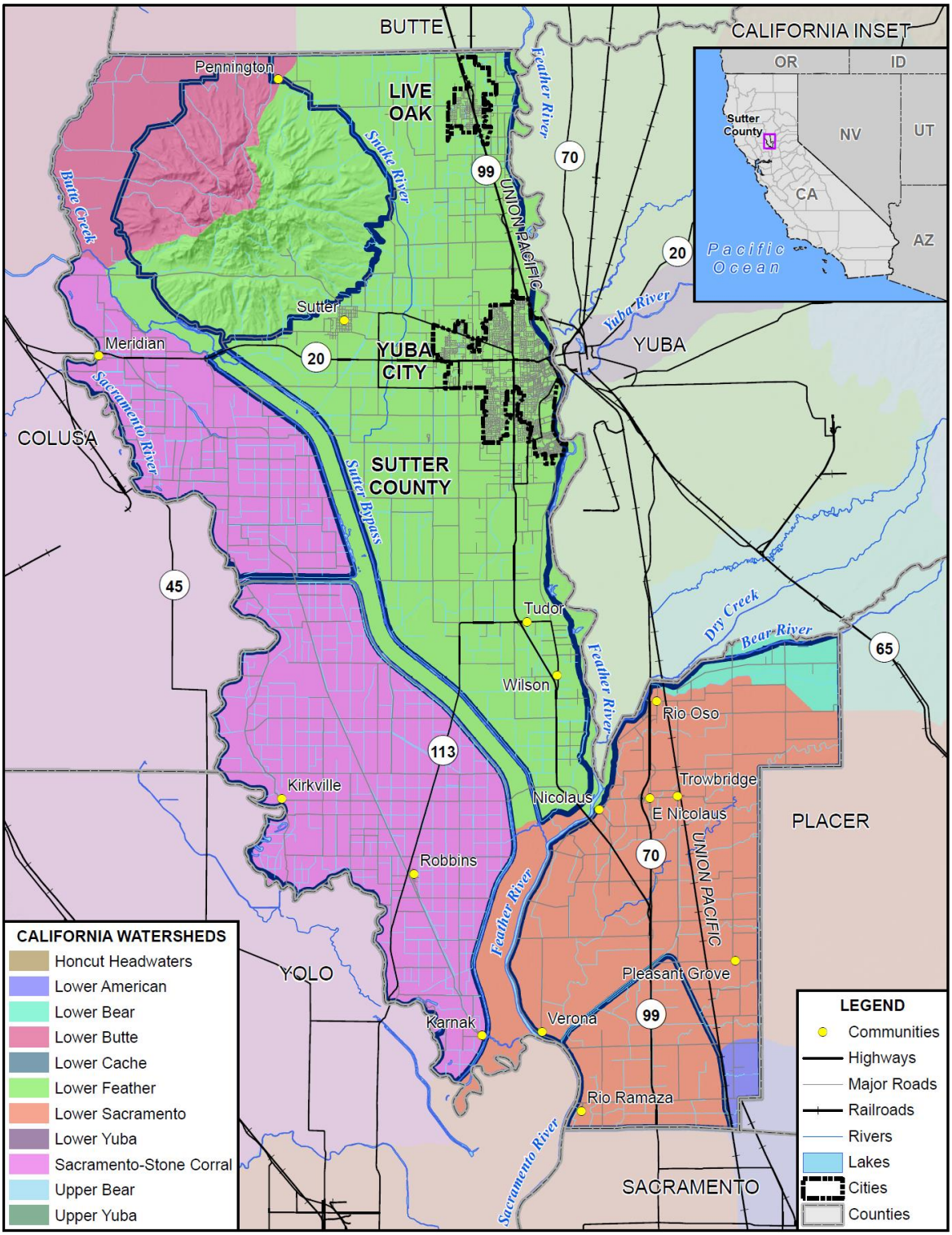


Source: 2018 State of California Hazard Mitigation Plan

The Sutter County Waterway System

Positioned on an alluvial plain between the Sacramento River on the west and the Feather River on the east, the Sutter County Planning Area lies within multiple watersheds and within the Sutter and Butte Drainage basins. In the southeastern portion of the County lies another alluvial plain situated south of the Bear River and east of the Feather River. These alluvial plains were geologically formed by water running over the stream banks during naturally occurring historic floods. Figure 4-50 illustrates the primary watersheds of Sutter County, as well as the primary waterways in the County.

Figure 4-50 Primary Watersheds and Waterways of Sutter County



Data Source: California Interagency Watershed Map of 1999 (Calwater 2.2, updated May 2004, "calw221"), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

The Sutter County Planning Area includes both natural and manmade waterways. In addition to the Sacramento, Feather, and Bear Rivers, natural waterways include Coon Creek, Pleasant Grove Creek, Markham and Auburn Ravines in the southeastern portion of the County, the Snake River on the east side of the Sutter Buttes, and other smaller streams and sloughs located throughout the county. Manmade waterways form an extensive network and are used for flood control as well as to convey irrigation water and to provide drainage channels from the croplands. Manmade waterways include the Sutter and Tisdale Bypasses, the Natomas Cross Canal, the Natomas East Main Drainage Canal, Wadsworth Canal, East/West Interceptor, Yankee Slough and Gilsizer Slough. Drainage and stormwater runoff, in addition to natural and manmade waterways, all contribute to potential flooding in the Sutter County Planning Area.

The more notable of these waterways are described in further detail below.

Sacramento River

The Sacramento River, the largest river in the state, extends for approximately 70 miles along the western border of Sutter County. Historically, the river has carved out a wide floodplain outside of its existing banks. The river provides drainage for all of Sutter County and the Sacramento Valley through a system of levees and bypasses completed in the 1920s. The final outlet of the water is the Delta and eventually, the San Francisco Bay. The river supports various recreational and boating activities, agricultural irrigation and diverse wildlife habitats. No communities in Sutter County use the river as a source of domestic or municipal water supply.

CA DWR established the Sacramento River Flood Control Project to implement flood protection programs for the river and its tributaries. The upper portion if the river is controlled by Shasta Dam, Whiskeytown Dam and Keswick Dam.

Feather River

The Feather River extends approximately 45 miles through Sutter County, forming part of the east Sutter County boundary. The Feather River reaches its confluence with the Sacramento River at the southern county boundary near Verona. Similar to the Sacramento River, the Feather River provides for recreational activities, agricultural irrigation and a diverse wildlife habitat. The river is listed as navigable below the City of Yuba City; however, due to siltation caused by past mining practices in the Sierra Foothills and lack of maintenance, only small boats can pass. The City of Yuba City obtains a large part of its annual water supply for municipal and domestic use from the river.

The Feather River is also part of the Sacramento River Flood Control Project managed by the CA DWR. Upstream the river is controlled by the Oroville Dam in Butte County.

Bear River

The Bear River roughly parallels about 11 miles of the eastern county boundary, entering the county from Placer County and crossing the boundary at several points. The river flows in a south-southwest direction until it joins the Feather River about one mile north of the town of Nicolaus. Although smaller than either the Sacramento or Feather Rivers, the Bear River also provides recreational opportunities, agricultural

irrigation water and a diverse wildlife habitat. River flows are controlled by the Camp Far West Reservoir in Yuba County.

Sutter Bypass

The Sutter Bypass, part of the Sacramento Flood Control Project, is an artificial flood control corridor approximately 3/4 mile wide, bordered by two parallel channels. The Bypass extends from the Sacramento River in the northwest portion of the County, north of Pass Road, and proceeds west of the Sutter Buttes continuing generally in a south-southeast direction for approximately 27 miles where it intercepts the Feather River about three miles south of Nicolaus. The Sutter Bypass collects flood overflow water from the Sacramento River after passing through Butte Slough and the Butte Sink.

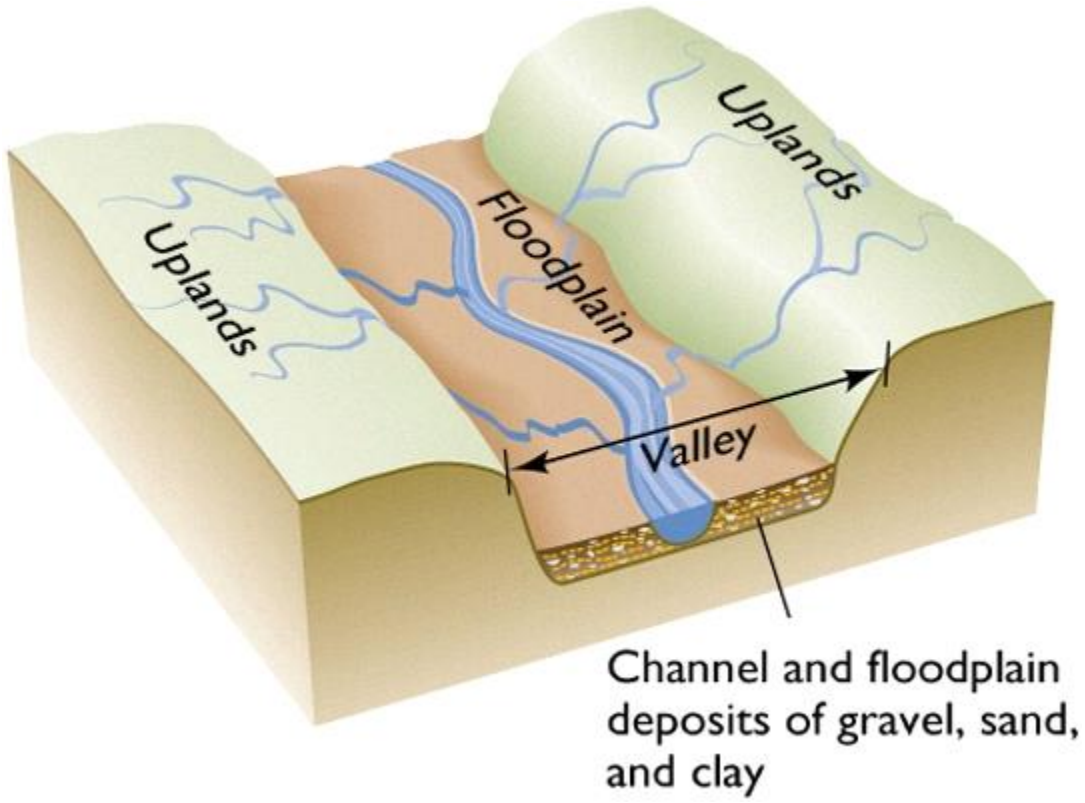
Tisdale Bypass

The Tisdale Bypass, another flood control corridor, extends for approximately four miles due west from the Sutter Bypass.

Floodplains

The area adjacent to a channel is the floodplain (see Figure 4-51). Floodplains are illustrated on inundation maps, which show areas of potential flooding and water depths. In its common usage, the floodplain most often refers to that area that is inundated by the 1% annual chance (or 100-year) flood, the flood that has a one percent chance in any given year of being equaled or exceeded. The 1% annual chance flood is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program. The 200-year flood is the flood that has a 0.5% chance of being equaled or exceeded in any given year. The 500-year flood is the flood that has a 0.2% chance of being equaled or exceeded in any given year. The potential for flooding can change and increase through various land use changes and changes to land surface, which result in a change to the floodplain. A change in environment can create localized flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. These changes are most often created by human activity.

Figure 4-51 Floodplain Schematic



Source: FEMA

According to the 2015 Flood Insurance Study for Sutter County, general rain floods can occur in the study area anytime during the period from November through April. This type of flood results from prolonged heavy rainfall and is characterized by high peak flows of moderate duration and by a large volume of runoff. Flooding is more severe when antecedent rainfall has resulted in saturated ground conditions. The severity of flooding on all the streams studied is intensified by backwater conditions between stream systems. Floodwater elevations are increased in the lower portions of tributary streams due to the backwater effect from main streams reducing hydraulic gradients and flow-storage areas. During this time there will be a high degree of coincidental l-percent-annual-chance floodflows on all the study area waterways.

Sutter County Flood Control Structures

Sutter County has many flood control structures to reduce the effects of flooding. The principal method of flood protection for the Sutter County Planning Area is structural, consisting of reservoirs (dams), levees and bypasses completed between the 1920s and 1960s. Most of the levees were constructed as parts of federal flood control projects and then, on completion, were turned over to local interests for operation and maintenance. Levees along the Sacramento River, Sutter Bypass, Feather River, Yankee Slough, Wadsworth Canal, Cross Canal, and Tisdale Bypass are part of the Sacramento River Flood Control Project which was authorized by the Flood Control Act of 1917. According to the Flood Insurance Study (FIS) for unincorporated Sutter County (2015), the original project designs and later improvements to the Sacramento River Basin Flood Control System provided a 100-year level of protection. However, as discussed later in this section, more recent studies evaluating the levee system have identified several deficiencies which

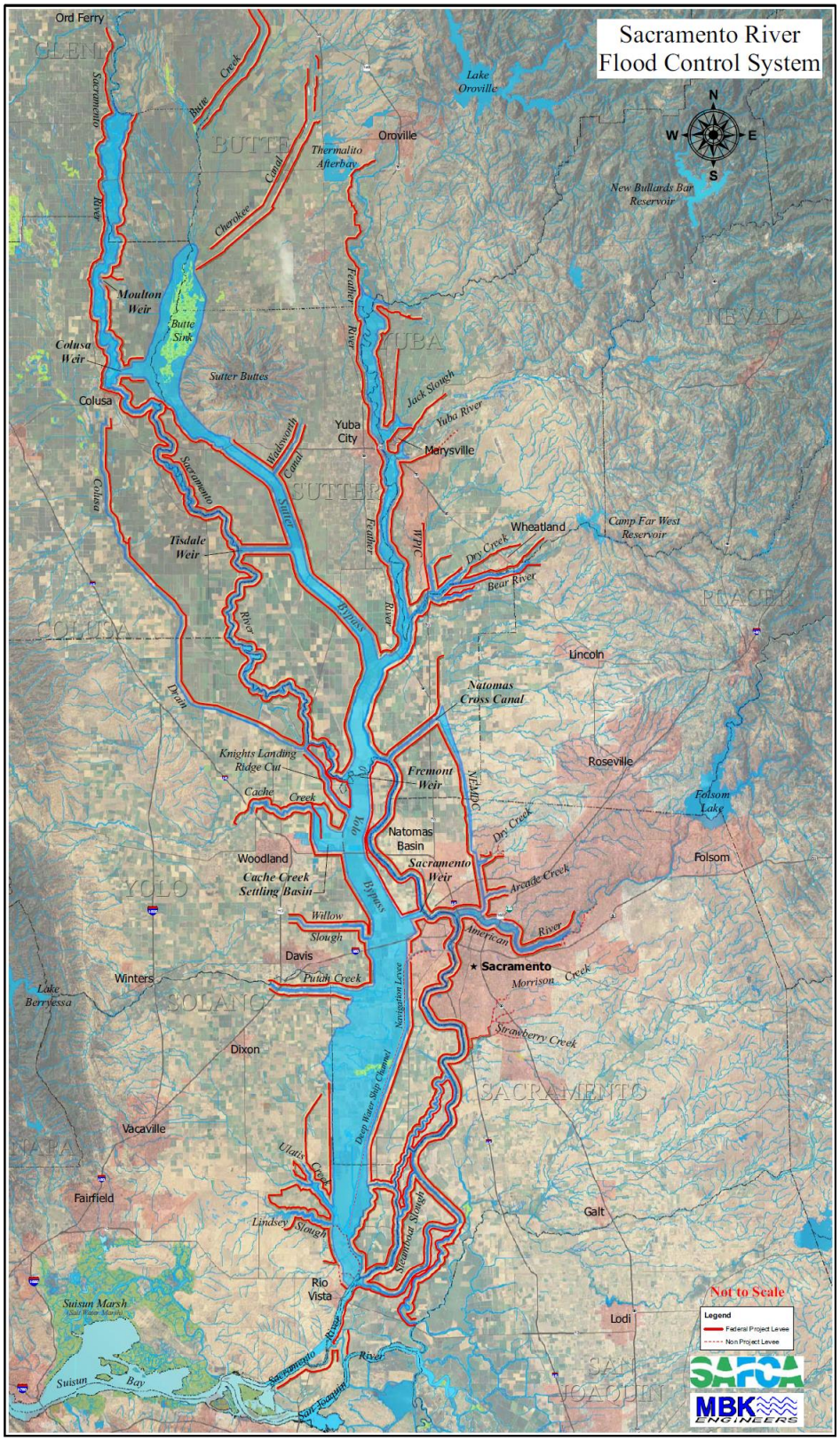
reduce the current level of protection of most area levees to below the 100-year level. Many of these levee segments are currently undergoing improvements which will ultimately increase the level of protection provided.

All of the reservoirs are located outside of the Planning Area. Within the Planning Area, the Sacramento and Feather Rivers rely primarily on a system of levees or earthen embankments to contain high river flows. Other flood control structures include bypasses. The bypasses, such as the Sutter Bypass, are auxiliary channels used to pass floodwater. Because the potential high flow of floodwaters within the Planning Area is larger than existing channel capacities, bypass systems have been developed to create additional capacity during critical peak flows. These bypass systems are needed only during major floods; as such, much of the lands reserved for this purpose can be used for agriculture, wildlife management, recreation or other compatible uses.

As the Sacramento River flows southward from Shasta Dam, natural overflow areas and two fixed weirs, Moulton and Colusa, permit floodwater to escape from the river into the Butte Basin. The Butte Basin is a natural flowage area that has not been drained and developed as have other basins in the area. Waters in the Butte Basin then flow into the upstream end of the Sutter Bypass. At the Tisdale Weir, additional water can be diverted from the Sacramento River directly into the Sutter Bypass. Draining the east side of the Sacramento Valley, flows from the Feather River enter the Sutter Bypass directly. The Sutter Bypass and the Sacramento River join just above the Fremont Weir. This weir divides the joint flow of the river-bypass system, limiting flow into the Sacramento River channel to its capacity and permitting the excess flow to cross the river and enter the Yolo Bypass. Near Sacramento, the Sacramento Weir provides the final escape route from the river to the Yolo Bypass. Also considered part of the flood control system within the Planning Area is a system of pumping plants which collect drainage waters and pumps the waters back into adjacent canals and rivers.

Flood control structures in Sutter County are shown in Figure 4-52 and discussed in greater detail in the levee failure (4.3.12) and dam failure (4.3.7) sections.

Figure 4-52 Sutter County – Flood Control Structures



Source: RD108.org, retrieved 11/4/2020

Sutter County Flood Mapping

As part of the County's ongoing efforts to identify and manage their flood prone areas, Sutter County relies on a variety of different mapping efforts. What follows is a brief description of FEMA and DWR mapping efforts covering the Sutter County Planning Area.

FEMA Floodplain Mapping

FEMA established standards for floodplain mapping studies as part of the National Flood Insurance Program (NFIP). The NFIP makes flood insurance available to property owners in participating communities adopting FEMA-approved local floodplain studies, maps, and regulations. Floodplain studies that may be approved by FEMA include federally funded studies; studies developed by state, city, and regional public agencies; and technical studies generated by private interests as part of property annexation and land development efforts. Such studies may include entire stream reaches or limited stream sections depending on the nature and scope of a study. A general overview of floodplain mapping is provided in the following paragraphs.

Flood Insurance Study (FIS)

The FIS develops flood-risk data for various areas of the community that will be used to establish flood insurance rates and to assist the community in its efforts to promote sound floodplain management. The current Sutter County FIS is dated June 16, 2015. This study covers both the unincorporated and incorporated areas of the County.

Flood Insurance Rate Map (FIRM)

The FIRM is designed for flood insurance and floodplain management applications. For flood insurance, the FIRM designates flood insurance rate zones to assign premium rates for flood insurance policies. For floodplain management, the FIRM delineates 1% and 0.2% annual chancer floodplains, floodways, and the locations of selected cross sections used in the hydraulic analysis and local floodplain regulation. The County FIRMs, for the south western portion of the County, have been replaced by digital flood insurance rate maps (DFIRMs) as part of FEMA's Map Modernization program, which is discussed further below. For the north eastern portion of the County, the April 5, 1988 FIRMs remain in effect. This data is represented in this section using Q3 data, based on a digital conversion of the paper maps.

Letter of Map Revision (LOMR) and Map Amendment (LOMA)

LOMRs and LOMAs represent separate floodplain studies dealing with individual properties or limited stream segments that update the FIS and FIRM data between periodic FEMA publications of the FIS and FIRM.

Digital Flood Insurance Rate Maps (DFIRM)

As part of its Map Modernization program, FEMA is converting paper FIRMS to digital FIRMs, DFIRMS. These digital maps:

- Incorporate the latest updates (LOMRs and LOMAs);

- Utilize community supplied data;
- Verify the currency of the floodplains and refit them to community supplied basemaps;
- Upgrade the FIRMs to a GIS database format to set the stage for future updates and to enable support for GIS analyses and other digital applications; and
- Solicit community participation.

Sutter County has a unique situation where the southern part of the county has 6/16/2015 DFIRMs effective, but the northern portion when Live Oak and Yuba City are located are still based on the 4/5/1988 FIRMs. Since there is no DFIRM for the northern portion of the County Q3 data that is based on the 4/5/1988 FIRMs was used to cover the northern portion of the County. The 2015 DFIRMs and the 1988 Q3 data are being used for the flood analysis for this LHMP Update.

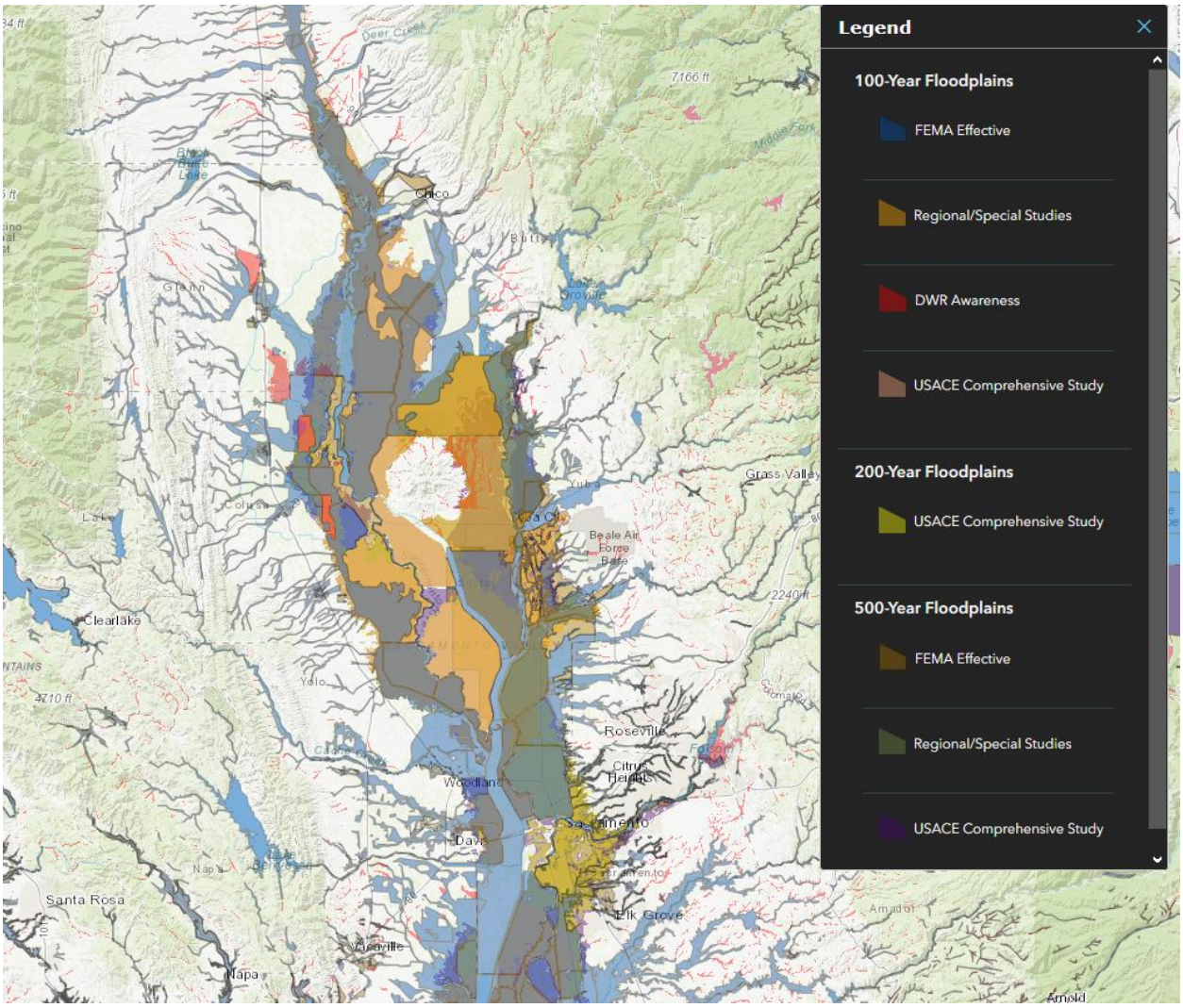
California Floodplain Mapping

Also to be considered when evaluating the flood risks in Sutter County are various floodplain maps developed by the California DWR for various areas throughout California, and in the Sacramento-San Joaquin Valley cities and counties. The FEMA regulatory maps provide just one perspective on flood risks in Sutter County. Senate Bill 5 (SB 5), enacted in 2007, authorized Cal-DWR to develop the Best Available Maps (BAM) displaying 1% and 0.5% (200-year) annual chance floodplains for areas located within the Sacramento-San Joaquin (SAC-SJ) Valley watershed. This effort was completed by DWR in 2008. DWR has expanded the BAM to cover all counties in the State and to include 0.2% annual chance flood zones.

Different than the FEMA DFIRMs which have been prepared to support the NFIP and generally reflect only the 1% and 0.2% annual chance flood risks, the BAMs are provided for informational purposes and are intended to reflect current 1%, 0.5% (200-year) as applicable, and 0.2% annual chance flood risks using the best available data. The 100-year floodplain limits on the BAM are a composite of multiple 1% annual chance floodplain mapping sources. It is intended to show all currently identified areas at risk for a 100-year flood event, including FEMA's 1% annual chance flood zones. The BAM are comprised of different engineering studies performed by FEMA, Corps, and DWR for assessment of potential 1%, 0.5%, and 0.2% annual chance floodplain areas. These studies are used for different planning and/or regulatory applications, and for each flood frequency may use varied analytical and quality control criteria depending on the study type requirements.

The value in the BAMs is that they provide a bigger picture view of potential flood risk to the County than that provided in the FEMA DFIRMs. This provides the community and residents with an additional tool for understanding potential flood hazards not currently mapped as a regulated floodplain. Improved awareness of flood risk can reduce exposure to flooding for new structures and promote increased protection for existing development. Informed land use planning will also assist in identifying levee maintenance needs and levels of protection. By including the FEMA 1% annual chance flood zone, it also supports identification of the need and requirement for flood insurance. Figure 4-53 shows the BAM for the Sutter County Planning Area.

Figure 4-53 Sutter County– Flood Awareness (Best Available) Map



Source: California DWR, Retrieved 8/18/2020

Legend explanation: Blue - FEMA 1%, Orange – Local 1% (developed from local agencies), Red – DWR 1%r (Awareness floodplains identify the 1% annual chance flood hazard areas using approximate assessment procedures.), Pink – USACE 1% (2002 Sac and San Joaquin River Basins Comp Study), Yellow – USACE 0.5% (2002 Sac and San Joaquin River Basins Comp Study), Tan – FEMA 0.2%, Grey – Local 0.2% (developed from local agencies), Purple – USACE 0.2%(2002 Sac and San Joaquin River Basins Comp Study).

Flood extents are usually measured in depths of flooding, geographical extent of the floodplain, as well as flood zones that a location falls in (i.e. 1% or 0.2% annual chance flood). Expected flood depths in the County vary and are not well defined. Flood durations in the County tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Geographical flood extent from the FEMA DFIRMs are shown later on Figure 4-56 and below in Table 4-53.

Table 4-53 Sutter County – Geographical Flood Hazard Extents in FEMA DFIRM Flood Zones

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance	159,876	39.73%	94,385	44.83%	65,491	34.13%
0.2% Annual Chance	126,945	31.54%	49,071	23.31%	77,874	40.58%
Other Areas	115,630	28.73%	67,099	31.87%	48,531	25.29%
Total	**402,451**	**100.00%**	**210,555**	**100.01%**	**191,896**	**100.00%**

Source: June 16, 2015 DFIRM

Stream bank erosion occurs on rivers, streams, and other moving waterways, including leveed areas, in the County Planning Area. The speed of onset of this erosion is slow, as the erosion takes place over periods of years. Duration of erosion is extended. Greater erosion occurs during periods of high stream flow and during storm and wind events when wave action contributes to the extent and speed of streambank erosion.

Past Occurrences

Disaster Declaration History

A list of state and federal disaster declarations for Sutter County from flooding, (including heavy rains and storms) is shown on Table 4-54. No disasters were related to streambank erosion. The County had no USDA disaster declarations since 2012 related to flood, as shown on Table 4-6.

Table 4-54 Sutter County – State and Federal Disaster Declaration from Flood 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

NCDC Events

The NCDC tracks flooding events for the County. Events have been tracked for flooding since 1993. Table 4-55 shows events in Sutter County since 1993. Other heavy rain and storm events can be found in the Past Occurrences of the Severe Weather: Heavy Rains and Storms in Section 4.3.4. More information from the NCDC on some of the flooding is woven into the discussion of HMPC events below. The NCDC does not track streambank erosion.

*Table 4-55 NCDC Flood Events in Sutter County 1993 to 4/30/2020**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Flood	23	0	0	0	0	$5,225,000	$7,800,000
Heavy Rain	4	0	0	0	0	$0	$0
Total	**27**	**0**	**0**	**0**	**0**	**$5,225,000**	**$7,800,000**

Source: NCDC

*Note: Losses reflect totals for all impacted areas, much of which fell outside of Sutter County

Hazard Mitigation Planning Committee Events

Historically, 1%/0.5%/0.2% annual chance and localized flooding have been an ongoing problem throughout the Planning Area. The most notable major flood events occurred in 1955, 1986, 1995, and 1997 as described in detail below. Primary damages were to property and agricultural crops. These damaging floods were generally the result of heavy prolonged rains, flooding, and failures of the levee systems rather than the levees being overtopped. Other lesser flooding events have also occurred in other years. Table 4-56 presents a timeline of past flooding events. Some streambank erosion would have occurred during these events, but no specific information regarding it could be recalled.

Table 4-56 Historic Timeline of Past Flooding Events in Sutter County and Surrounding Areas.

Date	Description
1805	Great Flood. Information from early settlers indicated the entire valley was inundated. Many lives were lost and villages destroyed.
1846-47	More data from early settlers indicated the loss of life and villages.
1852-53	More data from early settlers indicated the loss of life and villages.
1861	Dec. 10th. Marysville Appeal Newspaper described the entire town under water. All that was seen was the "roofs of houses and floating animals"
1862	1862 “Great Flood” - Inundated the entire Sacramento and San Joaquin Valleys an extent of 250-300 miles, averaging 20 miles in breadth. A monument near the Marysville Levee Commission building quotes W. T. Ellis, Jr.'s warning: "Remember the winter of 1861-62." Jan. 11th. Water was 6" higher than 1861. Farmers lost ¾ of herds.
1867-68	Extensive property and levee damage. 1/5th of levees were washed away.
1870	Large levee constructed in Colusa county penned in water in Sutter County. Meridian and Kirksville were submerged.
1875	Jan. 19. Levees in Yuba City and Maryville broke and flooded both cities. Volume and height of water unprecedented.
1906	Atmospheric rivers hit the Sierra Nevada area, causing large amounts of runoff that affected the County.
1907	March 1907 Spring runoff overwhelmed the Feather, even cutting across to the Butte Sink. Three weeks of heavy rain and March snowfall led to levees breaking in District 1 & 2 in mid-March. The levee failed about 6 miles north of Yuba City and still ended up overtopping the LD9 levees (flowing about 1.5’ above the LD9 levee crown). The next day, the river broke through the Feather levees below Yuba City at Shanghai bend, flooding miles of agricultural land. Flood wave sustained 200 miles. Damage amounted to $1000.

Date	Description
1917	In 1917, the first flood control committee was enacted in Mississippi. When California saw this, they thought "omg we should do that", so prompted by the 1907 flood, they created the "Sacramento Flood Control Project". A big motivator for this was that they saw the desperate need for the Sutter Bypass (RD1500 levees were not yet built, but they knew they needed them). Finally in 1919, after the Reclamation Board looked under rocks to raise funds (even borrowing from private landowners) were able to allocate $3M to build the eastern levee of the Sutter Bypass. Interestingly, this project tore out about 6 crappy cross levees and removed exceedingly dense brush from about 3.500 acres to make room.
1937	Levee break in E. Biggs. Water flowed over Hwy 20. Nicolaus bridge was damaged.
1940	Flood in Meridian from Sutter Bypass. February through March 1940 that spring runoff again. It flooded through the Butte Sink and inundated farms on the "east side" of the bypass. Though still tragic, the Sutter Bypass levee held successfully. After this flood the Shasta Dam was built to control the Sacramento River.
1942	Break in Sutter Bypass flooded Sutter/Robbins Basin.
1944	Break in the Bear River flooded Sutter County.
1948	Break in Bear River flooded Rio Oso/Nicolaus Basin.
1950	Nov. 19th break in Yankee Slough flooded Sutter County.
1955	Dec. All time record flow. Worst flood in Northern California history.
1986	Linda levee broke. Flooded 30 square miles. Emergency declared by Governor.
1995	Flooding caused by two direct downpours (from atmospheric river events) which created major surface drainage back-ups at numerous locations throughout the county. More than $850,000 in damages to county facilities.
1997	Flood in Yuba County, Sutter Lake area. 80,000 evacuated. Meridian basin floods from a break in the Sutter Bypass Levee.

Source: Sutter County

The following paragraphs provide a short synopsis of the most significant past flooding disasters occurring in Sutter County based on data from the HMPC and NCDC database.

1955 Flooding

This was the most devastating of all the floods to this area. A break in this levee south of Yuba City occurred at about midnight on December 23rd. The initial of surge water spread westerly through Gilsizer Slough to the Sutter Bypass and northerly into Yuba City. Within less than 24 hours, the heart of Sutter County was flooded from the Feather River on the east and south to the Bypass on the west and southwest. To the north, the water spread north of Colusa Avenue (Highway 20) in several areas, including some west of Walton Avenue.

Nearly 100,000 acres were flooded and resulted in 38 deaths, injuries to 3,200 people, and nearly $40 million in property damage. The bridge over the Feather River at 5th Street was washed out and telephone service was lost south of Colusa Avenue.

Figure 4-54 Downtown Yuba City December 1955 (Seepage Related Levee Break in Upper Center) View Southerly

Source: Yuba City Public Library

1962 Flooding

In October of 1962 a storm caused 6 to 9 inches of rain to fall in a 3-day period. Localized flooding was reported throughout the County.

1986 Flooding

While the most severe flooding occurred in neighboring Yuba County, Sutter County did experienced flooding. The most serious problems were located in the southern area of the county which is sparsely populated. The county was fortunate not to have a break in the levee but did experience slumping in the Robbins area. In the southeast area of the county, surface flow from Placer County led to extensive ponding. This coupled with two failures of minor levees, flooded numerous rural residences and agricultural facilities.

1995 Flooding

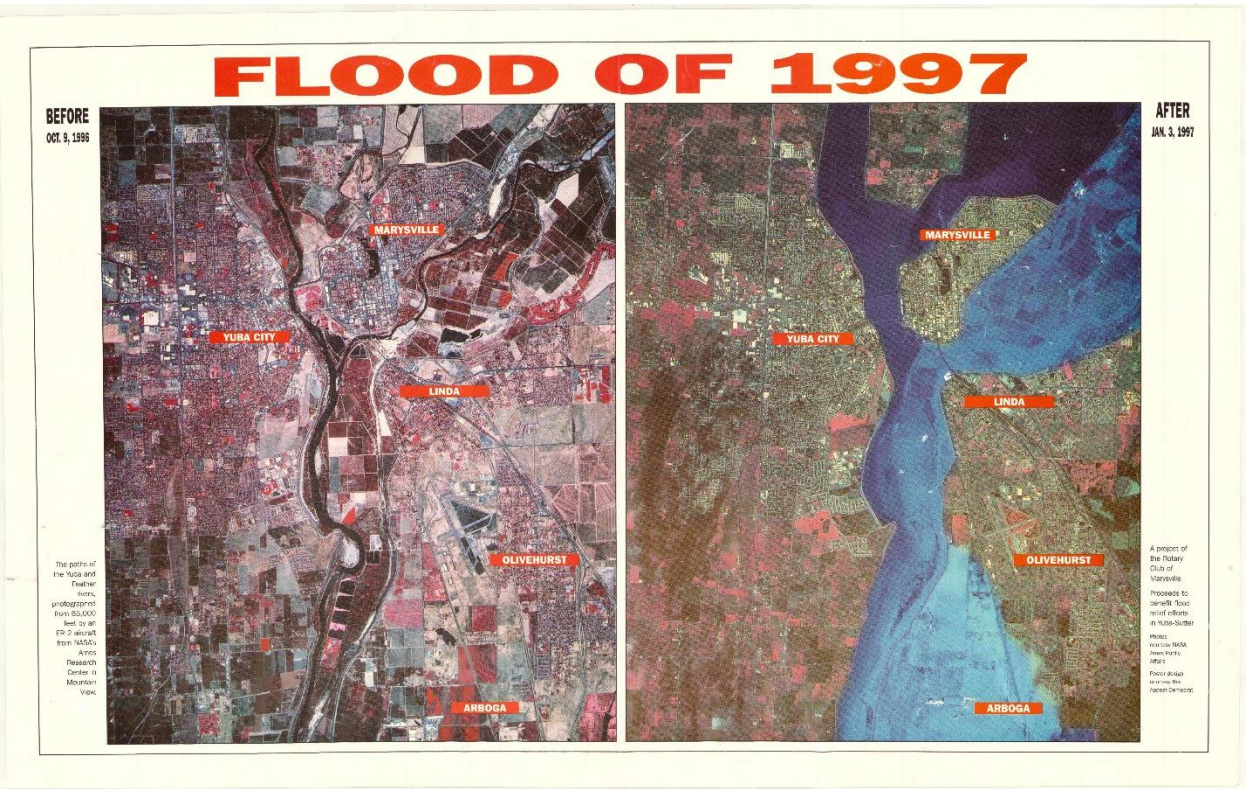
The 1995 floods were caused by two direct downpours which created major surface drainage back-ups at numerous locations throughout the county. Most of the water simply was on the wrong side of the levees. The storms were accompanied by high winds which also contributed significantly to the damage. The two separate events occurred in January and March and resulted in more than $850,000 in damage to county facilities.

1997 Flooding

A series of storms generated by the "Pineapple Express" dumped warm, heavy rains onto a nearly double than average snow pack in the Sierra Nevada Mountains in late December. Runoff was filling the Shasta, Oroville, and New Bullards Bar Dams. Sutter County was notified by Oroville Dam that uncontrolled releases of huge proportions within the next 24 hours were possible. Sutter County declared an emergency on New Year's Day at 11 a.m. and advised residents of voluntary evacuation. As the river continued to rise, the Sutter County Board of Supervisors directed a mandatory evacuation of the Nicolaus area and of all areas east of the Sutter Bypass and south of Pease Road. A break in the levee occurred at Arboga in Yuba County and it brought inundation to southwestern Yuba County. The mandatory evacuation was extended to Pleasant Grove and Robbins was added to the list on January 4th due to dangerous levee conditions evolving on the south side of Tisdale Weir. The mandatory evacuation was lifted when the conditions stabilized and residents were allowed to return to the Yuba City area but the levee experienced a massive break in the Sutter Bypass. The town of Meridian was under a mandatory evacuation order and over the next three days earthen berms were constructed on the east and south sides of town which successfully protected it from being flooded. Meridian was the hardest hit area of Sutter County with approximately 50 square miles under water. Virtually every facility in the basin was destroyed or damaged including nearly 100 homes and a school standing in 4 feet of water. Those flooded homes had power service continue, causing a risk of electrocution to those who attempted to stay and to those who were rescuing evacuees. A second break in the levee was made at the south end of the basin to allow the waters to return to the Bypass. The mandatory evacuation order was lifted on January 22nd and the basin was not dry until June. Even though Sutter County did not experience loss of lives with this flood, the estimated financial losses to individuals and businesses were about $18 million and agricultural losses exceeded $5 million, not including long term damage to orchard trees. Losses sustained by public agencies within the county amounted to about $10 million.

Illustrating the extent of flooding, a before and after aerial photo of the flooding of 1997 is included in Figure 4-55.

Figure 4-55 1997 Flood Event (Before and After)



Source: Sutter County Public Works

1998 Flooding

January 12, 1998 – The NCDC reported that heavy rains from a strong Pacific storm caused widespread but minor flooding across the Sacramento and Northern San Joaquin Valleys and nearby foothills. Hundreds of traffic accidents also occurred on the highways and city streets throughout the region.

January 18, 1998 – The NCDC reported that 0.75 inches of rain in 6 hours in downtown Sacramento was one of the lighter rainfall totals as a Pacific storm brought brief but heavy rain to the Sacramento and Northern San Joaquin Valleys and surrounding foothills. 27,000 customers across the area lost power at sometime during the storm. Numerous traffic accidents also occurred.

2005 Flooding

December 17, 2005 – The NCDC reported that a series of powerful but warm winter storms brought heavy rainfall to Northern California during a five day period. Five day rainfall totals in the County amounted to 3.5 to 4.5 inches.

2005/2006

Flood Damage Assessment reports for the 2005-2006 winter storms/heavy rains illustrates the impacts of some of these localized flooding issues as well as impacts associated with riverine flooding. A listing of

those areas impacted by the 2005-2006 winter storms include the following sites provided by the Sutter County Department of Public Works.

- Site No. 1: Sacramento Avenue
- Site No. 2: Keys and Natomas Road
- Site No. 3: Fifield Road
- Site No. 4: Howsely Road
- Site No. 5: East Catlett Road
- Site No. 6: Pleasant Grove Road
- Site No. 7: Pleasant Grove Road
- Site No. 8: Nicolaus Avenue
- Site No. 9: Brewer Road
- Site No. 10: Sabaco Road
- Site No. 11: Pennington Road
- Site No. 12: North Butte Road
- Site No. 13: West Butte
- Site No. 14: Kellog Road
- Site No. 15: Pass Road (Segment 1)
- Site No. 16: Pass Road (Segment 2)
- Site No. 17: Pass Road (Segment 3)
- Site No. 18: West Butte Road
- Site No. 19: Robbins Wastewater Treatment Plant
- Site No. 20: Yuba City Boat Ramp
- Site No. 21: Yuba City Boat Ramp Debris Removal

Yuba City also incurred damage as a result of high water events occurring during the 2005-2006 winter storms from December 17, 2005 through January 3, 2006. Of primary concern to the City was damage associated with two city-owned properties.

2008 Flooding

On **January 4, 2008**, a winter storm with strong winds caused loss of power throughout Northern California. sustained wind speeds were recorded at 31 MPH (gusts to 43 MPH). Throughout the day, sustained wind speeds increased to 45 MPH with gusts to 62 MPH locally. Unofficial reports of gusts from 89-92 MPH around the Sutter Buttes were later confirmed as probable by NWS based on damage sustained and radar imagery observed. Widespread wind damage caused sustained power outages to most of the county. Sheriff, fire, and public works personnel responded to reports of downed trees, downed power lines, fires, accidents, and damaged buildings. At approximately 7:00 am on January 4, 2008, the power was lost throughout Yuba City. This resulted in power being down to the Information Technology (IT) database center. This center controls IT for the county offices and provides the Critical Sheriff/Fire Services Dispatch and Law Enforcement Data Processing. The Town of Robbins lost power. With the outage the community had no fresh water or sewage treatment.

DWR and Reclamation District (RD) 70/1660 lost power to their pumps during the morning hours. The DWR pumps situated along the Sutter Bypass remove water from low lying areas for flood control. The RD 70 pumps along the Sacramento River and the RD 1660 pumps along the Tisdale Weir remove water

from low lying areas for flood control. When power is lost these areas see flooding when there is significant rainfall. On January 5, at 4:30 pm, Gilsizer Drainage District notified Yuba City Public Works of rising water in the Gilsizer Slough. This information is passed to the Sutter County Emergency Services Manager at approximately 4:45 pm. The cause of the rising water is the outage at DWR Pump Station 2. During the conversation, DWR reports Pump Station 1 is also experiencing an outage. Reports from personnel in the field indicate a slight rise in the drainage ditches in the general vicinity of Pump Station 1.

On **January 6, 2008**, a local emergency was declared due to the amount of storm damage, the continued power outage, and the strong possibility of flooding due to DWR pumps being out on the Sutter Bypass. Power outages were seen throughout the county until the morning of January 11, 2008, when the last area was restored.

2009 Flooding

March 3, 2009 – The NCDC reported a system that generated thunderstorms in the Central Valley, bringing heavy rain, flash flooding, and other severe effects. Numerous car accidents from wet roads were reported across the area, as well as trees falling from a combination of wet ground and wind. Minor flooding of rural county roads in the Nicolaus area of the County was reported.

2011 Flooding

Starting on **March 19, 2011**, a series of winter storms caused conditions of extreme peril to the safety of persons and property within this county. Disruption of electrical power at flood control pumping stations threatened homes, businesses, and roads throughout the county. Localized flooding was present in low lying areas due to the large amount of precipitation and associated drainage. The Department of Water Resources (DWR) pumping Station 3 on the Sutter Bypass lost power due to the high winds on March 19 at approximately 2000 hrs. Additionally, Reclamation Districts (RD) 1001 and 70 also lost power at their pumping stations. At approximately 11:27 am on March 21, Reclamation District 1001 reported cracking and material movement on the North levee of the Natomas Cross Canal in Verona. An area of the levee had cracking approximately 160 feet long and a drop of 3 inches on the landside at the north side of the road.

On the afternoon of **March 21, 2011**, RD1001 declared a local emergency for imminent danger of potential levee failure. It was determined that covering the cracking with Visqueen would prevent further deterioration of the levee.

On **March 22, 2011**, the damage had extended to approximately 240 feet. DWR called in California Conservation Corps who, with the assistance of local volunteers, put Visqueen and sandbags over the cracking. Over the next five days the damage grew to approximately 1000 feet long with vertical drops of material up to three feet in places. There was noticeable lateral bulging on the landside of the levee. During the course of this period of material movement, the river levels on the Sacramento River fluctuated between 34-36 feet. Once river levels dropped below 34 feet, the movement and cracking appeared to stop.

On **March 24, 2011**, Caltrans reported severe scouring of the Tenth Street Bridge (Hwy 20) and started monitoring the bridge for movement. By March 26, significant debris had piled against the Reclamation Bridge in the Tisdale Weir. This was determined not to be causing a problem for the bridge. However, there

was some concern that water flow around the debris might cause scouring to the levee. Situation was monitored and would need to be evaluated as the waters receded.

2012 Flooding

A severe winter storm event occurred over the County between November 30th and December 3rd, 2012. During this period, the wastewater treatment plant was nearly overwhelmed by inflow and infiltration. Since the treatment plant could not keep up with the influent (which was observed to be close to 100 gallons per minute), the entire collection system (including septic tank pumping system tanks) was back-charged. This placed the entire community of Robbins at risk of sanitary spills occurring both on their property and within their homes.

2017 Flooding

During the winter of 2017 a series of storms called Atmospheric Rivers inundated the Sutter Operational Area for more than a month. Most of California was impacted for these widespread warm storms. Three separate Presidential Disaster Declarations were issued and are as follows: DR-4301 (January 1-12), DR-4305 (January 18-23), and DR-4308 (February 1-23). During this time, the County responded to numerous events and incidents such as threats to the levee systems, road and highway damage, flooded areas and care and sheltering operations. Additionally, on February 12, 2017, information was received from the California Department of Water Resources (DWR} that the integrity of the emergency spillway on Oroville Dam was being compromised by erosion. The Butte County Sheriff's Department, in consultation with DWR and CAL FIRE technical experts, decided to evacuate citizens located in Butte County below Oroville Dam. Sutter County Administrator was notified by DWR and advised of the situation in Butte County, at the time of the notification it was strongly encouraged that Sutter County begin evacuation of the population as soon as possible. The County Administrative Officer in consultation with his management team and in coordination with the cities of Live Oak and Yuba City, made the decision to evacuate the County. After several days, the evacuation order was lifted and the residents were allowed to return back to their homes.

2018 Flooding

January of 2018 saw issues along Sacramento River in RD1660 and along LD1 on Feather River due to rains and increased flows from upstream dams. Homeless population evacuations in river bottoms due to rising water levels was necessary. On the Sacramento River, the closure of Lovies Landing RV Park was due to rising water and ingress/egress issues through the Park.

2019 Flooding

February 25, 2019 – A strong atmospheric river brought heavy precipitation with widespread impacts across interior Northern California. These impacts included heavy high elevation snow, flooding, debris flows, strong mountain winds, and periods of whiteout conditions. Roadway flooding was reported by CHP at 1619 Poole Blvd in Yuba City. Localized flooding occurred throughout the County.

Past Occurrences Affecting Nearby Communities

Although primarily affecting adjacent Yuba County, the 1986 and 1997 floods were the most significant flooding to occur since the completion of the Oroville Dam in 1964. This historical flood data is important to the Sutter County Planning Area as extreme flood conditions resulted in the failure of a levee that is part of the overall levee system protecting the Planning Area. Under slightly different circumstances, these same flood conditions could have resulted in a levee failure with more of a direct impact to the Sutter County Planning Area. As it was, in addition to the flooding it received, the Planning Area was also impacted through its efforts in assisting with evacuations and in providing shelter to those most affected from neighboring Yuba County. The affects of these flood events on neighboring Yuba County are described briefly below:

1986 Flooding

In February of 1896, a storm caused 6 to 9 inches of rain to fall in a 10 day period. The left levee of the Yuba River failed just upstream of the Feather River confluence (RD 784). The communities of Linda and Olivehurst were inundated, resulting in one death, 895 destroyed homes, and 150 destroyed businesses.

1997 Flooding

The left levee of the Feather River failed near Arboga (RD 784), killing one person, destroying 180 homes and businesses, and prompting evacuation of about 15,000 people from Linda and Olivehurst.

Likelihood of Future Occurrence

1% Annual Chance Flood

Occasional— The 1% annual chance flood (100-year) is the flood that has a 1 percent chance of being equaled or exceeded in any given year. This, by definition, makes the likelihood of future occurrence occasional. However, the 100-year flood could occur more than once in a relatively short period of time.

0.5% Annual Chance Flood

Unlikely—The 0.5% annual chance flood (500-year) is the flood that has a 0.5 percent chance of being equaled or exceeded in any given year. This, by definition, makes the likelihood of future occurrence unlikely.

0.2% Annual Chance Flood

Unlikely—The 0.2% annual chance flood (500-year) is the flood that has a 0.2 percent chance of being equaled or exceeded in any given year. This, by definition, makes the likelihood of future occurrence unlikely.

Climate Change and Flood

According to the CAS, climate change may affect flooding in Sutter County. While average annual rainfall may increase or decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century. It is possible that average soil moisture and runoff could decline, however, due to increasing temperature, evapotranspiration rates, and spacing between rainfall events. Reduced snowpack and increased number of intense rainfall events are likely to put additional pressure on water infrastructure which could increase the chance of flooding associated with breaches or failures of flood control structures such as levees and dams. Future precipitation projections were shown in Figure 4-30 in Section 4.3.4. Also according to the National Center for Atmospheric Research in Boulder, Colorado, Atmospheric Rivers are likely to grow more intense in coming decades, as climate changes warms the atmosphere enabling it to hold more water.

Vulnerability Assessment

Vulnerability—Extremely High

Historically, the Sutter County Planning Area has always been at risk to flooding during the rainy season from November through April. Normally, wintertime storm floodwaters are kept within defined limits by levees, dykes, and open lowlands and cause no damage. But, occasionally, extended heavy rains result in floodwaters exceeding normal high-water boundaries and causing damage. The big damaging floods of 1955, 1986, 1995, and 1997, were generally the result of failures of the levee systems rather than the levees being overtopped. Other lesser flooding events have also occurred in other years.

Several areas of the County are subject to flooding by the overtopping of rivers and creeks, levee failures, and the failure of urban drainage systems that cannot accommodate large volumes of water during severe rainstorms.

In addition to the major rivers, there are many streams, channels, canals, and creeks that serve the drainage needs of the County. There is significant threat of flooding in large areas of the county from several of these streams. Many of these streams are prone to rapid flooding with little notice.

Impacts

Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems, especially to critical facilities and infrastructure. Loss of power is usually a precursor to closure of governmental offices and community businesses. Schools may also be required to close or be placed on a delayed start schedule. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. A car will float in less than two feet of moving water and can be swept downstream into

deeper waters. This is one reason floods kill more people trapped in vehicles than anywhere else. During a flood, people can also suffer heart attacks or electrocution due to electrical equipment short outs. Floodwaters can transport large objects downstream which can damage or remove stationary structures, such as dam spillways. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwaters can also break utility lines and interrupt services. Standing water can cause damage to crops, roads, foundations, and electrical circuits. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Where flooding occurs in populated areas, warning and evacuation will be of critical importance to reduce life and safety impacts from any type of flooding.

The HMPC also noted that anything that can knock out power in Robbins will stop the water and wastewater system from operating. When the power comes back on all the pumps turning on at once can cause trouble at the wastewater plant. The grid is only fed from the south via Yolo and doesn't have redundancy like other areas of the County.

Erosion and deposition are occurring continually at varying rates over the Planning Area. Swiftly moving floodwaters cause rapid local erosion as the water carries away earth materials. This is especially problematic in leveed areas. Severe erosion removes the earth from beneath bridges, roads and foundations of structures adjacent to streams. By undercutting it can lead to increased rockfall and landslide hazard. The deposition of material can block culverts, aggravate flooding, destroy crops and lawns by burying them, and reduce the capacity of water reservoirs as the deposited materials displace water. Impacts from stream bank erosion include greater levee maintenance and increased risk of levee failure. Should the levees fail, the area protected by the levees would be flooded.

Flooding causes many impacts to agricultural production, including water contamination, damage to crops, loss of livestock, increased susceptibility of livestock to disease, flooded farm machinery, and environmental damage to and from agricultural chemicals.

Health Hazards from Flooding

Certain health hazards are also common to flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where cattle and hogs are kept or their wastes are stored can contribute polluted waters to the receiving streams.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as e. coli and other disease-causing agents.

The second type of health problems arise after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed

mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If a city or county water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

The Impact of Flood Control upon Flood Vulnerability

Continued reliance upon flood control structures in the Sutter County Planning Area and the Central Valley will be without reprieve. The history of the area, beginning with hydraulic mining techniques of the gold miners, through the ongoing conversion of agricultural lands to commercial and residential developments, makes it impossible to reverse the dependence upon structural flood control protection. Levee maintenance is a continuous effort, due to erosion and scour brought on by the channelization itself.

To address this issue, the USACE is in the process of studies and reconstruction efforts along the most critical areas of the levee system. Additional improvements to strengthen the levees and make them less susceptible to seepage induced failures to reduce the risk of flooding are a priority of local and state agencies. Once these improvements have been made, certification of these levees may be possible. While these improvements may mitigate, the risk of flooding due to levee failure, the levees will remain subject to overtopping by flood events larger than their design capacity. In addition to improvements to the existing levee system, other flood control measures are also being evaluated to provide increased levels of flood protection throughout the Planning Area. This is discussed in greater extent in Section 4.3.12.

Flooding has been frequent in the Sutter County Planning Area and the vulnerability to flood damages is high. This section quantifies the vulnerability of the Planning Area to floods.

Flood Hazard Assessment

This risk assessment for the Sutter County LHMP Update assessed the flood hazard specific to Sutter County. This included an evaluation of multiple flood hazards including the Special Flood Hazard Area (SFHA) shown on the DFIRM; Repetitive Loss (RL) Areas; localized, stormwater flooding areas; other areas that have flooded in the past, but not identified on the DFIRM; other areas of shallow flooding identified through other studies and sources; levee failure flooding; and dam failure flooding. This comprehensive flood risk assessment included an assessment of less-frequent flood hazards, areas likely to be flooded, and flood problems that are likely to get worse in the future as a result of changes in floodplain development and demographics, development in the watershed, and climate change. Existing studies, maps, historical data, and federal, state, and local community expertise and knowledge contributed to this

current flood assessment for Sutter County. An evaluation of the success of completed and ongoing flood control projects and associated maintenance aspects contributed to this flood hazard assessment and the resulting flood mitigation strategy for the Sutter County Planning Area. This flood risk assessment for this LHMP Update also includes an assessment of future flooding conditions based on historic development in the floodplains and proposed future development as further described throughout this Plan Update.

Two flood vulnerability assessments follow:

- The first focuses on the flood hazard based on FEMA Q3/DFIRM data, collectively providing coverage for the entire Sutter County Planning Area. This layer includes detailed FEMA flood zones that comprise the 1% and 0.2% annual chance floodplains and those areas not mapped or otherwise located outside of these areas. This analysis includes:
  - ✓ Values at Risk
  - ✓ Flooded Acres
  - ✓ Insurance Coverage, Claims, and Repetitive Losses
  - ✓ Populations at Risk
  - ✓ Critical Facilities at Risk
- The second focuses on the Sutter County Local Flood Hazard Area data. This data, developed by Sutter County, identifies those areas that are likely to be in a 1% annual chance flood zone once levee improvement projects are completed in the County. A primary consideration behind this local flood mapping was to provide a mechanism to establish construction standards for new development in these areas. Specifically, flood development standards for building in a FEMA Special Flood Hazard Area (SFHA) apply in these local flood hazard areas. However, since these are not FEMA maps developed as part of the County's participation in the NFIP, the requirements for maintaining flood insurance does not currently apply in the Local Flood Hazard Areas.
  - ✓ Values at Risk
  - ✓ Flooded Acres
  - ✓ Populations at Risk
  - ✓ Critical Facilities at Risk

Q3/DFIRM Flood Analysis

The Sutter County Planning Area has mapped FEMA flood hazard areas as previously described. GIS was used to determine the possible impacts of flooding within the County and how the risk varies across the Planning Area. The following methodology was followed in determining improved parcel counts and values at risk to the 1% annual chance flood event and 0.2% annual chance flood events.

Sutter County has a unique situation where the southern part of the county has 6/16/2015 DFIRMs effective, but the northern portion when Live Oak and Yuba City are located are still based on the 4/5/1988 FIRMs. Since there is no DFIRM for the northern portion of the County Q3 data that is based on the 4/5/1988 FIRMs was used to cover the northern portion of the County. Both the Q3 and DFIRM data was provided by Sutter County for this analysis.

Each of the DFIRM flood zones that begins with the letter 'A' depict the Special Flood Hazard Area, or the 1% annual chance flood event (commonly referred to as the 100-year flood). Table 4-57 explains the difference between DFIRM mapped flood zones within the 1% annual chance flood zone as well as other

flood zones located within the County. The effective DFIRM maps for the Sutter County Planning Area are shown on Figure 4-56.

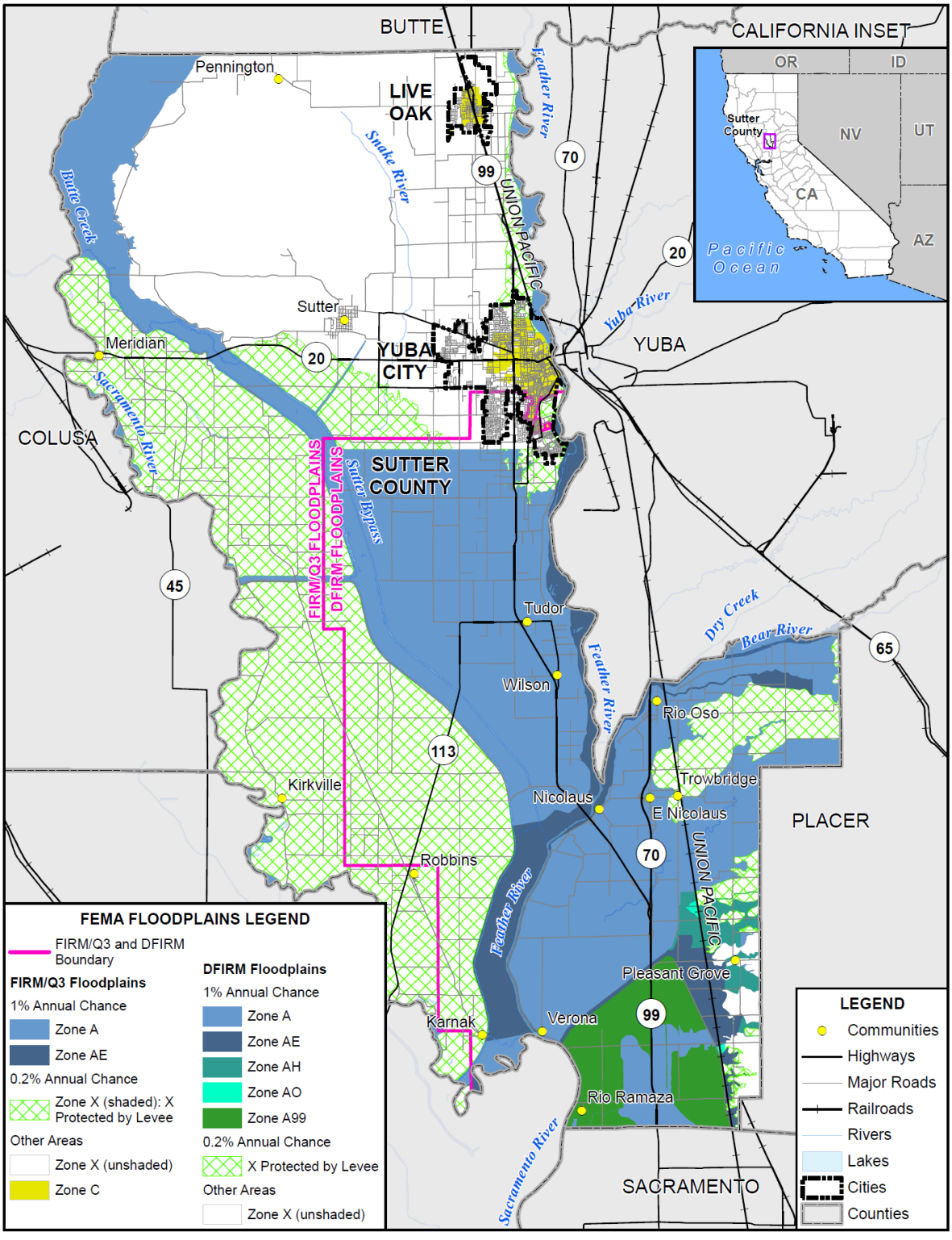
Table 4-57 Sutter County Planning Area – Q3/DFIRM Flood Hazard Zones

Flood Zone	Description
DFIRM Flood Zones	
A	1% annual chance flood: No base flood elevations provided
AE	1% annual chance flood: Base flood elevations provided
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.
X (unshaded)	No flood hazard
Q3 Flood Zones	
100-year flood	The flood that has a 1% chance of being equaled or exceeded in any given year.
A	100-year Flood: No base flood elevations provided
AE	100-year Flood: Base flood elevations provided
AH	100-year Flood: Shallow flooding, base flood depths provided
AO	100-year Flood: Sheet flow areas, base flood depths provided
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance
X (unshaded)	No flood hazard
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.

Source: FEMA

*These flood zones are from Q3 data, and are not used in current DFIRM floodplain maps.

Figure 4-56 Sutter County – Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Q3/DFIRM Values at Risk and Flood Loss Estimates Analysis

Quantifying the values at risk and estimating losses within mapped FEMA floodplains in the County is an important element in understanding the risk and vulnerability of the Sutter County Planning Area to the flood hazard.

Methodology

Sutter County's 2020 Parcel and Assessor Data, obtained from Sutter County, was used as the basis for the county inventory of parcels, values, and acres. Sutter County has a FEMA Q3 data dated April 5, 1988 and DFIRM dated 6/16/2015 which was utilized to perform the flood analysis.

In some cases, there are parcels in multiple flood zones, such as Zone A, Zone X, or Shaded X. GIS was used to create a centroid, or point representing the center of the parcel polygon. DFIRM flood data was then overlaid on the parcel layer. For the purposes of this analysis, the flood zone that intersected a parcel centroid was assigned the flood zone for the entire parcel. The parcels were segregated and analyzed in this fashion for Sutter County. Once completed, the parcel boundary layer was joined to the centroid layer and values were transferred based on the identification number in the Assessors database and the GIS parcel layer.

Analysis on values at risk to floods in the County is provided for Sutter County Planning Area and the unincorporated County in the below results section.

Limitations

It also should be noted that the resulting flood analysis estimates may actually be more or less than that presented in the below tables as the County may include structures located within the 1% or 0.2% annual chance floodplain that are elevated at or above the level of the base flood elevation, according to local floodplain development requirements. Also, it is important to keep in mind that these assessed values may be well below the actual market value of improved parcels located within the floodplain due primarily to Proposition 13, and to a lesser extent, properties falling under the Williamson Act.

Flood Loss Estimate

The loss estimate for flood is based on the total of improved and contents value. Improved parcels include those with improved structure values identified in the Assessor's database. Only improved parcels and the value of their structure improvements were included in the flood loss analysis. The value of land is not included in the loss estimates as generally the land is not at loss to floods, just the value of structure improvements and contents. The land value is represented in the detailed flood tables, but are only present to show the value of the land associated with each flood zone.

Once the potential value of affected parcels was calculated, a damage factor was applied to obtain loss estimates by flood zone. When a flood occurs, seldom does the event cause total loss of an area or building. Potential losses from flooding are related to a variety of factors including flood depth, flood velocity, building type, and construction. The percent of damage is primarily related to the flood depth. FEMA's flood benefit/cost module uses a simplified approach to model flood damage based on building type and

flood depth. The values at risk in the flood analysis tables were refined by applying an average damage estimation of 20% of the total building value. The 20% damage estimate utilized FEMA's Flood Building Loss Table based on an assumed average flood depth of 2 feet. The end result of the flood hazard analysis is an inventory of the numbers, types, and values of parcels subject to the flood hazard.

Q3/DFIRM Values at Risk and Flood Loss Estimates Results

The end result of the values at risk and flood loss estimates analysis is an inventory of the numbers, types, and values of parcels and estimated losses subject to the flood hazard by flood zone. Results are presented here first for the Sutter County Planning Area and secondly for unincorporated County. Results for the incorporated jurisdictions are presented in their annexes to this Plan.

Sutter County Planning Area

Table 4-58 and Table 4-59 contain flood analysis results for Sutter County. These tables show the number of parcels and values at risk to the 1% and 0.2% annual chance event for Sutter County. Table 4-58 shows a summary of the value of improved parcels by 1% and 0.2% annual chance flood zones in the Planning Area. Table 4-59 shows the values in each flood zone by jurisdiction for the Planning Area.

Table 4-58 Sutter County Planning Area – Count and Value of Parcels by 1% and 0.2% Flood Zone*

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood	4,236	2,529	$882,115,263.00	$431,241,330.00	$423,847,358.50	$1,737,203,951.50
0.2% Annual Chance Flood**	4,312	2,439	$696,399,454.00	$550,630,257.00	$426,875,151.50	$1,673,904,862.50
Other Areas	27,611	24,808	$2,247,689,485.00	$5,426,616,355.00	$3,563,813,541.00	$11,238,119,381.00
Grand Total	**36,159**	**29,776**	**$3,826,204,202.00**	**$6,408,487,942.00**	**$4,414,536,051.00**	**$14,649,228,195.00**

Source: FEMA 6/16/2015 DFIRM, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

Table 4-59 Sutter County Planning Area – Count and Value of Parcels by 1% and 0.2% Flood Zone by Jurisdiction*

Jurisdiction/ Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
City of Live Oak						
1% Annual Chance Flood	101	84	$3,930,576	$9,210,157	$6,781,951	$19,922,684

Jurisdiction/ Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
0.2% Annual Chance Flood	0	0	$0	$0	$	$0
Other Areas	2,735	2,250	$125,126,246	$367,297,798	$218,982,607	$711,406,651
City of Live Oak Total	**2,836**	**2,334**	**$129,056,822**	**$376,507,955**	**$225,764,558**	**$731,329,335**
City of Yuba City						
1% Annual Chance Flood	9	2	$1,738,053	$27,496	$27,496	$1,793,045
0.2% Annual Chance Flood	1,643	1,106	$82,822,130	$306,591,375	$186,796,566	$576,210,071
Other Areas	18,640	17,432	$1,396,187,358	$4,160,498,532	$2,708,953,720	$8,265,639,610
City of Yuba City Total	**20,292**	**18,540**	**$1,480,747,541**	**$4,467,117,403**	**$2,895,777,782**	**$8,843,642,726**
Unincorporated Sutter County						
1% Annual Chance Flood	4,126	2,443	$876,446,634	$422,003,677	$417,037,912	$1,715,488,223
0.2% Annual Chance Flood	2,669	1,333	$613,577,324	$244,038,882	$240,078,586	$1,097,694,792
Other Areas	6,236	5,126	$726,375,881	$898,820,025	$635,877,214	$2,261,073,120
Unincorporated Sutter County Total	**13,031**	**8,902**	**$2,216,399,839**	**$1,564,862,584**	**$1,292,993,711**	**$5,074,256,134**
Grand Total	**36,159**	**29,776**	**$3,826,204,202**	**$6,408,487,942**	**$4,414,536,051**	**$14,649,228,195**

Source: FEMA 6/16/2015 DFIRM, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance floodplain, exclusive of the 1% annual chance floodplain. The 0.2% annual chance flood also includes all parcels in the 1% annual chance floodplain.

Table 4-60 shows a summary table of loss estimates by 1% and 0.2% annual chance flood zone for the Sutter County Planning Area. The loss ratio is the loss estimate divided by the total potential exposure (i.e., total of improved and contents value for all parcels located in the Planning Area) and displayed as a percentage of loss. FEMA considers loss ratios greater than 10% to be significant and an indicator that a community may have more difficulties recovering from a flood. The County should keep in mind that the loss ratio could increase with additional development in the 1% and 0.2% annual chance flood zone, unless development is elevated in accordance with the local floodplain management ordinance.

Table 4-60 Sutter County Planning Area – Flood Loss Estimate

Flood Zone	Total Parcel Count*	Improved Parcel Count*	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance Flood	4,236	2,529	$882,115,263	$431,241,330	$423,847,359	$855,088,689	$171,017,738	1.67%
0.2% Annual Chance Flood**	4,312	2,439	$696,399,454	$550,630,257	$426,875,152	$977,505,409	$195,501,082	1.91%
Grand Total	**8,548**	**4,968**	**$1,578,514,717**	**$981,871,587**	**$850,722,511**	**$1,832,594,098**	**$366,518,820**	**3.58%**

Source: FEMA 6/16/2015 DFIRM, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual flood zone, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood also includes all parcels in the 1% annual chance flood zone.

According to the information in Table 4-58 through Table 4-60, the Sutter County Planning Area has 2,529 improved parcels and roughly $855 million of structure and contents value in the 1% annual chance flood zone. There are an additional 2,439 improved parcels and roughly $978 million of structure and contents value in the 0.2% annual chance flood event. A loss ratio of 1.67% (1% annual chance) and 1.91% (0.2% annual chance) indicates that while the Sutter County Planning Area has values at risk in the floodplain, flood losses would be somewhat limited compared to the total built environment and the community would likely be able to recover adequately.

Unincorporated Sutter County

Table 4-61 contain flood analysis results for unincorporated Sutter County. These tables show the number of parcels and values at risk to the 1% and 0.2% annual chance event for unincorporated Sutter County. Table 4-61 shows the number of improved parcels and associated structure and other improved values at risk to the each of the FEMA flood zones using the DFIRM data by property use type.

Table 4-61 Unincorporated Sutter County – Count and Value of Parcels by 1% and 0.2% Flood Zone by Property Use*

Flood Zone / Property Use / Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood						
Zone A						
Agricultural	2,313	1,541	$666,403,578	$205,572,098	$205,572,098	$1,077,547,774
Commercial	52	47	$10,988,151	$28,301,173	$28,301,173	$67,590,497
Industrial	73	33	$14,834,140	$53,871,994	$80,807,991	$149,514,125

Flood Zone / Property Use / Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Institutional	188	27	$6,578,292	$2,567,629	$2,567,629	$11,713,550
Miscellaneous	48	0	$0	$0	$0	$0
Residential	635	535	$28,982,147	$74,292,112	$37,146,056	$140,420,315
Vacant	75	0	$1,850,771	$0	$0	$1,850,771
Zone A Total	**3,384**	**2,183**	**$729,637,079**	**$364,605,006**	**$354,394,947**	**$1,448,637,032**
Zone AE						
Agricultural	165	88	$52,192,580	$8,605,627	$8,605,627	$69,403,834
Commercial	10	7	$1,436,488	$1,250,333	$1,250,333	$3,937,154
Industrial	1	0	$241,007	$0	$0	$241,007
Institutional	85	4	$3,573,878	$193,316	$193,316	$3,960,510
Miscellaneous	28	0	$0	$0	$0	$0
Residential	38	33	$6,255,380	$9,719,428	$4,859,714	$20,834,522
Vacant	22	1	$860,182	$26,336	$0	$886,518
Zone AE Total	**349**	**133**	**$64,559,515**	**$19,795,040**	**$14,908,990**	**$99,263,545**
Zone AH						
Agricultural	53	39	$15,632,791	$5,186,826	$5,186,826	$26,006,443
Commercial	1	1	$5,246	$47,977	$47,977	$101,200
Industrial	0	0	$0	$0	$0	$0
Institutional	1	0	$0	$0	$0	$0
Miscellaneous	2	0	$0	$0	$0	$0
Residential	6	3	$274,204	$350,947	$175,474	$800,625
Vacant	1	0	$90,203	$0	$0	$90,203
Zone AH Total	**64**	**43**	**$16,002,444**	**$5,585,750**	**$5,410,277**	**$26,998,471**
Zone AO						
Agricultural	4	3	$428,663	$149,173	$149,173	$727,009
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0
Miscellaneous	3	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
Vacant	0	0	$0	$0	$0	$0
Zone AO Total	**7**	**3**	**$428,663**	**$149,173**	**$149,173**	**$727,009**
Zone A99						
Agricultural	167	59	$57,511,115	$7,135,213	$7,135,213	$71,781,541
Commercial	3	3	$394,818	$2,721,497	$2,721,497	$5,837,812
Industrial	9	9	$3,281,792	$21,301,891	$31,952,837	$56,536,520

Flood Zone / Property Use / Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Institutional	123	1	$3,863,600	$19,850	$19,850	$3,903,300
Miscellaneous	0	0	$0	$0$0	$0	$0
Residential	19	9	$367,608	$690,257	$345,129	$1,402,994
Vacant	1	0	$400,000	$0	$0	$400,000
Zone A99 Total	**322**	**81**	**$65,818,933**	**$31,868,708**	**$42,174,525**	**$139,862,166**
1% Annual Chance Flood Total	**4,126**	**2,443**	**$876,446,634**	**$422,003,677**	**$417,037,912**	**$1,715,488,223**
0.2% Annual Chance Flood						
X Protected by Levee						
Agricultural	1,773	772	$569,922,574	$108,460,477	$108,460,477	$786,843,528
Commercial	47	42	$6,262,596	$8,590,234	$8,590,234	$23,443,064
Industrial	90	40	$8,734,949	$54,740,045	$82,110,068	$145,585,062
Institutional	68	18	$1,107,674	$9,587,488	$9,587,488	$20,282,650
Miscellaneous	60	0	$0	$0	$0	$0
Residential	515	461	$24,011,962	$62,660,638	$31,330,319	$118,002,919
Vacant	116	0	$3,537,569			$3,537,569
X Protected by Levee Total	2,669	1,333	$613,577,324	$244,038,882	$240,078,586	$1,097,694,792
0.2% Annual Chance Flood Total	**2,669**	**1,333**	**$613,577,324**	**$244,038,882**	**$240,078,586**	**$1,097,694,792**
Other Areas						
Zone X (unshaded)						
Agricultural	2,121	1,423	$488,684,197	$229,655,271	$229,655,271	$947,994,739
Commercial	116	97	$22,475,263	$48,762,236	$48,762,236	$119,999,735
Industrial	59	43	$9,951,070	$25,950,705	$38,926,058	$74,827,833
Institutional	132	62	$17,237,480	$42,620,844	$42,620,844	$102,479,168
Miscellaneous	34	0	$0	$0	$0	$0
Residential	3,572	3,498	$182,141,108	$551,825,611	$275,912,806	$1,009,879,525
Vacant	202	3	$5,886,763	$5,358	$0	$5,892,121
Zone X (unshaded) Total	**6,236**	**5,126**	**$726,375,881**	**$898,820,025**	**$635,877,214**	**$2,261,073,120**
Other Areas Total	**6,236**	**5,126**	**$726,375,881**	**$898,820,025**	**$635,877,214**	**$2,261,073,120**

Flood Zone / Property Use / Jurisdiction	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Unincorporated Sutter County Total	**13,031**	**8,902**	**$2,216,399,839**	**$1,564,862,584**	**$1,292,993,711**	**$5,074,256,134**

Source: FEMA 6/16/2015 DFIRM, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance floodplain, exclusive of the 1% annual chance floodplain. The 0.2% annual chance flood also includes all parcels in the 1% annual chance floodplain.

Table 4-62 shows a summary table of loss estimates by 1% and 0.2% annual chance flood zone for unincorporated Sutter County. The loss ratio is the loss estimate divided by the total potential exposure (i.e., total of improved and contents value for all parcels located in the Planning Area) and displayed as a percentage of loss. FEMA considers loss ratios greater than 10% to be significant and an indicator that a community may have more difficulties recovering from a flood. The County should keep in mind that the loss ratio could increase with additional development in the 1% and 0.2% annual chance flood zone, unless development is elevated in accordance with the local floodplain management ordinance.

Table 4-62 Unincorporated Sutter County – Flood Loss Estimate

Flood Zone	Total Parcel Count*	Improved Parcel Count*	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance Flood	4,126	2,443	$876,446,634	$422,003,677	$417,037,912	$839,041,589	$167,808,318	1.64%
0.2% Annual Chance Flood**	2,669	1,333	$613,577,324	$244,038,882	$240,078,586	$484,117,468	$96,823,494	0.95%
Grand Total	**6,236**	**5,126**	**$726,375,881**	**$898,820,025**	**$635,877,214**	**$1,534,697,239**	**$306,939,448**	**3.00%**

Source: FEMA 6/16/2015 DFIRM, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual flood zone, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood also includes all parcels in the 1% annual chance flood zone.

According to the information in Table 4-60, unincorporated Sutter County has 2,443 improved parcels and roughly $839 million of structure and contents value in the 1% annual chance flood zone. There are an additional 1,333 improved parcels and roughly $484 million of structure and contents value in the 0.2% annual chance flood event. A loss ratio of 1.67% (1% annual chance) and 1.91% (0.2% annual chance) indicates that while the Sutter County Planning Area has values at risk in the floodplain, flood losses would be somewhat limited compared to the total built environment and the community would likely be able to recover adequately.

Q3/DFIRM Flooded Acres

In addition to the centroid analysis used to obtain numbers of parcels and values at risk to flood hazards, parcel boundary analysis was performed to obtain total acres and flooded acres by flood zone for each parcel. The parcel layer was intersected with the FEMA Q3/DFIRM data to obtain the acres flooded. The following is an analysis of flooded acres in the County.

Methodology

GIS was used to calculate acres flooded by FEMA flood zones and property use categories. The Sutter County parcel layer and FEMA Q3/DFIRM were intersected, and each segment divided by the intersection of flood zone and parcels was calculated for acres. This process was conducted for 1% and 0.2% annual chance floodplain areas, with each segment being defined by zone type (A, AE, 0.2% Annual Chance, and X) and acres. The resulting data tables with flooded acreages were then imported into a database and linked back to the original parcels, including total acres by parcel number. Once this was completed, each parcel contained acreage values for flooded acre by zone type within the parcel. In the tables below, the 1% and 0.2% annual chance flood zones are summarized and then split out by property use, their total flooded acres, total improved acres, and percent of improved acres that are flooded.

Limitations

One limitation created by this type of analysis is that improvements are uniformly found throughout the parcel, while in reality, only portions of the parcel are improved, and improvements may or may not fall within the flood zone portion of a parcel; thus, areas of improvements flooded calculated through this method may be higher or lower than those actually seen in a similar real-world event.

The following tables represent a summary and detailed analysis of total acres for each FEMA Q3/DFIRM flood zone in the Planning Area. Table 4-63 gives summary information by 1% and 0.2% annual chance flood zone for the entire Sutter County Planning Area. In all of these tables, the Other Areas are areas (Zone X Unshaded – areas outside mapped flood hazard areas) outside of mapped flood hazard area.

Table 4-63 Sutter County Planning Area– Flooded Acres Summary

Jurisdiction/Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres*
City of Live Oak						
1% Annual Chance Flood	22	0.01%	18	0.01%	5	0.00%
0.2% Annual Chance Flood	0	0.00%	0	0.00%	0	0.00%
Other Areas	1,806	0.45%	1,020	0.48%	786	0.41%
City of Live Oak Total	**1,828**	**0.45%**	**1,037**	**0.49%**	**791**	**0.41%**

Jurisdiction/Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres*
City of Yuba City						
1% Annual Chance Flood	277	0.07%	254	0.12%	23	0.01%
0.2% Annual Chance Flood	670	0.17%	428	0.20%	242	0.13%
Other Areas	7,097	1.76%	5,978	2.84%	1,119	0.58%
City of Yuba City Total	**8,044**	**2.00%**	**6,660**	**3.16%**	**1,384**	**0.72%**
Unincorporated Sutter County						
1% Annual Chance Flood	159,577	39.65%	94,113	44.70%	65,464	34.11%
0.2% Annual Chance Flood	126,275	31.38%	48,643	23.10%	77,632	40.46%
Other Areas	106,727	26.52%	60,101	28.54%	46,626	24.30%
Unincorporated Sutter County Total	**392,579**	**97.55%**	**202,858**	**96.34%**	**189,722**	**98.87%**
Grand Total	**402,452**	**100.00%**	**210,555**	**100.00%**	**191,897**	**100.00%**

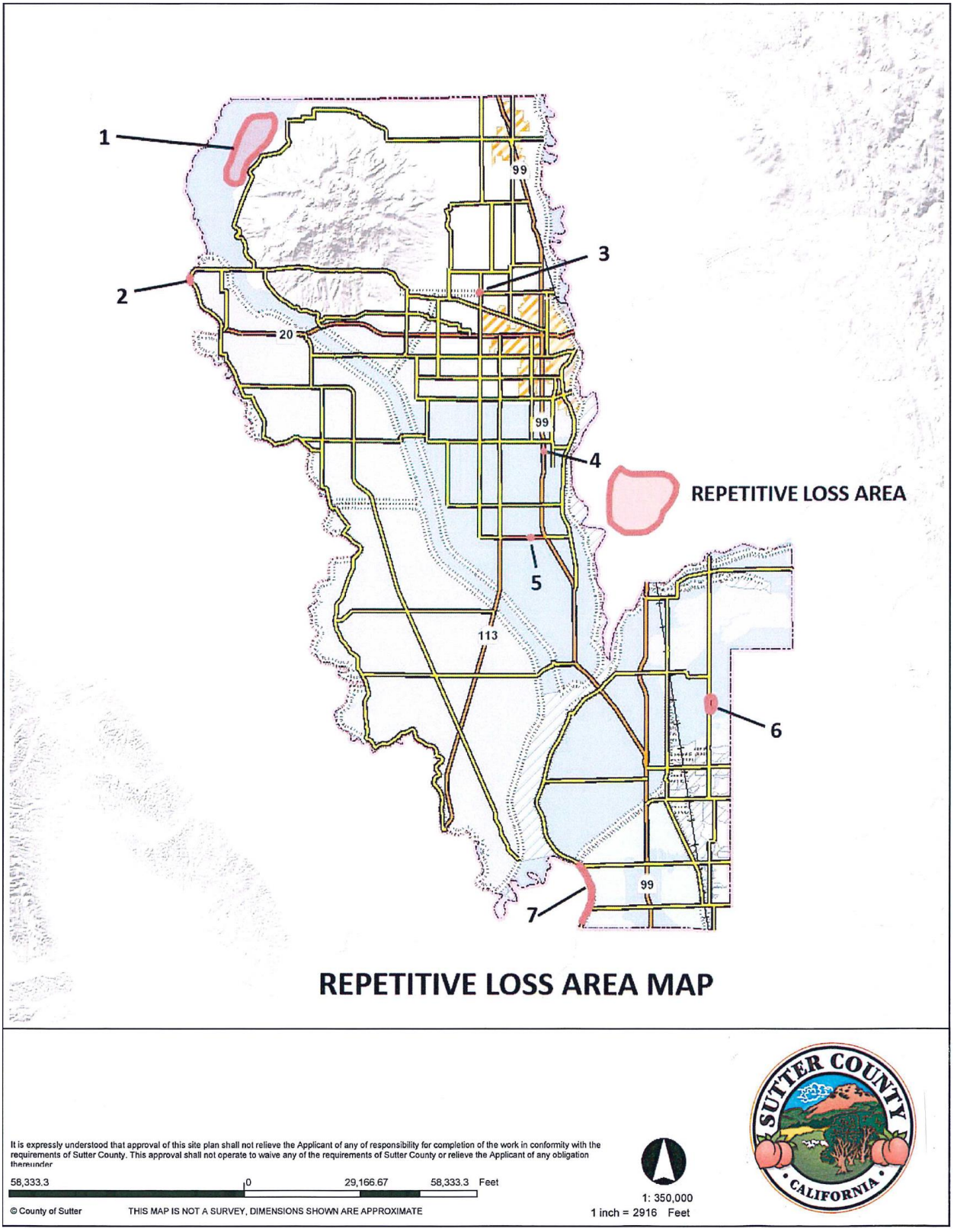
Source: FEMA DFIRM 6/6/2015, Sutter County 2020 Parcel/Assessor's Data

*percent of the total acres in Sutter County

FEMA NFIP Insurance Coverage, Claims Paid, and Repetitive Losses

Unincorporated Sutter County joined the NFIP on March 23, 1984. The County participates in the CRS, and is currently a Class 6 community, which provides for a 20% discount to flood insurance policies in the SFHA. This saves residents in the unincorporated County an estimated $191,527 each year. NFIP insurance data provided by DWR indicates that as of March 24, 2020, there were 4,044 policies in force in the unincorporated County, resulting in $1,314,845,000 of insurance in force. There have been 156 closed paid losses totaling $2,741,721.52. Of these losses, 35 were parcels in A zones and 101 parcels were in B, C, or X zone, with 20 in unknown or flood zones that no longer exist. Of the 156 claims, 108 claims were associated with pre-FIRM structures and 28 with post-FIRM structures, with 20 unknown. There are 20 repetitive loss (RL) structures, and 0 severe repetitive loss (SRL) structures in the County. There have been 14 substantial damage claims since 1978. Repetitive loss areas are shown on Figure 4-57.

Figure 4-57 Sutter County – Repetitive Loss Flood Areas



Source: Sutter County Public Works

Based on this analysis of insurance coverage, Sutter County has significant values at risk to the 1% and 0.2% annual chance and greater floods. Of the 2,443 improved parcels within the 1% annual chance flood zone, only 230 (or 9.4 percent) of those parcels maintain flood insurance. This can be seen on Table 4-64, along with insurance information from the 2 incorporated communities in the County.

Table 4-64 Sutter County Planning Area– Percentage of Policy Holders to Improved Parcels in the 1% Annual Chance Floodplain

Jurisdiction	Improved Parcels in SFHA (1% Annual Chance) Floodplain*	Insurance Policies in the SFHA (1% Annual Chance) Floodplain	Percentage of 1% Annual Chance Floodplain Parcels Currently Insured
City of Live Oak	84	0	0.0%
City of Yuba City	2	0	0.0%
Unincorporated County	2,443	230	9.4%

Source: FEMA DFIRM 6/16/2015, Sutter County 2020 Parcel/Assessor's Data

Q3/DFIRM Population at Risk

A separate analysis was performed to determine populations that reside in flood zones. Using GIS, the DFIRM Flood dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect a flood zone were counted and multiplied by the Census Bureau average household size; and tabulated by flood zone (see Table 4-65). According to this analysis, there is a population of 1,864 in the 1% annual chance flood zone, and 4,543 in the 0.2% annual chance flood zone for the entire Sutter County Planning Area. Of these, in unincorporated Sutter County, there is a population of 580 and 1,688 respectively in the 1% and 0.2% annual chance floodplains

Table 4-65 Sutter County Planning Area – Residential Population at Risk to 1% and 0.2% Annual Chance Flooding

Jurisdiction	1% Annual Chance		0.2% Annual Chance*	
	Improved Residential Parcels*	Population at Risk	Improved Residential Parcels*	Population at Risk
City of Live Oak	68	176	0	0
City of Yuba City	0	0	1,066	3,187
Unincorporated Sutter County	580	1,688	466	1,356
Total	**648**	**1,864**	**1,532**	**4,543**

Source: FEMA DFIRM 6/16/2015, US Census Bureau Average Household Sizes: City of Live Oak (2.59); City of Yuba City (2.99); unincorporated Sutter County (2.91)

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Q3/DFIRM Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Sutter County and all jurisdictions to determine critical facilities in the 1% and 0.2 annual chance flood zones. Using GIS, the DFIRM flood

zones were overlayed on the critical facility GIS layer. Figure 4-58 shows critical facilities, as well as the DFIRM flood zones. Table 4-66 summarizes the critical facilities in the County by DFIRM flood zone. Table 4-67 details critical facilities by facility type and count for the Planning Area. Details of critical facility definition, type, name and address by flood zone are listed in Appendix F. PUT PLANNING AREA AND UNINCORPORATED IN THE HEADINGS

Figure 4-58 Sutter County – Critical Facilities in DFIRM Flood Zones

Table 4-66 Sutter County – Summary of Critical Facilities in DFIRM Flood Zones

Source: Sutter County GIS, FEMA 6/16/2015 DFIRM

Table 4-67 Sutter County – Critical Facilities in DFIRM Flood Zones by Facility Category

Source: Sutter County GIS, FEMA 6/16/2015 DFIRM

Sutter County Local Flood Study Analysis

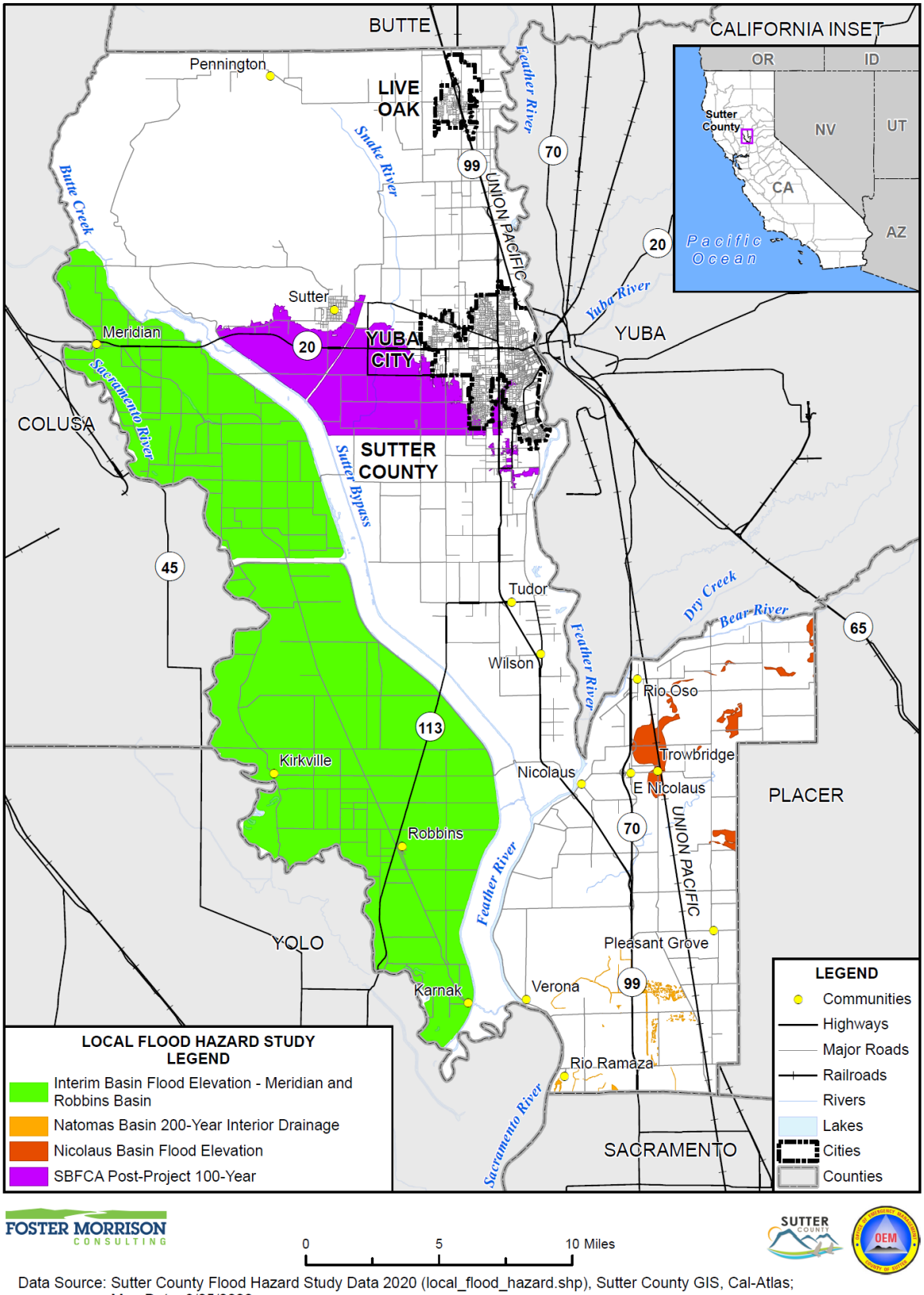
Sutter County has conducted studies and generated maps, known as the Sutter County Local Flood Study areas, that show what the flood zones will look like once the levee certification and FEMA remapping is complete in the County.

This includes the following areas and maps:

- Interim Basin Flood Elevation Map - Meridian and Robbins Basin
- Natomas Basin 200 Year Interior Drainage Study
- Nicolaus Basin Flood Elevation Map
- SBFCA Post-Project 100-Year Map

The County mapped these Local Flood Study areas, in part, to regulate new development in these areas while the levee improvement projects are completed. All new development in these areas are required to be constructed as if in a FEMA SFHA; although, unlike the FEMA SFHA requirements, flood insurance is not required in these areas. A map showing the Sutter County Local Flood Study areas is shown on Figure 4-59.

Figure 4-59 Sutter County – Local Flood Study Areas



Data Source: Sutter County Flood Hazard Study Data 2020 (local_flood_hazard.shp), Sutter County GIS, Cal-Atlas;
Map Date: 8/25/2020.

Local Flood Study Values at Risk

Quantifying the values at risk and estimating losses within the mapped Local Flood Hazard Study areas helps to understand the local areas subject to County floodplain development regulations until such time the levees improvement projects are complete and the FEMA floodplains remapped.

Methodology

The methodology and limitations for this section is the same as the Q3/DFIRM analysis above. Analysis on values at risk to floods in the County is provided for Sutter County Planning Area and the unincorporated County in the below results section.

Local Flood Study Values at Risk and Flood Loss Estimates Results

The end result of the values at risk and flood loss estimates analysis is an inventory of the numbers, types, and values of parcels and estimated losses located in these Local Flood Hazard Study areas. Results are presented here first for the Sutter County Planning Area and secondly for unincorporated County. Detailed results for the City of Yuba City are presented in their annex to this Plan. Note that there are no Local Flood Hazard Study areas in the City of Live Oak.

Sutter County Planning Area

Table 4-68 contain flood analysis results for the Sutter County Planning Area and shows the values in each Local Flood Study area by jurisdiction for the Planning Area.

Table 4-68 Sutter County Planning Area – Count and Value of Parcels in Local Flood Study Areas

Jurisdiction/Local Flood Study Area	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
City of Yuba City						
SBFCA Post-Project 100-Year Map	499	495	$29,930,078	$98,613,141	$49,708,867	$178,252,086
City of Yuba City Total	**499**	**495**	**$29,930,078**	**$98,613,141**	**$49,708,867**	**$178,252,086**
Unincorporated Sutter County						
Interim Basin Flood Elevation Map - Meridian and Robbins Basin	1,829	725	$462,427,553	$101,852,533	$101,978,609	$666,258,695
Natomas Basin 200 Year Interior Drainage Study	2	1	$1,433,793	$19,850	$19,850	$1,473,493
Nicolaus Basin Flood Elevation Map	109	82	$14,059,047	$10,533,775	$8,991,313	$33,584,135
SBFCA Post-Project 100-Year Map	1,092	903	$179,723,344	$151,150,071	$116,938,190	$447,811,605

Jurisdiction/Local Flood Study Area	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Unincorporated Sutter County Total	**3,032**	**1,711**	**$657,643,737**	**$263,556,229**	**$227,927,962**	**$1,149,127,928**
Grand Total	**3,531**	**2,206**	**$687,573,815**	**$362,169,370**	**$277,636,828**	**$1,327,380,013**

Source: Sutter County Local Flood Study, Sutter County 2020 Parcel/Assessor's Data

Unincorporated Sutter County

Table 4-69 contain flood analysis results for unincorporated Sutter County, and shows the values in each Local Flood Study area by property use.

Table 4-69 Unincorporated Sutter County – Count and Value of Parcels in Local Flood Study Areas

Local Flood Study Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Interim Basin Flood Elevation Map - Meridian and Robbins Basin						
Agricultural	1,270	404	$440,233,137	$36,801,486	$36,801,486	$513,836,109
Commercial	36	33	$3,995,331	$6,136,885	$6,136,885	$16,269,101
Industrial	68	22	$4,585,988	$29,369,735	$44,054,603	$78,010,326
Institutional	44	10	$206,974	$426,844	$426,844	$1,060,662
Miscellaneous	44	0	$0	$0	$0	$0
Residential	289	256	$10,777,388	$29,117,583	$14,558,792	$54,453,763
Vacant	78	0	$2,628,735	$0	$0	$2,628,735
Total	**1,829**	**725**	**$462,427,553**	**$101,852,533**	**$101,978,610**	**$666,258,696**
Natomas Basin 200 Year Interior Drainage Study						
Agricultural	1	0	$1,383,793	$0	$0	$1,383,793
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	1	1	$50,000	$19,850	$19,850	$89,700
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
Vacant	0	0	$0	$0	$0	$0
Total	**2**	**1**	**$1,433,793**	**$19,850**	**$19,850**	**$1,473,493**
Nicolaus Basin Flood Elevation Map						
Agricultural	65	56	$12,062,048	$6,885,608	$6,885,608	$25,833,264
Commercial	2	2	$189,071	$197,044	$197,044	$583,159
Industrial	2	1	$109,331	$18,743	$28,115	$156,189

Local Flood Study Area / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Institutional	3	3	$93,200	$328,713	$328,713	$750,626
Miscellaneous	6	0	$0	$0	$0	$0
Residential	25	20	$1,437,412	$3,103,667	$1,551,834	$6,092,913
Vacant	6	0	$167,985	$0	$0	$167,985
Total	**109**	**82**	**$14,059,047**	**$10,533,775**	**$8,991,314**	**$33,584,136**
SBFCA Post-Project 100-Year Map						
Agricultural	430	311	$137,758,570	$49,110,322	$49,110,322	$235,979,214
Commercial	19	16	$4,790,776	$6,639,987	$6,639,987	$18,070,750
Industrial	26	21	$4,657,082	$11,682,853	$17,524,280	$33,864,215
Institutional	33	10	$1,304,163	$3,610,293	$3,610,293	$8,524,749
Miscellaneous	3	0	$0	$0	$0	$0
Residential	559	545	$30,522,906	$80,106,616	$40,053,308	$150,682,830
Vacant	22	0	$689,847	$0	$0	$689,847
Total	**1092**	**903**	**$179,723,344**	**$151,150,071**	**$116,938,190**	**$447,811,605**
Unincorporated Sutter County Total	**3,032**	**1,711**	**$657,643,737**	**$263,556,229**	**$227,927,962**	**$1,149,127,928**

Source: Sutter County Local Flood Study, Sutter County 2020 Parcel/Assessor's Data

Local Flood Study Flooded Acres

In addition to the centroid analysis used to obtain numbers of parcels and values at risk to flood hazards, parcel boundary analysis was performed to obtain total acres and flooded acres by flood zone for each parcel. The parcel layer was intersected with the FEMA DFIRM data to obtain the acres flooded. The following is an analysis of flooded acres in the County.

Table 4-70 Sutter County Planning Area – Local Flood Study Flooded Acres by Jurisdiction

Jurisdiction / Flood Hazard Study	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
City of Live Oak						
Outside of Flood Hazard Study Area	1,828	0.45%	1,037	0.49%	791	0.41%
City of Live Oak Total	**1,828**	**0.45%**	**1,037**	**0.49%**	**791**	**0.41%**
City of Yuba City						
SBFCA Post-Project 100-Year	130	0.03%	124	0.06%	6	0.00%

Jurisdiction / Flood Hazard Study	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Outside of Flood Hazard Study Area	7,917	1.97%	6,537	3.10%	1,380	0.72%
City of Yuba City Total	**8,046**	**2.00%**	**6,660**	**3.16%**	**1,386**	**0.72%**
Unincorporated Sutter County						
Interim Basin Flood Elevation - Meridian and Robbins Basin	100,213	24.89%	29,221	13.88%	70,992	36.98%
Natomas Basin 200-Year Interior Drainage	396	0.10%	134	0.06%	262	0.14%
Nicolaus Basin Flood Elevation	2,572	0.64%	2,121	1.01%	451	0.23%
SBFCA Post-Project 100-Year	18,577	4.61%	12,382	5.88%	6,195	3.23%
Outside of Flood Hazard Study Area	270,944	67.30%	159,038	75.52%	111,906	58.29%
Unincorporated Sutter County Total	**392,703**	**97.55%**	**202,897**	**96.34%**	**189,806**	**98.87%**
Grand Total	**402,578**	**100.00%**	**210,594**	**100.00%**	**191,983**	**100.00%**

Source: Sutter County Local Flood Study, Sutter County 2020 Parcel/Assessor's Data

Local Flood Study Populations at Risk

A separate analysis was performed to determine populations that reside in the Local Flood Study areas. Using GIS, the Local Flood Study dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect a flood zone were counted and multiplied by the Census Bureau average household size; and tabulated by flood zone (see Table 4-71).

Table 4-71 Sutter County Planning Area– Residential Population at Risk in Local Flood Study Areas

Local Flood Study Area	City of Live Oak		City of Yuba City		Unincorporated County	
	Improved Residential Parcels*	Improved Residential Parcels*	Population at Risk	Population at Risk	Population at Risk	Population at Risk
Interim Basin Flood Elevation Map - Meridian And Robbins Basin	0	0	0	0	256	745
Natomas Basin 200 Year Interior Drainage Study	0	0	0	0	0	0
Nicolaus Basin Flood Elevation Map	0	0	0	0	20	58
SBFCA Post-Project 100-Year Map	0	0	493	1,277	545	1,568
Total	**0**	**0**	**493**	**1,277**	**821**	**2,371**

Source: Sutter County Local Flood Study, Sutter County 2020 Parcel/Assessor's Data, US Census Bureau Average Household Sizes: City of Live Oak (2.59); City of Yuba City (2.99); unincorporated Sutter County (2.91)

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Local Flood Study Critical Facilities at Risk

INSERT

Overall Community Impact

Floods and their impacts vary by location and severity of any given flood event and will likely only affect certain areas of the County during specific times. Natural areas, such as wetlands and riparian areas within the floodplain, often benefit from periodic flooding as a naturally recurring phenomenon. These natural areas often reduce flood impacts by allowing absorption and infiltration of floodwaters. Preserving and protecting these areas and associated functions are a vital component of sound floodplain management practices for Sutter County. Based on the risk assessment, it is evident that floods will continue to have potentially devastating economic impacts to certain areas of the County. However, many of the floods in the County are minor, localized flood events that are more of a nuisance than a disaster. Impacts that are not quantified, but can be anticipated in large future events, include:

- Injury and loss of life;
- Commercial and residential structural and property damage;
- Disruption of and damage to public infrastructure and services;
- Health hazards associated with mold and mildew, contamination of drinking water, etc.;
- Damage to roads/bridges resulting in loss of mobility;
- Significant economic impact (jobs, sales, tax revenue) to the community;
- Negative impact on commercial and residential property values; and

- Significant disruption to students and teachers as temporary facilities and relocations would likely be needed.
- Impact on the overall mental health of the community.

Future Development and Future Flood Conditions

This section provides an analysis of the flood hazard and proposed future development within the County based on FEMA floodplains and also discusses considerations in evaluating future flooding conditions.

Future Development: General Considerations

Communities that participate in the NFIP adopt regulations and codes that govern development in special flood hazard areas (SFHAs) and enforce those requirements through their local floodplain management ordinances through the issuance of permits. Sutter County's floodplain management ordinance provides standards for development, subdivision of land, construction of buildings, and improvements and repairs to buildings that meet, and in some instances exceed, the minimum requirements of the NFIP.

The International Residential Code (IRC) and International Building Code (IBC), by reference to ASCE 24, include requirements that govern the design and construction of buildings and structures in flood hazard areas. FEMA has determined that the flood provisions of the I-Codes are consistent with the requirements of the NFIP (the I-Code requirements shown either meet or exceed NFIP requirements). ASCE 24, a design standard developed by the American Society of Civil Engineers, expands on the minimum NFIP requirements with more specificity, additional requirements, and some limitations.

With the adoption of the International Codes, communities will be moving towards a more stringent approach to regulatory floodplain management, beyond the minimum requirements of the NFIP. The adoption and enforcement of disaster-resistant building codes is a core community action to promote effective mitigation. When communities ensure that new buildings and infrastructure are designed and constructed in accordance with national building codes and construction standards, they significantly increase local resilience now and in the future. With continued advancements in building codes, local ordinances should be reviewed and updated to meet and exceed standards as practicable to protect new development from future flood events and to further promote disaster resiliency.

One of the most effective ways to reduce vulnerability to potential flood damage is through careful land use planning that fully considers applicable flood management information and practices. Master planning will also be necessary to assure that open channel flood flow conveyances serving the smaller internal streams and drainage areas are adequately prepared to accommodate the flows. Preservation and maintenance of natural and riparian areas should also be an ongoing priority to realize the flood control benefits of the natural and beneficial functions of these areas.

Future Development and Streambank Erosion

Also to be considered in reducing flooding in areas of existing and future development is to promote implementation of stormwater program elements and erosion and sediment controls, including the clearing of vegetation from natural and man-made drains that are critical to flood protection. Both native and invasive species can clog drains, and reduce flows of floodwaters, which slow that natural drainage process

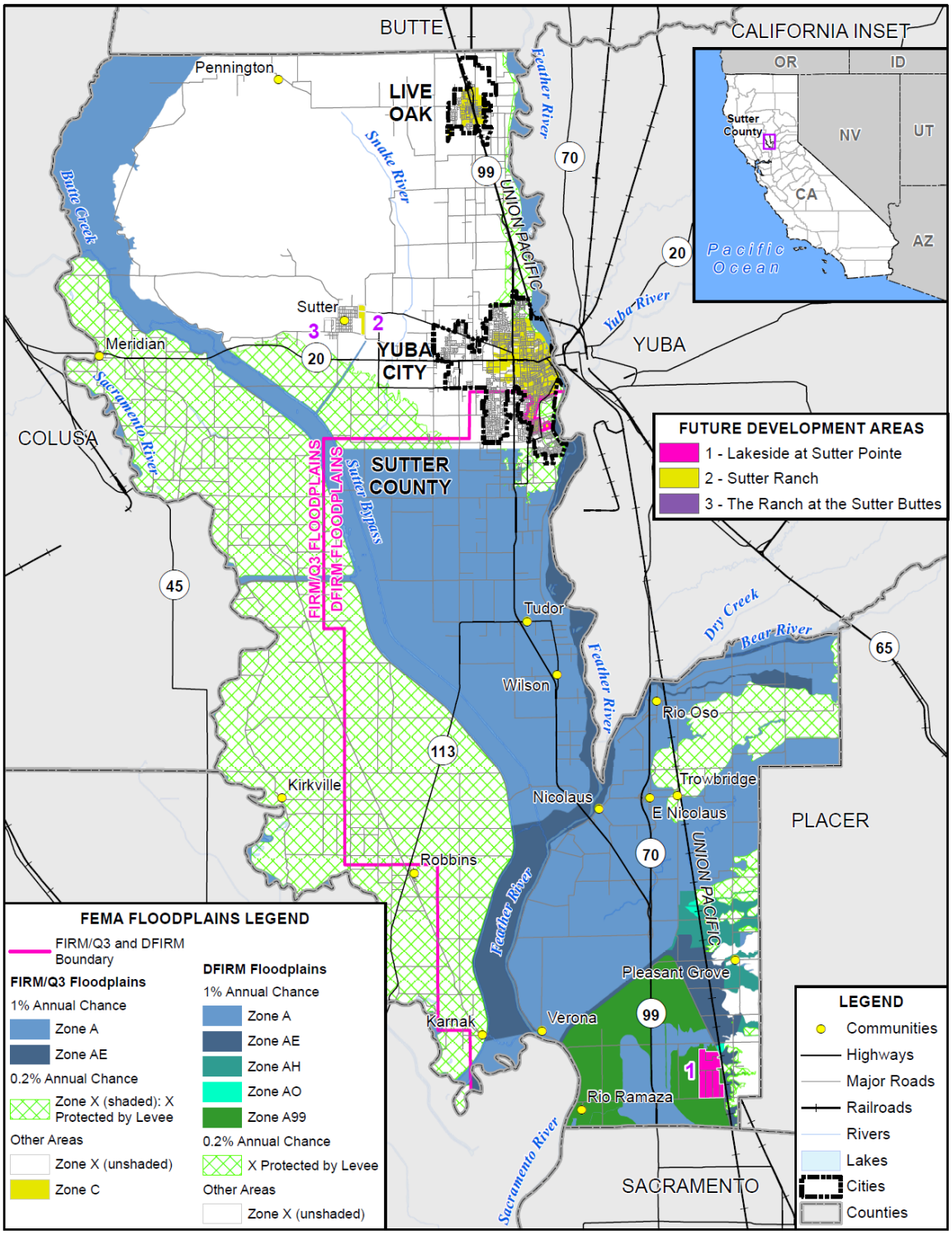
and can exacerbate flooding. Planned developments should take erosion risk areas into account during the construction of new homes and commercial properties. Erosion to streambanks may increase as development increases the amount of impervious surface that would normally hold or slow rainwaters. The County will continue to enforce the zoning and subdivision ordinances that are discussed in Section 4.4.1.

Future Development: GIS Analysis

Sutter County's 2020 Parcel/Assessor's data and data from the County planning department were used as the basis for the unincorporated County's inventory of parcels and acres of future development areas. Using the GIS parcel spatial file and the APNs, the three future development projects were mapped.

For the flood analysis of future development areas, the parcel data was converted to a point layer using a centroid conversion process, in which each parcel was identified by a central point and linked to the Assessor's data. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts and acreage within each FEMA flood zone. Q3/DFIRM flood zones and future development areas are shown on Figure 4-60 and parcels and acreages in those areas are shown in Table 4-72.

Figure 4-60 Unincorporated Sutter County – Future Development in Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

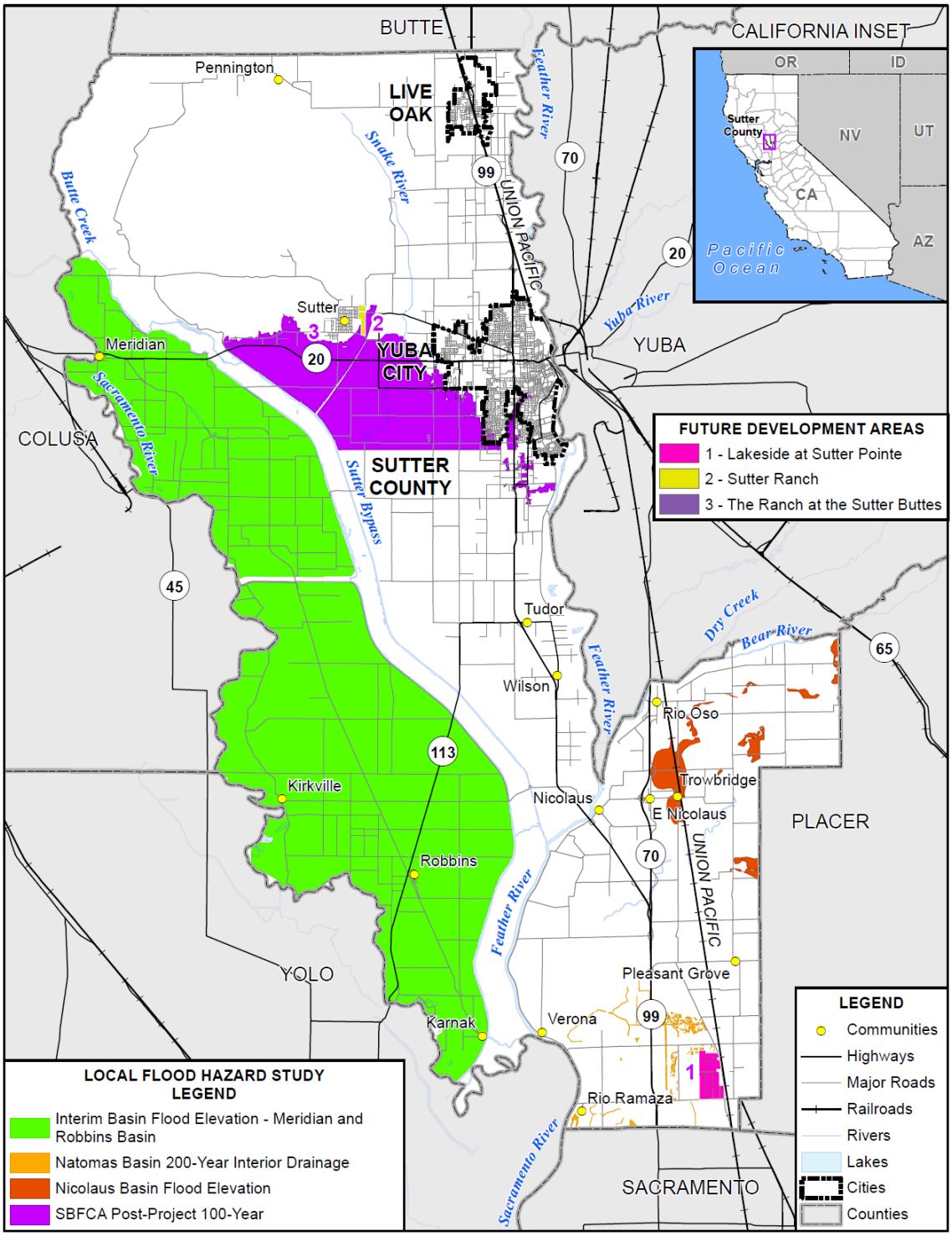
Table 4-72 Unincorporated Sutter County – Future Development Parcels and Acres in Q3/DFIRM Flood Zones

Flood Zone Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
1% Annual Chance Flood Hazard			
Lakeside at Sutter Pointe	6	4	871.2
1% Annual Chance Flood Hazard Total	**6**	**4**	**871.2**
Other Areas			
Sutter Ranch	2	1	137.4
The Ranch at the Sutter Buttes	15	2	8.2
Other Areas Total	**17**	**3**	**145.7**
Unincorporated Sutter County Total	**23**	**7**	**1,016.9**

Source: FEMA 6/16/2015 DFIRM, Sutter County Sutter County GIS

Sutter County Local Flood Hazard areas and future development areas are shown on Figure 4-61 and parcels and acreages in those areas are shown in Table 4-73.

Figure 4-61 Unincorporated Sutter County – Future Development in Local Flood Hazard Areas



Data Source: Sutter County Flood Hazard Study Data 2020 (local_flood_hazard.shp), Sutter County GIS, Cal-Atlas;
Map Date: 2/15/2021.

Table 4-73 Unincorporated Sutter County – Future Development Parcels and Acres in Local Flood Hazard Study Areas

Flood Zone Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
SBFCA Post-Project 100-Year Map			
Sutter Ranch	1	1	101.1
Total	**1**	**1**	**101.1**

Source: Sutter County Local Flood Hazard Study, Sutter County GIS

Future Flood Conditions: The Effects of Climate Change

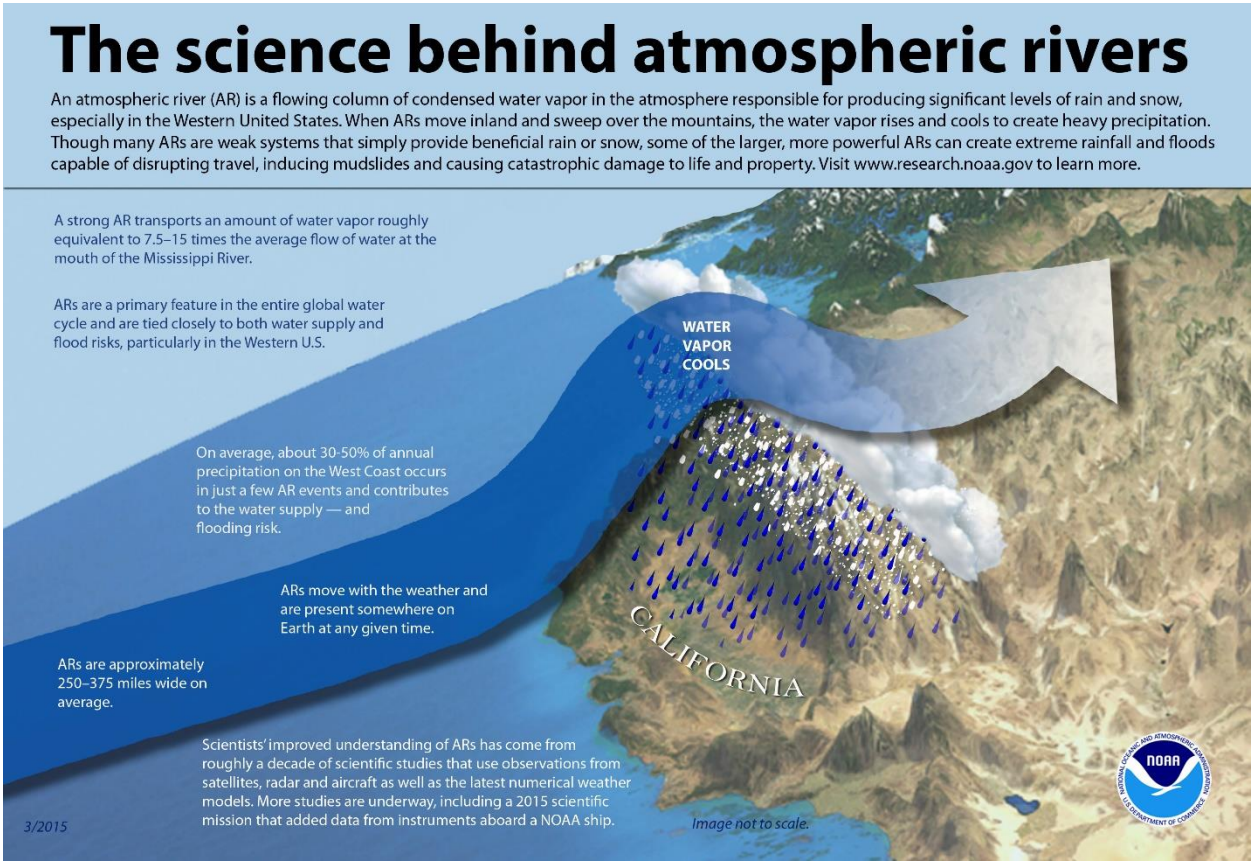
The effects of climate change on future flood conditions should also be considered. While the risk and associated short and long-term impacts of climate change are uncertain, experts in this field tend to agree that among the most significant impacts include those resulting from increased heat and precipitation events that cause increased frequency and magnitude of flooding. Changes associated with climate change and flooding could be significant given the higher elevations in neighboring counties where winter snow could turn to more significant rain events. Increases in damaging flood events will cause greater property damage, public health and safety concerns displacement, and loss of life. In addition, an increase in the magnitude and severity of flood events can lead to potential contamination of potable water and contamination of food crops given the agricultural industry in the County. Displacement of residents can include both temporary and long-term displacement, increase in insurance rates or restriction of coverage in vulnerable areas.

Sutter County will continue to study the risk and vulnerability associated with future flood conditions, both in terms of future growth areas and other considerations such as climate change, as they evaluate and implement their flood mitigation and adaptation strategy for the Sutter County Planning Area.

Future Flood Conditions: Atmospheric Rivers

Sutter County and the rest of Northern California can be affected by a phenomenon known as an atmospheric river. According to the NOAA, atmospheric rivers are relatively long, narrow regions in the atmosphere – like rivers in the sky – that transport most of the water vapor outside of the tropics. These columns of vapor move with the weather, carrying an amount of water vapor roughly equivalent to the average flow of water at the mouth of the Mississippi River. When the atmospheric rivers make landfall, they often release this water vapor in the form of rain or snow. This can be seen in Figure 4-62.

Figure 4-62 Atmospheric Rivers



Source: NOAA

Although atmospheric rivers come in many shapes and sizes, those that contain the largest amounts of water vapor and the strongest winds can create extreme rainfall and floods, often by stalling over watersheds vulnerable to flooding. These events can disrupt travel, induce mudslides and cause catastrophic damage to life and property. A well-known example is the "Pineapple Express," a strong atmospheric river that is capable of bringing moisture from the tropics near Hawaii over to the U.S. West Coast.

Not all atmospheric rivers cause damage; most are weak systems that often provide beneficial rain or snow that is crucial to the water supply. Atmospheric rivers are a key feature in the global water cycle and are closely tied to both water supply and flood risks — particularly in the western United States.

While atmospheric rivers are responsible for great quantities of rain that can produce flooding, they also contribute to beneficial increases in snowpack. A series of atmospheric rivers fueled the strong winter storms that battered the U.S. West Coast from western Washington to southern California from Dec. 10–22, 2010, producing 11 to 25 inches of rain in certain areas. These rivers also contributed to the snowpack in the Sierras, which received 75 percent of its annual snow by Dec. 22, the first full day of winter.

Future Flood Conditions: ARkStorm Scenario

Also to be considered in evaluating potential "worst case" future flood conditions, is the ARkStorm Scenario. Although much attention in California's focuses on the "Big One" as a high magnitude earthquake, there is the risk of another significant event in California – a massive, statewide winter storm. The last such storms occurred in the 19th century, outside the memory of current emergency managers, officials, and communities. However, massive storms are a recurring feature of the state, the source of rare but inevitable disasters. The USGS Multi Hazards Demonstration Project's (MHDP) developed a product called ARkStorm, which addressed massive U.S. West Coast storms analogous to those that devastated California in 1861-1862. Over the last decade, scientists have determined that the largest storms in California are the product of phenomena called Atmospheric Rivers, and so the MHDP storm scenario is called the ARkStorm, for Atmospheric River 1000 (a measure of the storm's size).

Scientific studies of offshore deposits in northern and southern California indicate that storms of this magnitude and larger have occurred about as often as large earthquakes on the southern San Andreas Fault. Such storms are projected to become more frequent and intense as a result of climate change. This scientific effort resulted in a plausible flood hazard scenario to be used as a planning and preparation tool by hazard mitigation and emergency response agencies.

For the ARkStorm Scenario, experts designed a large, scientifically realistic meteorological event followed by an examination of the secondary hazards (e.g., landslides and flooding), physical damages to the intense winter storms of 1861-62 that left California's Central Valley impassible. Storms far larger than the ARkStorm, dubbed megastorms, have also hit California at least six times in the last two millennia.

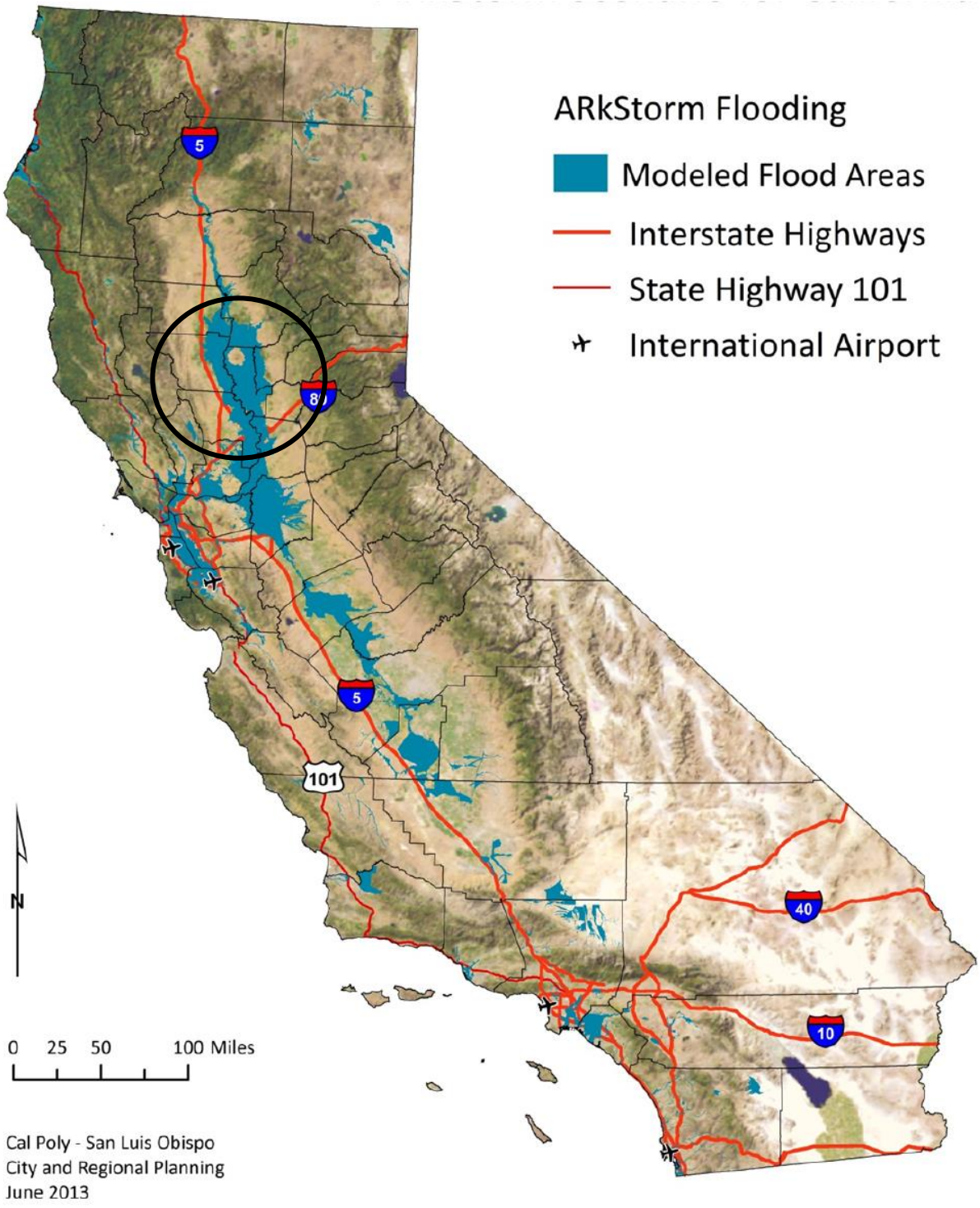
The ARkStorm produces precipitation in many places exceeding levels experienced on average every 500 to 1,000 years. Extensive flooding in many cases overwhelms the state's flood protection system, which is at best designed to resist 100- to 200-year runoffs (many flood protection systems in the state were designed for smaller runoff events). The Central Valley experiences widespread flooding. Serious flooding also occurs in Orange County, Los Angeles County, San Diego, the San Francisco Bay Area, and other coastal communities. In some places, winds reach hurricane speeds, as high as 125 miles per hour. Hundreds of landslides occur, damaging roads, highways, and homes. Property damage exceeds $300 billion, most of it from flooding. Agricultural losses and other costs to repair lifelines, dewater flooded islands, and repair damage from landslides brings the total direct property loss to nearly $400 billion, of which only $20 to $30 billion would be recoverable through public and commercial insurance. Power, water, sewer, and other lifelines experience damage that takes weeks or months to restore. Flooding evacuation could involve over one million residents in the inland region and Delta counties.

A storm of ARkStorm's magnitude has important implications: 1) it raises serious questions about the ability of existing national, state, and local disaster policy to handle an event of this magnitude; 2) it emphasizes the choice between paying now to mitigate, or paying a lot more later to recover; 3) innovative financing solutions are likely to be needed to avoid fiscal crisis and adequately fund response and recovery costs; 4) responders and government managers at all levels could be encouraged to conduct self-assessments and devise table-top exercises to exercise their ability to address a similar event; 5) the scenario can be a reference point for application of FEMA and Cal OES guidance connecting federal, state, and local natural hazards mapping and mitigation planning under the NFIP and Disaster Mitigation Act of 2000; and 6)

common messages to educate the public about the risk of such an extreme event could be developed and consistently communicated to facilitate policy formulation and transformation.

Figure 4-63 depicts an ARkStorm modeled scenario showing the potential for flooding primarily in the Central Valley as the result of a large storm. In Sutter County, the modeled scenario suggests the County could be inundated almost fully in this ARkStorm model scenario.

Figure 4-63 Projected ARkStorm Flooding in California



Source: USGS ArkStorm

4.3.11. Flood: Localized Flooding

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

Localized, stormwater flooding also occurs throughout the County during the rainy season from November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration. Most runoff is pumped into the Sutter Bypass out of the Gilsizer Slough and Live Oak Canal. Flooding is more severe when previous rainfall has created saturated ground conditions. Urban storm drainpipes and pump station have a finite capacity. When rainfall exceeds this capacity, or the system is clogged, water accumulates in the street until it reaches a level of overland release. This type of flooding may occur when intense storms occur over areas of development.

Within the county and cities, there are several areas not mapped on FEMA or local flood maps where mostly minor, but sometimes more substantial field, road, and street flooding occur from the relatively large storms that have occurred over the last 10 years.

Stormwater drainage throughout much of Sutter County is provided by piped storm drain conveyance systems and open channel systems. Stormwater flowing in these systems is either pumped or gravity drains the water into the Sacramento River, the Sutter Bypass, or the Feather River. These stormwater systems are owned and operated by a variety of agencies including reclamation districts, cities, Sutter County, and the State of California.

PLEASE UPDATE BELOW STATUS OF STORMWATER SYSTEMS

Stormwater drainage facilities are typically sized to address design storms with return frequencies of 2-years to 100-years. A storm with a 2-year rainfall or a larger event is statistically expected to return once every 2 years over a long term average. Alternatively, a storm with a 2-year rainfall or a larger event has a 50 percent probability of occurring in any single year. A storm with a 100-year rainfall or a larger event is statistically expected to return once every 100 years over a long term average. Alternatively, a storm with a 100-year rainfall or a larger event has a 1 percent probability of occurring in any single year. Design storm rainfall depths have been determined for Sutter County, as summarized in Table 4-74.

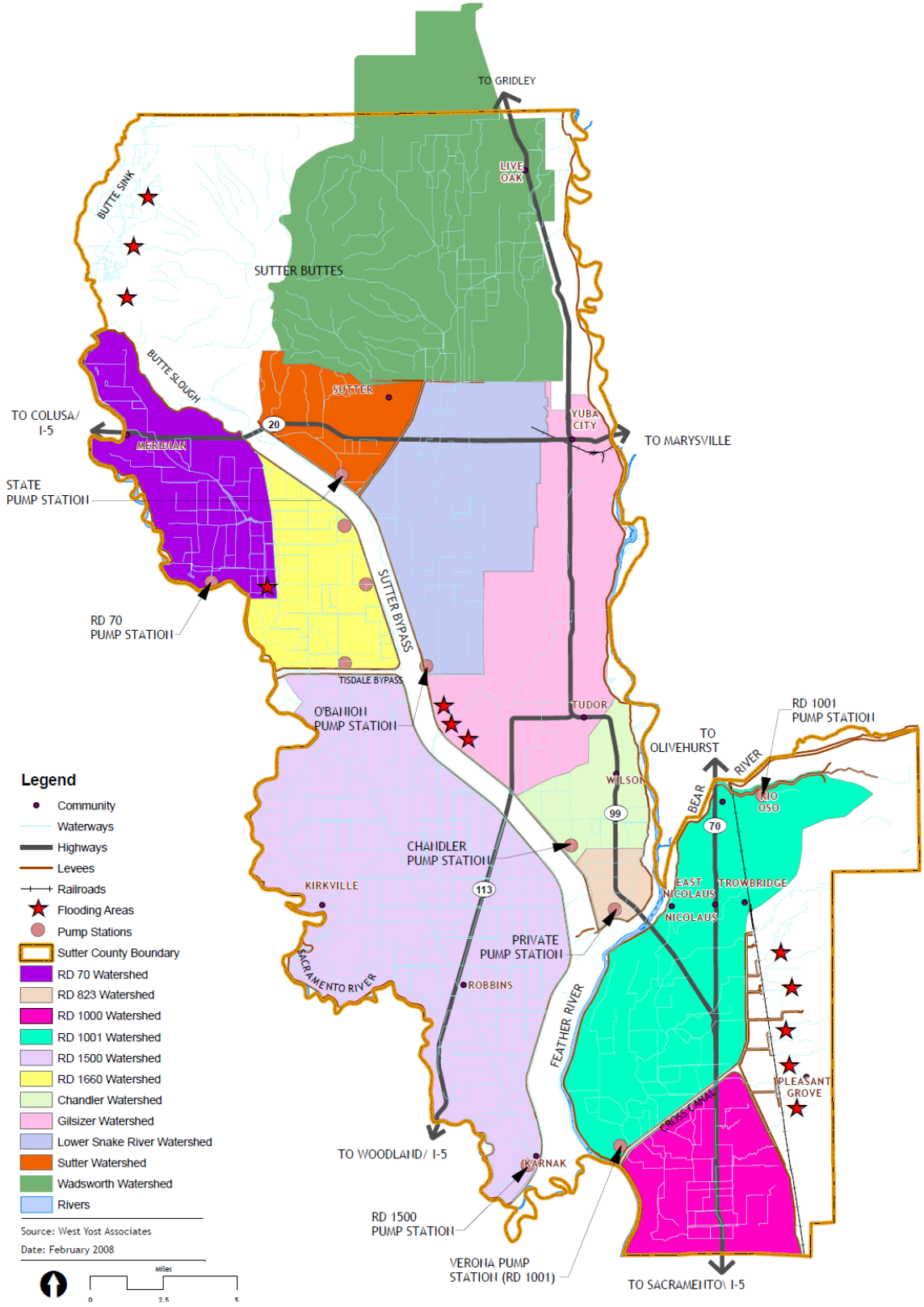
Table 4-74 Average Design Storm Rainfall Depths for Sutter County

Design Storm Return Frequency	Rainfall Depth for 1-day Duration	Rainfall Depth for 4-day Duration
2-year	1.91	2.90
10-year	2.98	4.86
100-year	4.23	7.16

Source: Goodridge, James D., Design Rainfall Study for Sutter County, prepared for Sutter County, June 11, 1998.

Most of Sutter County is protected from significant flooding from the Feather River and the Sutter Bypass by levees; consequently, most of the rainfall and resulting runoff must be pumped into the Feather River. This is done with the pump stations shown as red dots on Figure 4-64. However, one exception to this is the Wadsworth Basin (shown in green on Figure 4-64) which flows by gravity into the Wadsworth Canal and then into the Sutter Bypass. Another exception is the west half of the Sutter Buttes and the Butte Sink Area, which is located west of the Sutter Buttes (the unshaded area on Figure 4-64). These areas simply drain into the Sutter Bypass. STILL TRUE? DOES LOCALIZED FLOODING CAUSE PROBLEMS IN THE COUNTY? PLEASE UPDATE

Figure 4-64 Location of Pump Stations in Sutter County

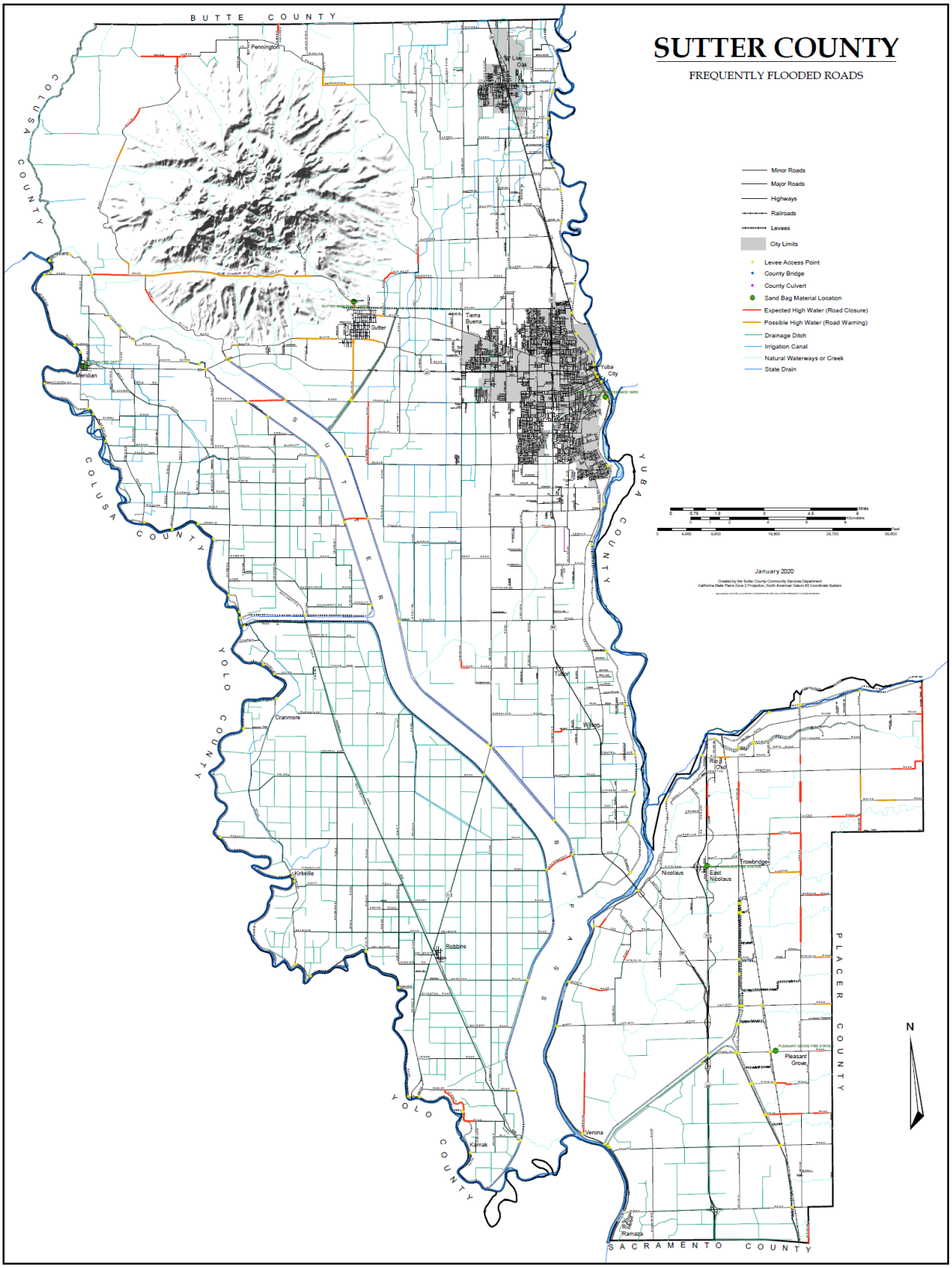


Source: Sutter County General Plan Technical Background Report

Location and Extent

According to Sutter County, numerous parcels and roads throughout the County not included in the FEMA % and 0.2% annual chance floodplains and Local Flood Study areas are subject to flooding in heavy rains. In addition to flooding, damage to these areas during heavy storms includes pavement deterioration, washouts, mudslides, debris areas, and downed trees. The frequency and type of damage or flooding that occurs varies from year to year, depending on the quantity of runoff. There is no established scientific scale or measurement system for localized flooding. Localized flooding is generally measured by depth of flooding and the area affected. Localized flooding often happens quickly and has a short speed of onset. Localized flooding often has a short duration. Localized flooding areas in the County are shown on Figure 4-65 and in Table 4-39.

Figure 4-65 Sutter County – Frequently Flooded Roads



Source: Sutter County Public Works January 2020

Table 4-75 Sutter County Localized Flooding Areas

Road/Area Name	Flooding	Pavement Deterioration	Washouts	High Water/ Creek Crossing	Landslides/ Mudslides	Debris	Downed Trees
Almond Orchard Road	X					X	
Bear River Road	X	X					
Brewer Road	X	X	X			X	X
Butte House Road	X					X	X
Catlett Road	X		X			X	
East Butte Road	X	X	X		X	X	X
Fifield Road	X		X		X	X	
Franklin Road	X	X	X				
Hagaman road	X						
Hicks Road	X	X				X	X
Howsley Road	X	X				X	
Hughes	X	X	X			X	X
Kellogg Road	X	X	X		X	X	X
Kempton Road	X	X					
Keyes Road	X	X	X				
Lower Pass Road	X	X	X			X	X
Metter Road	X	X					
Nicolaus Ave	X	X					
North Butte Rd	X	X	X		X	X	X
Oswald	X	X				X	X
Pass Road	X	X	X		X	X	
Pennington Road	X	X	X			X	X
Placer Road	X	X					
Pleasant Grove Road	X	X	X			X	
Powell road	X	X	X			X	X
Reclamation Road	X	X			X		
Sacramento Avenue	X	X	X			X	X
South Butte Road	X	X	X			X	X
Subaco Road		X	X		X		
West Butte Road	X	X	X		X	X	

Source: Sutter County

According to the 2015 FIS for the County, the severity of flooding is often intensified by backwater conditions between stream systems. This occurs when floodwater elevations are increased in lower portions of tributary streams due to the backwater effect from main streams reducing hydraulic gradients and flow-storage areas. The 2015 FIS identified several areas where the high flow of floodwaters cause backwater conditions on other channels:

- High flows on the Sacramento River generate backwater conditions on the lower reaches of the Cross Canal.
- The American River peak 1-percent-annual-chance flows induce backwater conditions in the lower reach of the Natomas East Main Drainage Canal.
- Coincidentally, high flows on the Natomas East Main Drainage Canal cause backwater conditions on the lower reaches of Arcade and Dry Creeks.
- High flows on Cross Canal create backwater conditions on Pleasant Grove Creek Canal.

The 2015 FIS also noted localized flooding issues on the Bear River and its tributaries.

Past Occurrences

Disaster Declarations

There are no identified state or federal disaster declarations for localized flooding, as shown in Table 4 4. However, localized flooding was likely an issue during previous declarations for severe storms, heavy rains and floods. The County had no USDA disaster declarations since 2012 related to localized flood, as shown on Table 4-6.

NCDC Events

The past occurrences of localized flooding are included in the 1% and 0.2% annual Chance Flood profile in Section 4.2.10.

Hazard Mitigation Planning Committee Events

The HMPC noted that localized flooding is an annual occurrence. The HMPC also noted that localized flooding has varying effects in the County. The Sutter County Public Works reviewed past road closures from localized flooding that have occurred since the 2016 Plan Update. Events in 2016 and 2017 are shown in Table 4-76, and flooded areas in 2019 are shown on Figure 4-66.

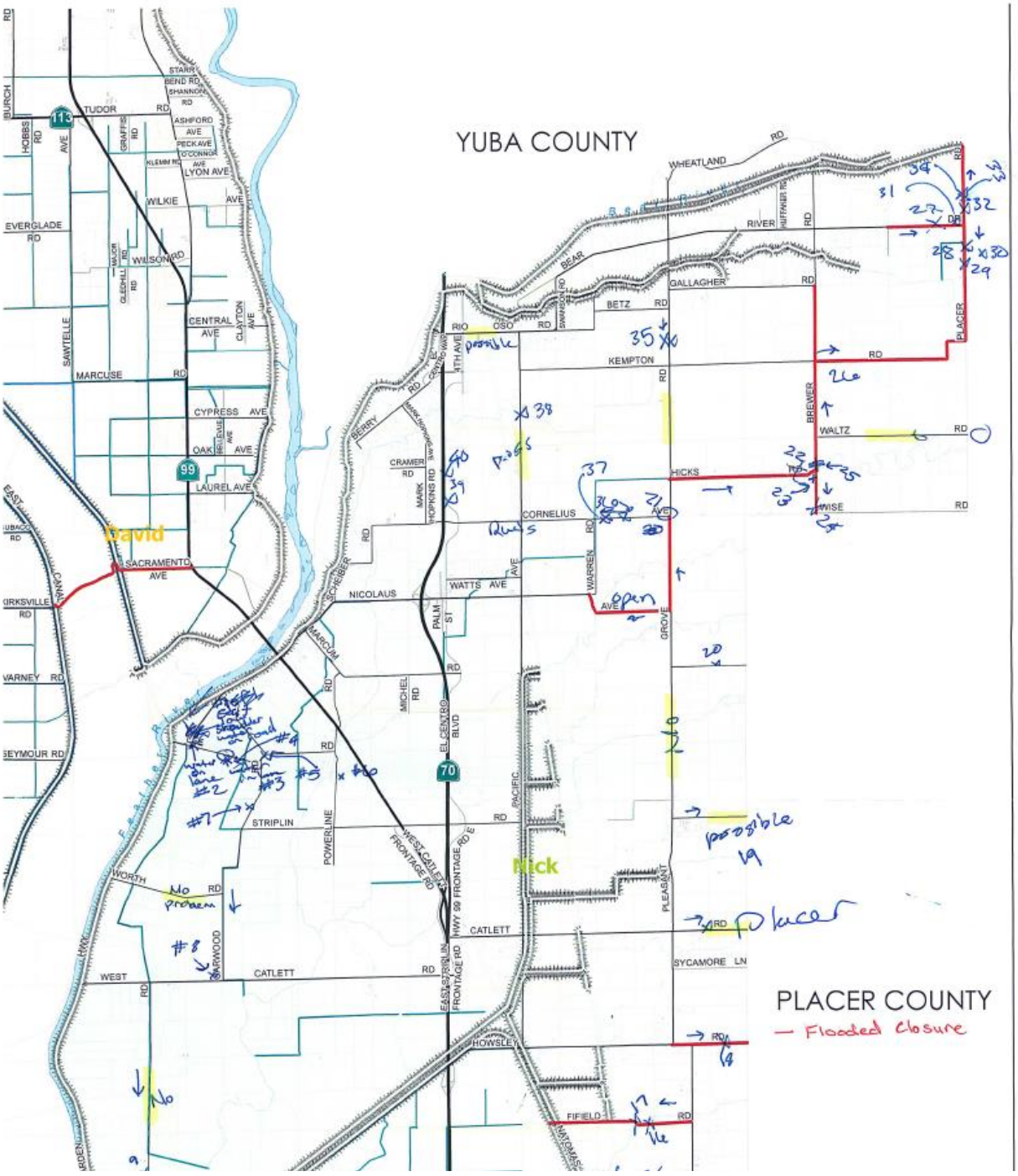
Table 4-76 Suter County – Localized Flooding Road Closures in 2016 and 2017

Road	From	To	Closed	Reason
Franklin Road	Acacia Ave	Tarke Road	12/12/2016	Flooding
Fifield Rd	Natomas Rd	Pleasant Grove Rd	1/3/2017	Flooding
West Butte Rd	Pass Rd.	North Butte Rd.	1/7/2017	Flooding
Bear River Rd.	Pleasant Grove Rd.	Riosa Rd.	1/8/2017	Flooding
Kempton Rd.	Brewer Rd.	Placer Rd.	1/8/2017	Flooding

Road	From	To	Closed	Reason
Placer Rd.	Kempton Rd.	Riosa Rd.	1/8/2017	Flooding
Howsley Rd	Pleasant Grove Rd.	Placer County Line	1/8/2017	Flooding
Hicks Rd.	Pleasant Rd.	Brewer Rd.	1/8/2017	Flooding
Brewer Rd.	Hicks Rd.	West Wise Rd.	1/8/2017	Flooding
Pleasant Rd.	Riego Rd.	Sac County Line	1/8/2017	Flooding
Pleasant Grove Rd.	Cornelius Ave.	Nicolaus Ave.	1/8/2017	Flooding
Keys, Rd.	Pleasant Grove Rd.	Natomas Rd.	1/8/2017	Flooding
Pleasant Grove Rd.	Riego Rd.	Sankey Rd.	1/8/2017	Flooding
Sacramento Ave.	East Levee	Kirkville Rd.	1/9/2017	Flooding
Nicolaus Ave.	Warren Rd.	Pleasant Grove Rd.	1/9/2017	Flooding
Pleasant Grove Rd.	Nicolaus Ave.	Marcum Rd.	1/9/2017	Flooding

Source: Sutter County Public Works

Figure 4-66 Sutter County – 2019 Localized Flood Road Closures and Impact Areas



Source: Sutter County Public Works

Likelihood of Future Occurrence

Highly Likely— With respect to localized, stormwater flood issues, the potential for flooding may increase as storm water is channelized due to land development. Such changes can create localized flooding

problems in and outside of natural floodplains by altering or confining natural drainage channels. Urban storm drainage systems have a finite capacity. When rainfall exceeds this capacity or systems clog, water accumulates in the street until it reaches a level of overland release. With older infrastructure, this type of flooding will continue to occur on an annual basis during heavy rains.

Climate Change and Localized Flood

Even if average annual rainfall may decrease slightly, the intensity of individual rainfall events is likely to increase during the 21st century, increasing the likelihood of overwhelming stormwater systems built to historical rainfall averages. This makes localized flooding more likely.

Vulnerability Assessment

Vulnerability—Medium

Historically, the Sutter County Planning Area has been at risk to flooding primarily during the winter and spring months when stream systems in the County swell with heavy rainfall. Localized flooding also occurs throughout the Planning Area at various times throughout the year with several areas of primary concern unique to each community as detailed above.

Impacts

Localized flooding can cause damage to roads, infrastructure and utilities, as well as to buildings in the County. Temporary road closures due to localized flooding can be a significant issue in the County. In addition to flooding and road closures, damage to these areas during heavy storms includes, pavement deterioration, washouts, landslides/mudslides, debris areas, and downed trees. Local community service districts have seen infiltration and inflow into sewer systems during heavy rain and localized flooding events. Power outages can be a significant concern during these events, especially in those areas that rely on pumping to alleviate local flood conditions. Life safety issues from localized flooding would be more limited. Flooding causes many impacts to agricultural production, including water contamination, damage to crops, loss of livestock, increased susceptibility of livestock to disease, flooded farm machinery, and environmental damage to and from agricultural chemicals.

Future Development

The potential for flooding may increase as storm water is channelized due to land development. Such changes can create localized flooding problems in and outside of natural floodplains by altering or confining natural drainage channels. The risk of stormwater/localized flooding to future development can be minimized by accurate recordkeeping of repetitive localized storm activity. Mitigating the root causes of the localized stormwater flooding or choosing not to develop in areas that often are subject to localized flooding will reduce future risks of losses due to stormwater/localized flooding.

Any floodplain modeling and master planning should be based on the ultimate built-out land use in order to assure that all new development remains safe from future hydrologic conditions. While local floodplain management, stormwater management, and water quality regulations and policies address these changes on a site-by-site basis, their cumulative effects can continue to result in floodplain impacts.

4.3.12. Levee Failure

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

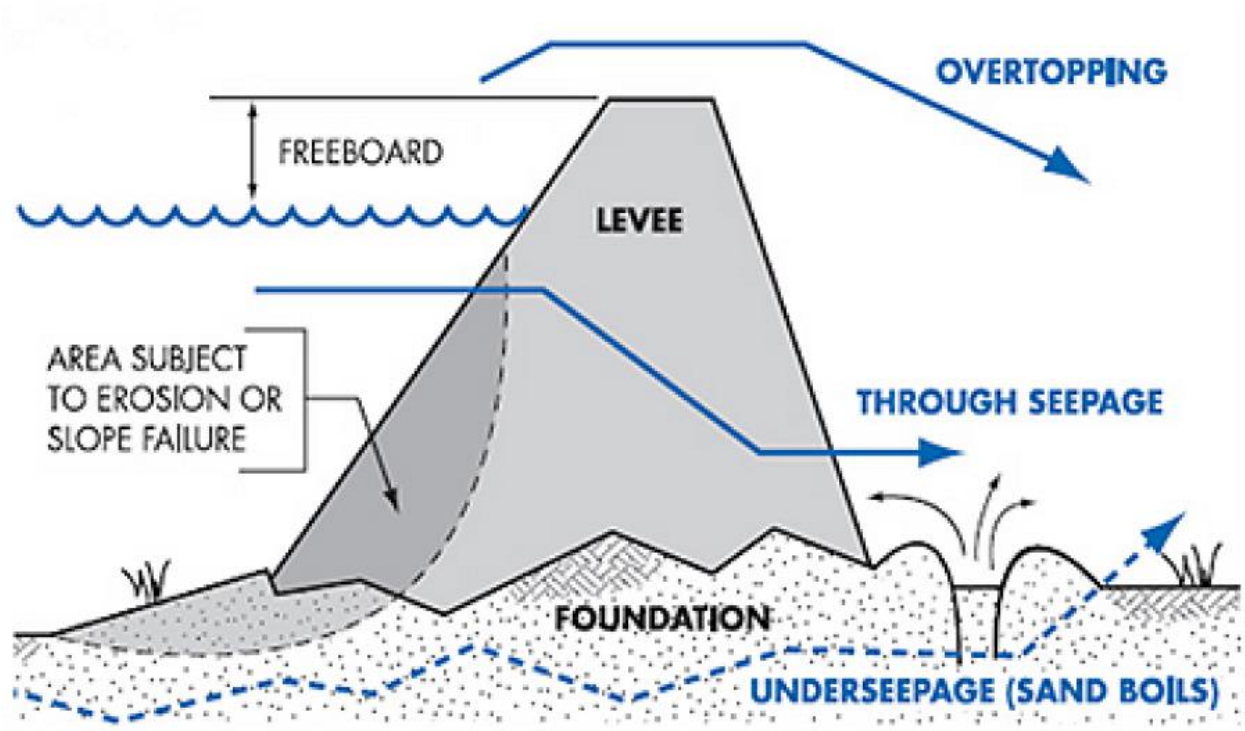
Hazard/Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high-water velocities. It is important to remember that no levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

In addition to overtopping, levee systems can fail or be compromised in a variety of ways. Under-seepage refers to water flowing under the levee through the levee foundation materials, often emanating from the bottom of the landside slope and ground surface and extending landward from the landside toe of the levee. Through-seepage refers to water flowing through the levee prism directly, often emanating from the landside slope of the levee. Both conditions can lead to failure by several mechanisms, including excessive water pressures causing foundation heave and slope instabilities, slow progressing internal erosion, and piping leading to levee slumping. Rodents can burrow into and compromise the levee system. Erosion can also lead to levee failure. Figure 4-67 depicts the causes of levee failure.

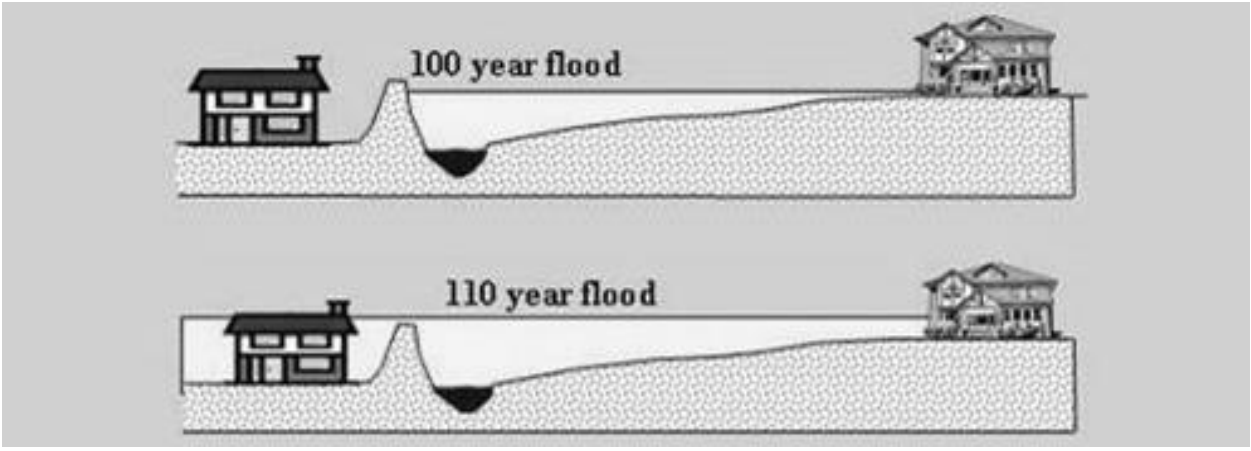
Figure 4-67 Potential Causes of Levee Failure



Source: USACE

Overtopping failure occurs when the flood water level rises above the crest of a levee. As shown in Figure 4-68, overtopping of levees can cause greater damage than a traditional flood due to the often lower topography behind the levee.

Figure 4-68 Flooding from Levee Overtopping



Source: Levees in History: The Levee Challenge. Dr. Gerald E. Galloway, Jr., P.E., Ph.D., Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.

In addition to the above levee failure causes, streambank erosion can cause levees to fail. When flood waters are high, there is greater erosive capabilities of water. In addition, high winds during times of

flooding can cause additional erosive pressures on levees. Streambank erosion was discussed in more detail in the flood profile of Section 4.3.10. Rodent infestations can cause issues with levees, with the HMPC noting that there have been past issues with nutria causing issues with levees. Nutria burrowing causes extensive damage to water infrastructure, banks, and levees, and creates a hazard for people, livestock, and machine operators. Potential levee and dike failures due to nutria burrowing have serious implications for flood protection, water delivery, and agricultural irrigation in Sutter County and in greater California.

The principal method of flood protection for the Sutter County Planning Area is structural, consisting of reservoirs (dams), levees and bypasses completed between the 1920s and 1960s. Most of the levees were constructed as parts of federal flood control projects and then, on completion, were turned over to local interests for operation and maintenance. Levees along the Sacramento River, Sutter Bypass, Feather River Yankee Slough, Wadsworth Canal, Cross Canal, and Tisdale Bypass are part of the Sacramento River Flood Control Project which was authorized by the Flood Control Act of 1917. According to the Flood Insurance Study (FIS) for unincorporated Sutter County, the original project designs and later improvements to the Sacramento River Basin Flood Control System provided a 100-year level of protection. However, more recent studies evaluating the levee system have identified several deficiencies which reduce the current level of protection of most area levees to below the 100-year level. These levees are currently being reinforced to provide 100-year flood protection. UPDATE THE LANGUAGE ABOVE

Table 4-77 provides an inventory of the status of levees in Sutter County, separated out into 3 categories: Protecting Federal Levee, Protecting Non-Federal Levee, and Non-Protecting Levee. UPDATE?

Table 4-77 State Plan of Flood Control – State Levees in Sutter County

River and Levee Segments	River Miles		River Miles	Banks w/Levees in Sutter County	Subtotal Levee Miles
	From	To			
Sacramento River					
Meridian to Knights Landing	143.00	90.00	53.00	East	53.00
Knights Landing to Sac County Line	90.00	78.00	12.00	East	12.00
Sutter Bypass					
Butte Slough to Feather River	93.00	67.00	26.00	East & West	52.00
Feather River to Verona	67.00	59.00	8.00	East & West	16.00
Wadsworth Canal					
Wadsworth Canal	5.00	0.50	4.50	East & West	9.00
Interceptor Canal					
Interceptor Canal	3.83	0.00	3.83	North & South	7.67
Feather River					
County line to Yuba River	45.00	27.40	17.60	West	17.60
Yuba River to Bear River	27.40	12.00	15.40	West	15.40
Bear River to Sutter Bypass	12.00	8.00	4.00	West	4.00

River and Levee Segments	River Miles		River Miles	Banks w/Levees in Sutter County	Subtotal Levee Miles
	From	To			
Natomas Cross Canal					
Natomas Cross Canal	4.70	0.00	4.70	East & West	9.40
East Side Canal					
Auburn Ravine to Natomas Cross Canal	5.95	0.00	5.95	East & West	11.90
Pleasant Grove Creek Canal					
Natomas Cross Canal to County Line	6.89	0.00	6.89	East & West	13.79
Tisdale Bypass					
Sacramento River to Sutter Bypass	4.36	0.00	4.36	East & West	8.71
Bear River					
Bear River	13.00	0.00	13.00	East & West	26.00
Yankee Slough					
Yankee Slough	5.57	0.00	5.57	East & West	11.14

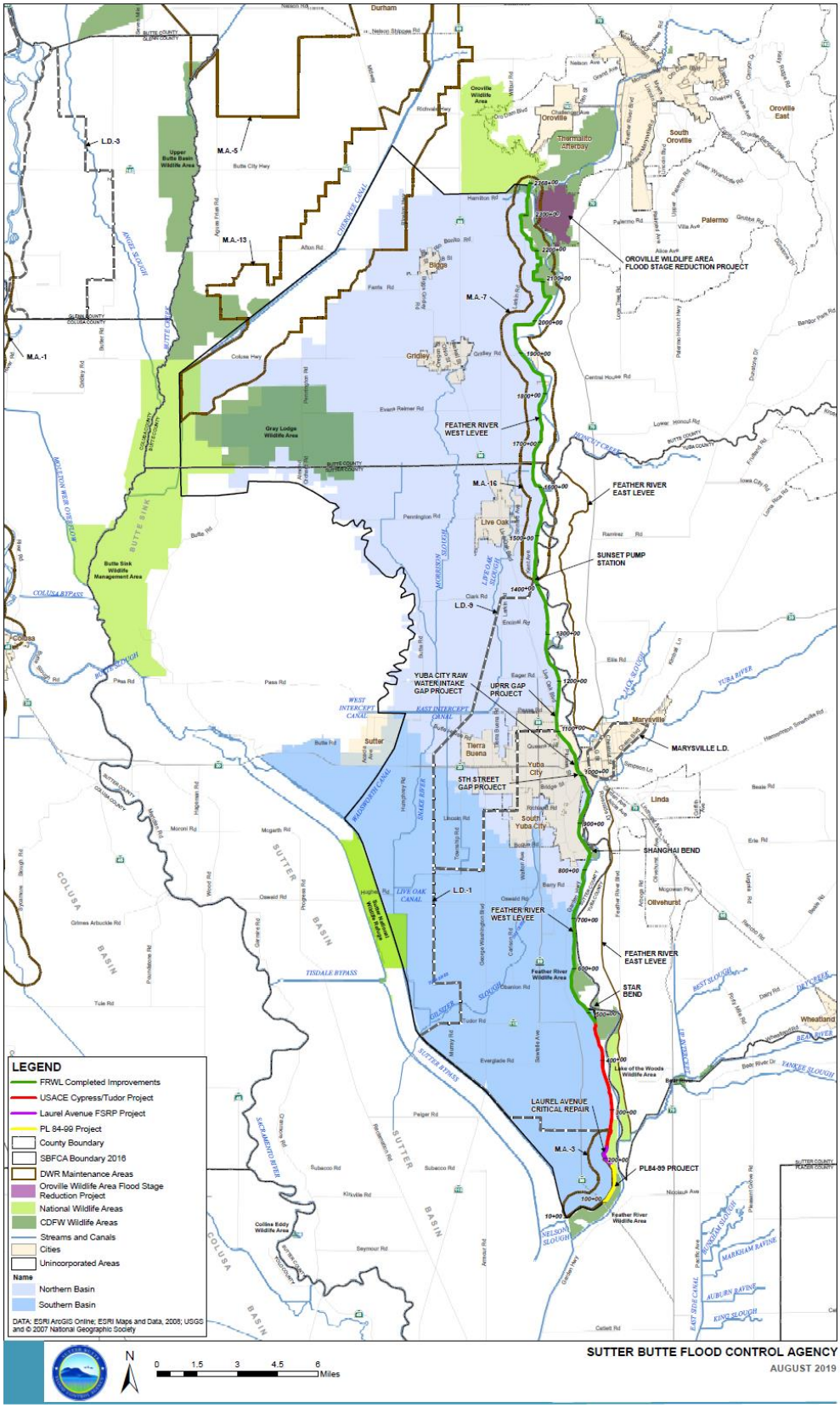
Source: State Plan of Flood Control – November 2016

Location and Extent

The 2015 FIS noted that the Sacramento River, Sutter Bypass, the Feather River, Yankee Slough, Wadsworth Canal, Cross Canal, the Bear River, and Tisdale Bypass are bounded by levees that were constructed as part of the Sacramento River Flood Control Project, which was authorized by the Flood Control Act of 1917 as modified by the Acts of 1928, 1937, and 1941. Existing flood protection measures include sections of modified channel along parts of several of the streams studied in the FIS.

The FIS noted that within Sutter County lie levees that have not been demonstrated by the community or levee owner to meet the requirements of NFIP regulation 65.10 regarding its ability to provide protection from the 1% annual chance flood event. A map of the County is shown on Figure 4-69.

Figure 4-69 Sutter County – Levee Status



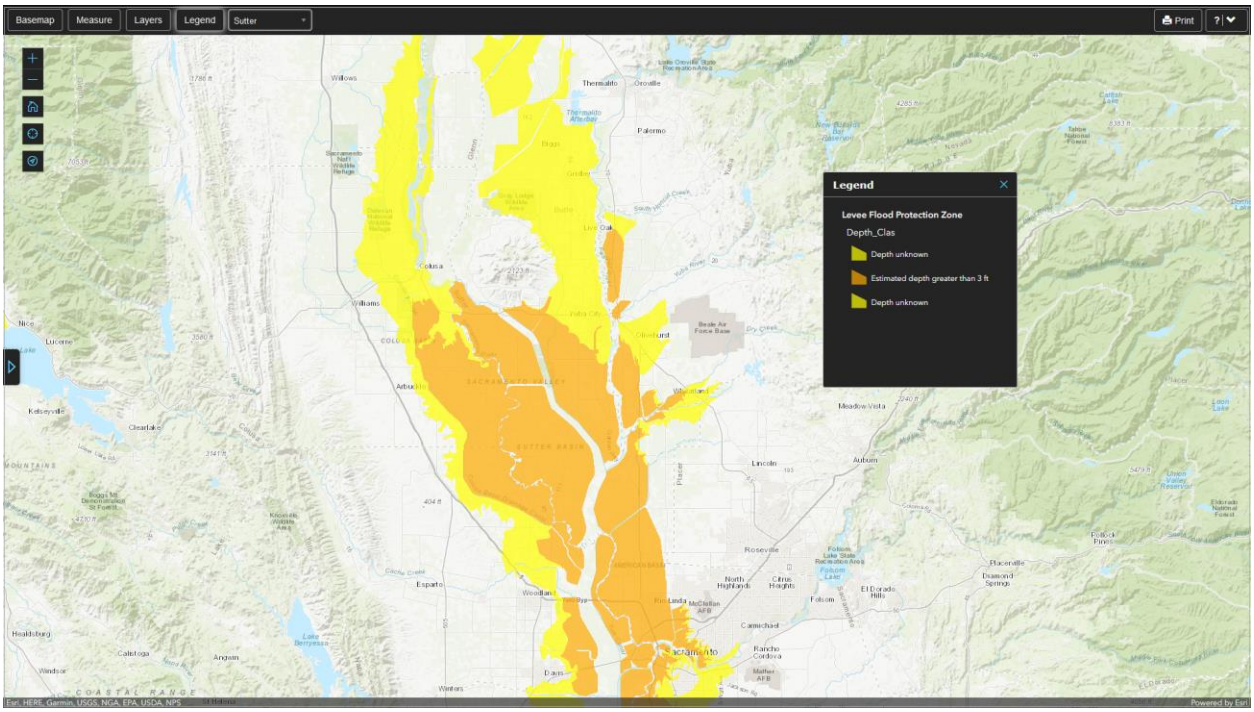
SBFCA is currently finishing construction of the improvements along the Feather River west levee from Thermalito Afterbay to Star Bend (FRWLP). This will result in 200-year flood protection to most of the urban and urbanizing areas of Yuba City, Live Oak, Gridley, and Biggs. The USACE is currently in the process of constructing improvements along the Feather River west levee from Star Bend to Laurel Avenue to bring that reach of levee up to 100-year standards. The USACE is also currently constructing cutoff wall improvements from Laurel Avenue to Highway 99 as part of a PL84-99 repair project, which will bring that reach of levee up to 100-year standards as well. Once the USACE work is complete, large areas of residual floodplains will still remain in the south portion of the basin and in the "Sutter triangle" due to the non-accredited levees along the Sutter Bypass, Wadsworth Canal, and Feather River downstream of Highway 99. In addition, limited residual floodplains will persist for areas north of the Wadsworth Interceptor Canals due to interior drainage flooding. Future projects will be pursued by SBFCA to reduce these residual risks. But in the meantime, 200-Year protection documentation and FEMA 100-Year flood insurance rate maps for the basin will be developed based on the protection provided by the completion of the FRWLP and USACE work, and the lands and people within the basin will be subject to FEMA and SB 5 compliance based on the post-project floodplain mapping. The Feather River West Levee Project from Star Bend to Thermalito will finish construction in 2020 and the USACE work is scheduled to be complete by June of 2021. Upon completion of the projects SBFCA will provide documentation to support changes to FEMA floodplain maps, and to support cities and counties making findings to demonstrate an urban level of flood protection (ULOP) for urban and urbanizing communities within the basin.

Levee Flood Protection Zones

Levee Flood Protection Zones estimate the maximum area that may be inundated if a project levee fails when water surface elevation is at the top of a project levee. Zones depicted on Figure 4-70 do not necessarily depict areas likely to be protected from flow events for which project levees were designed. Figure 4-70 illustrates the depths of flooding should a levee that protects that area fail.

Lands within the Levee Flood Protection Zones may be subject to flooding due to various factors, including the failure or overtopping of project or non-project levees, flows that exceed the design capacity of project or non-project levees, and flows from water sources not specifically protected against by project levees. Lands not mapped within a Levee Flood Protection Zone are not invulnerable to flood risk, and some may also experience flooding from these or other related events.

Figure 4-70 Sutter County LFPZs



Source: CA DWR Best Available Maps – 11/23/2020

There is not a scientific scale or measurement system in place for levee failure. It us usually measured in area covered and depth of flooding. Maps showing inundation depths due to a levee failure in the County do not exist. The speed of onset is slow as the river rises, but if a levee fails the warning times are short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back.

Past Occurrences

Disaster Declaration History

There have been no disasters declarations related to levee failure in Sutter County, as shown on Table 4-5. The County had no USDA disaster declarations since 2012 related to levee failure, as shown on Table 4-6.

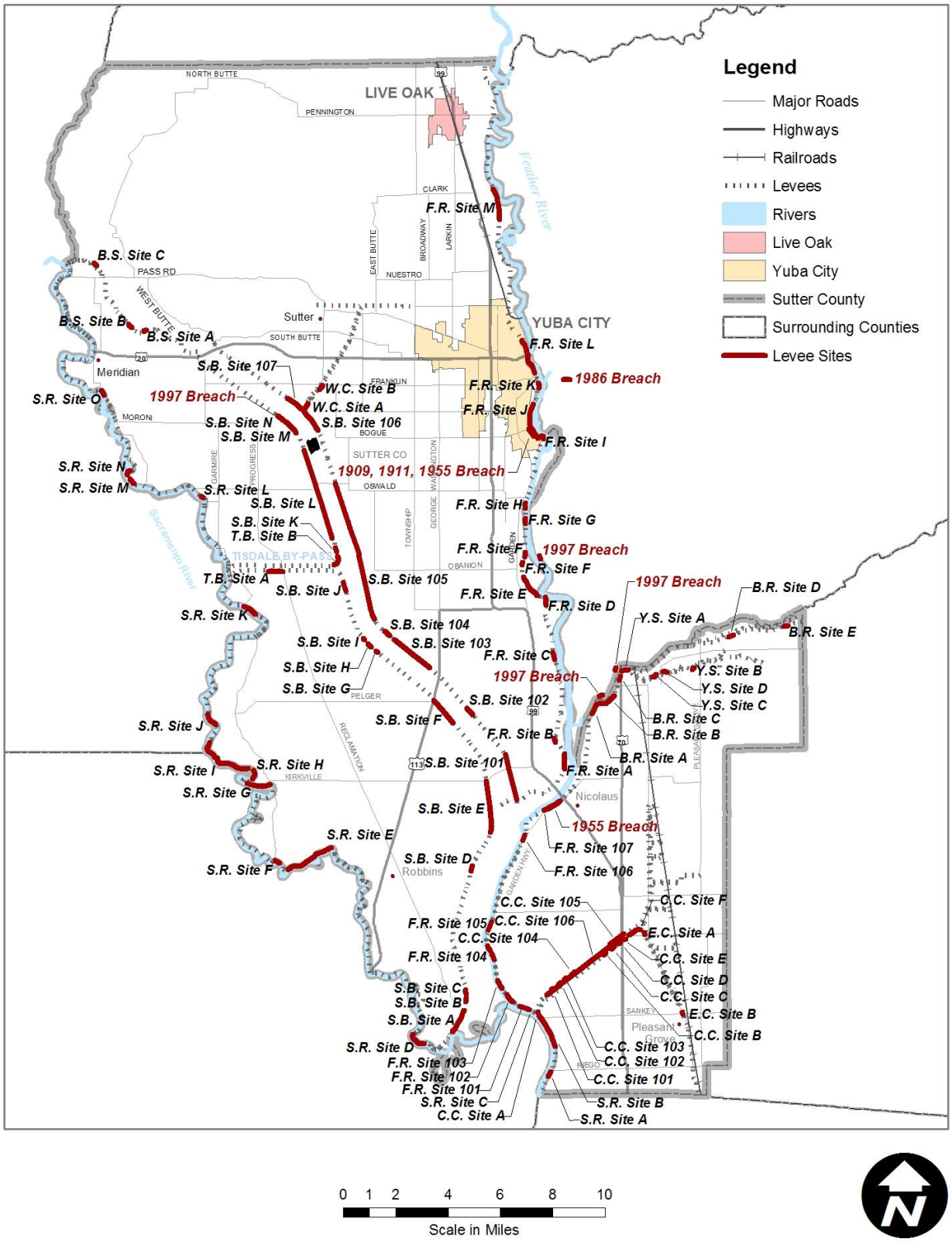
NCDC Events

There have been no NCDC levee failure events in Sutter County.

Hazard Mitigation Planning Committee Events

Sutter County has experienced significant flood events since the levees were constructed. These are shown on Figure 4-71 (until the year 2007).

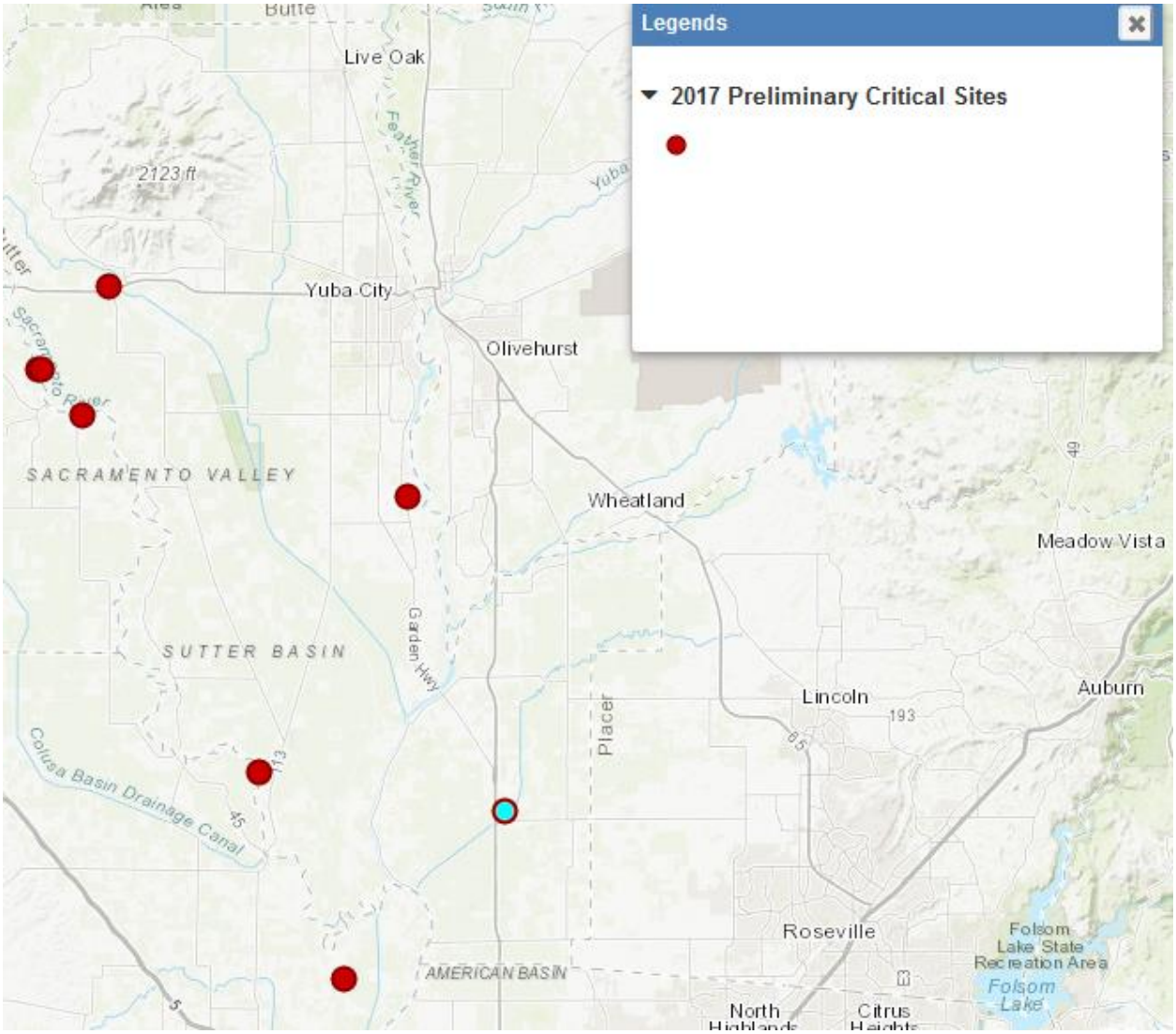
Figure 4-71 Sutter County Planning Area – Past Levee Breaks



Source: Sutter County

In 2017, the winter storms and resultant flooding caused damage at certain levee sites in Sutter County. These are shown on Figure 4-72. Information on each of the four levee damaged area can be found in Table 4-78.

Figure 4-72 Sutter County – 2017 Levee Storm Damage Areas



Source: .CA DWR Flood Emergency Response Information Exchange (FERIX). Map retrieved 1/11/2021

Table 4-78 Sutter County – 2017 Levee Damage Sites and Repairs

DWR Site ID	Local Maintaining Agency	Levee Unit	Damage Length	Damage Type	Comments	Repair Type
493	RD 1001	5	150 feet	Waterside Erosion	Critical – This site will likely fail or suffer serious degradation in the next high-water event. Emergency repairs are recommended.	Rock Slope Protection

DWR Site ID	Local Maintaining Agency	Levee Unit	Damage Length	Damage Type	Comments	Repair Type
145	Levee District 1	1	100 feet	Waterside Erosion	Critical – This site will likely fail or suffer serious degradation in the next high-water event. Emergency repairs are recommended. No riprap is present on the slope. 100-foot erosion present at waterside toe. Soil is weak and easily eroded.	Rock Slope Protection
154	Reclamation District 70	1	50 feet	Waterside Erosion	Critical – This site will likely fail or suffer serious degradation in the next high-water event. Emergency repairs are recommended. Levee crown over 55 feet wide.	Rock Slope Protection
152	Reclamation District 70	2	100 feet	Waterside Erosion	Critical – This site will likely fail or suffer serious degradation in the next high-water event. Emergency repairs are recommended. Existing bank rip rap eroded away causing erosion to cut into bank slope/berm at/around WS drainage junction box (8-feet by 8-feet). RD 70 drainage pump house observed on the landside.	Rock Slope Protection

Source: Source: .CA DWR Flood Emergency Response Information Exchange (FERIX)

Given their location relative to the County, the Feather and Sacramento Rivers and associated tributaries present the greatest flood potential to the Sutter County Planning Area. Table 4-79 provides a record of peak water levels at several key monitoring stations on both the Feather and Sacramento Rivers. CAN THIS BE UPDATED?

Table 4-79 Sutter County River/Stream Historic Levels

River/Stream	Forecast Point	Monitoring Station	Top of Levee Elevation	Peak Level of Record
Feather River	Yuba City	Feather River @ 5th Street Bridge (YUB)	83.5'	82.4' 12/24/1955
Feather River	Nicolaus	Feather River @ Nicolaus (NIC)	60.3'	51.6' 12/23/1955
Sacramento River	Colusa Weir	Sacramento River @ Colusa Weir (CLW)	74.8'	70.6' 3/1/1940
Sacramento River	Colusa	Sacramento River @ Colusa Bridge (COL)	73.0'	69.2' 2/8/1942
Sacramento River	Tisdale Weir (Robbins Basin)	Sacramento River @ Tisdale Weir (TIS)	57.0'	53.3' 3/1/1940
Sacramento River	Knight's Landing (Robbins Basin)	Sacramento River @ Knights Landing (KNL)	47.5'	41.8' 2/8/1942
Sacramento River	Below Wilkins Slough (SE County Basin)	Sacramento River @ Wilkins Slough	56.1'	52.8' 3/1/1940
Sacramento River	Fremont Weir (SE County Basin)	Sacramento River @ Fremont Weir	45.4'	39.7' 12/23/1955

River/Stream	Forecast Point	Monitoring Station	Top of Levee Elevation	Peak Level of Record
Sacramento River	Verona (SE County Basin)	Sacramento River @ Verona	46.0'	41.2' 3/1/1940
Sutter By-Pass	Meridian Basin	Sutter By-Pass @ Long Bridge (LNB)	61.8'	57.7' 3/1/1940
Yuba River	Englebright Dam	–	527.0'*	546.1' 12/22/1964

Source: Sutter County Operational Area Emergency Operations Plan, Annex 5 – Floods and Dam Failure
All elevations are United States Engineering Datum (USED)
*Spillway crest elevation.

In a 2009 report from Kleinfelder to the Sutter Butte Flood Control Agency (SBFCA) regarding Feather River Levees, the following levee failures on or near failures were reported and are shown in Table 4-80. CAN THIS BE UPDATED?

Table 4-80 Levee Performance on Feather River Levees within SBFCA Boundaries

DWR Stations	Observed Performance Repairs
3300+80 to 3380+44	Seepage reported during storms of 1997.
3302+50 to 3319+00	Sinkholes observed and repaired in January 1966.
3409+00	Boil and piping 1955 landward half of levee.
3425+50 to 3434+00	Heavy levee saturation reported by LD 9.
3432+50 to 3435+10	Bank saturation.
3445+00 to 3463+25	Seepage 1997.
3455+00 to 3462+50	Pinboils 1997.
3482+50 to 3487+00	Heavy levee saturation reported by LD 9.
3487+20	Boil and piping 1955.
3495+25	Boil 1986.
3541+60 to 3556+50	Seepage noticed in 1957 by LD 9.
3541+75 to 3594+50	Seepage and sand boils.
3567+75	Boil 1986.
3584+00 to 3595+00	Landside embankment distress 1997.
3595+00 to 3595+10	Landside embankment distress 1997.
3682+00 to 3694+00	Bank erosion.
3687+10 to 3698+80	Levee erosion noticed by citizens in 1991.
3844+40 to 3888+00	Waterside seepage observed during irrigation season.
3982+40 to 3990+10	Seepage and boils 1986.
3984+50	Boil 1986.
4351+50	Boil 1986.
4469+60 to 4520+00	Levee breach and boils 1955.

Source: Kleinfelder 2009, Preliminary Problem Identification and Conceptual Alternatives Analysis Report Sutter Butte Flood Control Agency Feather River West Levee Evaluation Thermalito Afterbay to Yuba City Butte and Sutter Counties, California

Not all of the levees shown on the previous table are located in Sutter County, but the levees are all located on the Feather River. The value of the table is that all of the levee issues are indicative of the levee conditions in and near Sutter County.

Other levee failure issues/more detailed information reported by the previous plan are discussed in the flood profile in Section 4.3.10.

Likelihood of Future Occurrence

Unlikely – Due to the number of past events, eroding levees, and the volume of levees in Sutter County, future levee failures should be considered unlikely. However, due to the amount of repair and reinforcement of the levees, future levee failure occurrences are estimated to be occasional. SBFCA noted that 40 miles of levee have been updated and improved. The County is working with SBFCA and FEMA to certify levees in the County.

Climate Change and Levee Failure

In general, increased flood frequency in California is a predicted consequence of climate change. Mechanisms whereby climate change leads to an elevated flood risk include more extreme precipitation events and shifts in the seasonal timing of river flows. This threat may be particularly significant because recent estimates indicate the additional force exerted upon the levees is equivalent to the square of the water level rise. These extremes are most likely to occur during storm events, leading to more severe damage from waves and floods.

Vulnerability Assessment

Vulnerability—Extremely High

Levee failure flooding can occur as the result of partial or complete collapse of an impoundment, and often results from prolonged rainfall and flooding. The primary danger associated with dam or levee failure is the high velocity flooding of those properties downstream of the breach. Impacts from this include property damage, critical facility damage, and life safety issues. A levee failure can range from a small, uncontrolled release to a catastrophic failure. Vulnerability to levee failures is generally confined to the areas subject to inundation downstream of the facility. Secondary losses would include loss of the multi-use functions of the facility and associated revenues that accompany those functions.

Impacts

Levee failure flooding and associated impacts would vary depending on which structure fails and the nature and extent of the failure and associated flooding. This flooding can present a threat to life and property, including buildings, their contents, and their use. Large flood events can affect lifeline utilities (e.g., water, sewerage, and power), transportation, jobs, tourism, the environment, agricultural industry, and the local and regional economies. Levee failure flooding can cause many impacts to agricultural production, including water contamination, damage to crops, loss of livestock, increased susceptibility of livestock to disease, flooded farm machinery, and environmental damage to and from agricultural chemicals.

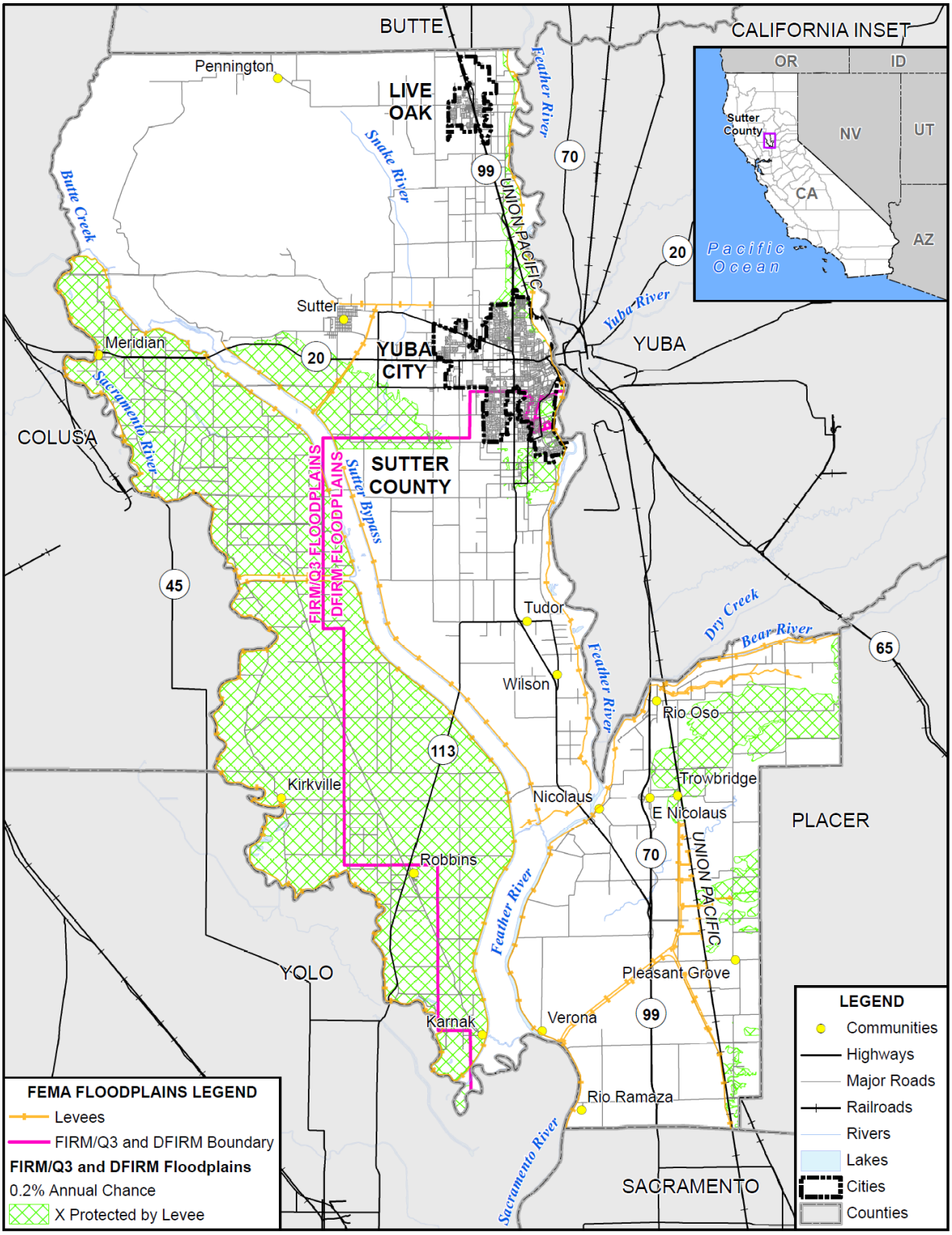
Vulnerability Analysis

This risk assessment for the Sutter County LHMP Update assesses the levee failure hazard specific to Sutter County. Existing studies, maps, historical data, and federal, state, and local community expertise and knowledge contributed to this current levee failure assessment for Sutter County. An evaluation of the success of completed and ongoing flood control and levee improvement projects and associated maintenance aspects contributed to this levee hazard assessment and the resulting levee failure mitigation strategy for the Sutter County Planning Area. This flood risk assessment for this LHMP Update also includes an assessment of future flooding conditions based on historic development in the floodplains and proposed future development as further described throughout this plan. The levee failure vulnerability assessment that follows focuses on the flood hazard based on FEMA DFIRMs.

Levee Failure Analysis

Sutter County has a FEMA effective DFIRM dated 6/16/2015, which was obtained from the National Flood Hazard Layer to perform the levee failure analysis. The X Protected by Levee DFIRM flood zone was extracted from the Q3/DFIRMs and analyzed. The effective FEMA flood maps and levee locations for the Sutter County Planning Area are shown on Figure 4-73.

Figure 4-73 Sutter County – Levees and DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Values at Risk and Levee Failure Flood Loss Estimates Analysis

Quantifying the values at risk and estimating losses within mapped FEMA floodplains, including the X-Protected by Levee flood zone, in the County is an important element in understanding the risk and vulnerability of the Sutter County Planning Area to the levee failure hazard. The following methodology was followed in determining improved parcel counts and values at risk to levee failure events.

Methodology

Sutter County's 2020 Parcel and Assessor Data, obtained from Sutter County, was used as the basis for the county inventory of parcels, values, and acres. Sutter County has a FEMA Q3/DFIRM dated 6/16/2015 which was utilized to perform the levee analysis. This analysis follows the same methodology provided in Section 4.3.10 for the flood hazard. Based on this analysis, values at risk to a levee failure in the County is provided for Sutter County Planning Area and the unincorporated County in the below results section.

Values at Risk Results

The end result of the values at risk and flood loss estimates analysis is an inventory of the numbers, types, and values of parcels and estimated losses subject to the levee failure flooding. Results are presented here first for the Sutter County Planning Area and secondly for unincorporated County. Results for the incorporated jurisdictions are presented in their annexes to this Plan.

Sutter County Planning Area

Table 4-81 contain levee failure flood analysis results for Sutter County. These tables show the number of parcels and values at risk in the X Protected by Levee flood zone for Sutter County. Table 4-58 shows a summary of the value of improved parcels in levee protected flood zones in the Planning Area. More details regarding levee flood zones in each jurisdiction can be found in their respective annexes to this Plan Update.

Table 4-81 Sutter County Planning Area – Count and Value of Parcels in X Protected by Levee Flood Zone by Jurisdiction*

Jurisdiction/ Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
City of Live Oak						
X Protected by Levee	0	0	$0	$0	$0	$0
City of Yuba City						
X Protected by Levee	1,643	1,106	$82,822,130	$306,591,375	$186,796,566	$576,210,071
Unincorporated Sutter County						
X Protected by Levee	2,669	1,333	$613,577,324	$244,038,882	$240,078,586	$1,097,694,792

Jurisdiction/ Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Grand Total	**4,312**	**2,439**	**$696,399,454**	**$550,630,257**	**$426,875,152**	**$1,673,904,863**

Source: FEMA 6/16/2015 DFIRM, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Unincorporated Sutter County

Table 4-82 contain levee failure flood analysis results for unincorporated Sutter County. These tables show the number of parcels and values at risk to the 1% and 0.2% annual chance event for unincorporated Sutter County. Table 4-61 breaks down the unincorporated Sutter County line from Table 4-81 and shows the number of improved parcels and associated structure and other improved values at risk to the each of the FEMA flood zones using the DFIRM data by property use type.

Table 4-82 Unincorporated Sutter County – Count and Value of Parcels in X Protected by Levee Flood Zone by Property Use*

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
0.2% Annual Chance Flood						
X Protected by Levee						
Agricultural	1,773	772	$569,922,574	$108,460,477	$108,460,477	$786,843,528
Commercial	47	42	$6,262,596	$8,590,234	$8,590,234	$23,443,064
Industrial	90	40	$8,734,949	$54,740,045	$82,110,068	$145,585,062
Institutional	68	18	$1,107,674	$9,587,488	$9,587,488	$20,282,650
Miscellaneous	60	0	$0	$0	$0	$0
Residential	515	461	$24,011,962	$62,660,638	$31,330,319	$118,002,919
Vacant	116	0	$3,537,569			$3,537,569
X Protected by Levee Total	2,669	1,333	$613,577,324	$244,038,882	$240,078,586	$1,097,694,792
0.2% Annual Chance Flood Total	**2,669**	**1,333**	**$613,577,324**	**$244,038,882**	**$240,078,586**	**$1,097,694,792**

Source: FEMA 6/16/2015 DFIRM, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Flooded Acres

In addition to the centroid analysis used to obtain numbers of parcels and values at risk to flood hazards, parcel boundary analysis was performed to obtain total acres and flooded acres by flood zone for each parcel. The parcel layer was intersected with the FEMA DFIRM data to obtain the acres flooded. The following is an analysis of flooded acres in the County.

Using the same methodologies as in Section 4.3.10, the following table represents a summary and detailed analysis of total acres for the X Protected by Levee flood zone in the Planning Area. Table 4-83 gives summary information for the Planning Area by 1% and 0.2% annual chance flood zone for the entire Sutter County Planning Area.

Table 4-83 Sutter County – Flooded Acres Summary

Flood Zone / Jurisdiction	Total Acres	% of Total Acres*	Improved Acres	% of Total Improved Acres*	Unimproved Acres	% of Total Unimproved Acres*
City of Live Oak						
X Protected by Levee	0	0.00%	0	0.00%	0	0.00%
City of Live Oak Total	**0**	**0.00%**	**0**	**0.00%**	**0**	**0.00%**
City of Yuba City						
X Protected by Levee	670	0.53%	428	0.87%	242	0.31%
City of Yuba City Total	**670**	**0.53%**	**428**	**0.87%**	**242**	**0.31%**
Unincorporated Sutter County						
X Protected by Levee	126,275	99.47%	48,643	99.13%	77,632	99.69%
Unincorporated Sutter County Total	**126,275**	**99.47%**	**48,643**	**99.13%**	**77,632**	**99.69%**

Source: FEMA DFIRM 6/6/2015, Sutter County 2020 Parcel/Assessor's Data
*percent of the total acres in Sutter County

Population at Risk

A separate analysis was performed to determine populations that reside in flood zones. Using GIS, the DFIRM Flood dataset was overlayed on the improved residential parcel data. Those parcel centroids that intersect X Protected by Levee flood zones were counted and multiplied by the Census Bureau average household size; and tabulated by flood zone (see Table 4-84).

Table 4-84 Sutter County – Residential Population at Risk to Levee Failure Flooding

Jurisdiction	X Protected by Levee	
	Improved Residential Parcels*	Population at Risk
City of Live Oak	0	0
City of Yuba City	1,106	3,307
Unincorporated Sutter County	1,333	3,879
Total	**2,439**	**7,186**

Source: FEMA DFIRM 6/16/2015, US Census Bureau Average Household Sizes: City of Live Oak (2.59); City of Yuba City (2.99); unincorporated Sutter County (2.91)

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

Critical Facilities at Risk

INSERT

Future Development

INSERT

Future Development GIS Analysis

INSERT

4.3.13. Pandemic

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity.

A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention (CDC) has been working closely with other countries and the WHO to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning, preparation, and response. An especially severe pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the County is at risk, as pandemic is a regional, national, or international event. The speed of onset of a pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by the numbers who die.

Past Occurrences

Disaster Declaration History

There has been one state and federal disaster declaration due to pandemic, as shown in Table 4-85. The County had no USDA disaster declarations since 2012 related to pandemic, as shown on Table 4-6.

Table 4-85 Sutter County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

NCDC Events

The NCDC does not track pandemic.

WHO Events

The 20th century saw three outbreaks of pandemic flu.

- The **1918-1919 Influenza Pandemic (H1N1),** (aka the Spanish Flu**),** is the catastrophe against which all modern pandemics are measured. It is estimated that approximately 20 to 40 percent of the worldwide population became ill and that over 50 million people died. Approximately 675,000 deaths from the flu occurred in the U.S. alone.
- The **February 1957-1958 Influenza Pandemic (H2N2)** (aka the Asian Flu) was first identified in the Far East. Immunity to this strain was rare in people less than 65 years of age, and a pandemic was predicted. In preparation, vaccine production began in late May 1957, and health officials increased surveillance for flu outbreaks. Unlike the virus that caused the 1918 pandemic, the 1957 pandemic virus was quickly identified, due to advances in scientific technology. Vaccine was available in limited supply by August 1957. The virus came to the U.S. quietly, with a series of small outbreaks over the summer of 1957. When U.S. children went back to school in the fall, they spread the disease in classrooms and brought it home to their families. Infection rates were highest among school children, young adults, and pregnant women in October 1957. Most influenza-and pneumonia-related deaths occurred between September 1957 and March 1958. The elderly had the highest rates of death. By December 1957, the worst seemed to be over. However, during January and February 1958, there was another wave of illness among the elderly. This is an example of the potential "second wave" of infections that can develop during a pandemic. The disease infects one group of people first, infections appear to decrease and then infections increase in a different part of the population. Although the Asian flu pandemic was not as devastating as the 1918-1919 flu, about 69,800 people in the U.S. died.
- The **1968 Influenza Pandemic (H3N2)** was first detected in Hong Kong (aka the Hong Kong Flu). The first cases in the U.S. were detected as early as September of that year, but illness did not become widespread in the U.S. until December. Deaths from this virus peaked in December 1968 and January 1969. Those over the age of 65 were most likely to die. The same virus returned in 1970 and 1972.

The number of deaths between September 1968 and March 1969 for this pandemic was 33,800, making it the mildest pandemic in the 20th century.

To date, the 21st century has seen two acknowledged pandemics.

- **2009 Swine Flu (H1N1)**— 2009 H1N1 (sometimes called "swine flu") was a new influenza virus causing illness in people. This virus was originally referred to as "swine flu" because laboratory testing showed that many of the genes in this new virus were very similar to influenza viruses that normally occur in pigs (swine) in North America. But further study showed that this virus was very different from what normally circulates in North American pigs. It had two genes from flu viruses that normally circulate in pigs in Europe and Asia and bird (avian) genes and human genes. Scientists call this a "quadruple reassortant" virus. This virus spread from person-to-person worldwide, probably in much the same way that regular seasonal influenza viruses spread. On June 11, 2009, the WHO) signaled that a pandemic of 2009 H1N1 flu was underway. It was first detected in the United States in early 2009 and spread to the world later that year. About 70 percent of people who were hospitalized with this 2009 H1N1 virus had one or more medical conditions previously recognized as placing people at "high risk" of serious seasonal flu-related complications. This included pregnancy, diabetes, heart disease, asthma, and kidney disease. Young children were also at high risk of serious complications from 2009 H1N1, just as they are from seasonal flu. And while people 65 and older were the least likely to be infected with 2009 H1N1 flu, if they got sick, they were also at "high risk" of developing serious complications from their illness. Some studies estimated that 11 to 21 percent of the global population at the time—or around 700 million to 1.4 billion people (of a total 6.8 billion)—contracted the illness. This was more than the number of people infected by the Spanish flu pandemic, but only resulted in about 150,000 to 575,000 fatalities for the 2009 pandemic. A follow-up study done in September 2010 showed that the risk of serious illness resulting from the 2009 H1N1 flu was no higher than that of the yearly seasonal flu. For comparison, the WHO estimates that 250,000 to 500,000 people die of seasonal flu annually.
- **2019/2020** COVID 19 – During the creation of this LHMP Update, the world was under various forms of lockdown due to COVID-19 (known also as coronavirus). Coronaviruses are a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most recently discovered coronavirus causes coronavirus disease COVID-19. COVID-19 is the infectious disease caused by the most recently discovered coronavirus. This new virus and disease were unknown before the outbreak began in Wuhan, China, in December 2019. The most common symptoms of COVID-19 are fever, tiredness, and dry cough. Some patients may have aches and pains, nasal congestion, runny nose, sore throat or diarrhea. These symptoms are usually mild and begin gradually. Some people become infected but don't develop any symptoms and don't feel unwell. Most people (about 80%) recover from the disease without needing special treatment. Around 1 out of every 6 people who gets COVID-19 becomes seriously ill and develops difficulty breathing. Older people, and those with underlying medical problems like high blood pressure, heart problems or diabetes, are more likely to develop serious illness. People with fever, cough and difficulty breathing should seek medical attention. As of the beginning of December 2020, there had been roughly 60 million cases worldwide, with 1.4 million deaths.

HMPC Events

The HMPC noted that during the Covid outbreak of 2020/2021, the workforce in the County (both in the public and private sector) was decimated due to the lockdowns and closing of businesses in the County.

PLACE COVID ITEMS AT END OF PROCESS

Likelihood of Future Occurrence

Likely – The calculation for future occurrence of pandemic must first be considered in light of circumstances. The diseases are naturally occurring in the populations that reside in the County. In addition, this Plan is not examining the pandemic potential of these diseases, but instead examines when these diseases manifest in severe injury or fatalities among humans. Given these assumptions and the five outbreaks since 1900, the likelihood of future occurrence is considered likely.

Climate Change and Pandemic

According to the WHO, there are three categories of research into the linkages between climatic conditions and infectious disease transmission. The first examines evidence from the recent past of associations between climate variability and infectious disease occurrence. The second looks at early indicators of already-emerging infectious disease impacts of long-term climate change. The third uses the above evidence to create predictive models to estimate the future burden of infectious disease under projected climate change scenarios.

Early Impacts of Climate Change

There is much evidence of associations between climatic conditions and infectious diseases. These include several infectious diseases, health impacts of temperature extremes and impacts of extreme climatic and weather events. Changes in infectious disease transmission patterns are a likely major consequence of climate change. We need to learn more about the underlying complex causal relationships, and apply this information to the prediction of future impacts, using more complete, better validated, integrated, models.

Vulnerability Assessment

Vulnerability—High

Pandemic has and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public health officials can use to combat pandemic flu. Constant surveillance regarding current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent spread of pandemic flu by staying home, or "self-quarantining," if they suspect they are infected. Pandemic does not affect the buildings, critical facilities, and infrastructure in the County. Pandemic can have varying levels of impact to the citizens of the County, depending on the nature of the pandemic.

Impacts

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently) and unemployment rose significantly. Supply chains for food can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Future Development

Future development is not expected to be significantly impacted by this hazard, though population growth in the County could increase exposure to pandemic flu, and increase the ability of each disease to be transmitted among the population of the County. If the median age of County residents continues to increase, vulnerability to pandemic diseases may increase, due to the fact that these diseases are often more deadly to senior citizens. During 2020, it was reported that one in five adults moved due to COVID-19 or know someone who did according to Pew Research. Many college aged students moved back home, which increased populations in the areas in which they returned.

4.3.14. Wildfire

Hazard Profile

This hazard profile contains multiple sections that detail how this hazard can affect Sutter County. These sections include a hazard/problem description; description of location and extent; past occurrences of this hazard; and how climate change can affect this hazard.

Hazard/Problem Description

California is recognized as one of the most fire-prone and consequently fire-adapted landscapes in the world. The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural and aboriginal ignition sources, has created conditions for extensive wildfires. Wildland fire is an ongoing concern for the Sutter County Planning Area. Generally, the fire season extends from June through October of each year during the hot, dry months. Fire conditions arise from a combination of high temperatures, an accumulation of vegetation, low humidity, and high winds. Wildland fires that burn in natural settings with little or no development are part of a natural ecological cycle and may actually be beneficial to the landscape. Century old policies of fire exclusion and aggressive suppression have given way to better understanding of the importance fire plays in the natural cycle of certain forest types.

Location and Extent

Wildfire risk in Sutter County varies by location. According to the HMPC, within the County, the Sutter Buttes are the primary concern when considering the wildland fire hazard, with their limited access, steep terrain and remote location. In other areas, large concentrations of highly flammable brush located in flat

open spaces are also quite susceptible to wildland fire. Also at risk are the "river bottoms" or those areas along the Sacramento, Feather and Bear Rivers within the levee system, since much of the area inside these levees are left in a natural state, allowing combustible fuels to accumulate over long periods of time.

Wildland Urban Interface

Throughout California, communities are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire control practices have affected the natural cycle of the ecosystem. While wildfire risk is predominantly associated with wildland urban interface (WUI) areas, significant wildfires can also occur in heavily populated areas. The WUI is a general term that applies to development adjacent to landscapes that support wildland fire. The WUI defines the community development into the foothills and mountainous areas of California. The WUI describes those communities that are mixed in with grass, brush and timbered covered lands (wildland). These are areas where wildland fire once burned only vegetation but now burns homes as well. Due to the nature and type of terrain and fuels located throughout the Planning Area which creates a low risk of wildfires, no WUI exists in Sutter County.

Sutter County Wildfire Setting

As previously stated, there are areas in the County that are prone to wildfire. Wildland fires affect grass, forest, and brushlands, as well as any structures located within them. Where there is human access to wildland areas the risk of fire increases due to a greater chance for human carelessness and historical fire management practices. Generally, there are four major factors that sustain wildfires and allow for predictions of a given area's potential to burn. These factors include fuel, topography, weather, and human actions.

- **Fuel** – Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also to be considered as a fuel source are man-made structures, such as homes, and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Fuel is the only factor that is under human control.
- **Topography** – An area's terrain and land slopes affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes.
- **Weather** – Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely. Wind is the most treacherous weather factor. The greater a wind, the faster a fire will spread, and the more intense it will be. Winds can be significant at times in the Sutter County Planning Area. Lightning also ignites wildfires, often in difficult-to reach terrain for firefighters. Also of concern, during periods of drought, the threat of wildfire increases.
- **Human Actions** – Most wildfires are ignited by human action, the result of direct acts of arson, carelessness, or accidents. Many fires originate in populated areas along roads and around homes, and are often the result of arson or careless acts such as the disposal of cigarettes, use of equipment or debris

burning. Recreation areas that are located in high fire hazard areas also result in increased human activity that can increase the potential for wildfires to occur.

Wildfires tend to be measured in structure damages, injuries, and loss of life as well as on acres burned and the intensity of the burn. CAL FIRE measures fuels in the areas as part of their Fire Hazard Severity maps. Extents are measured in the following Fire Hazard Severity Zones (FHSZ) categories (discussed in more detail below):

- Very High
- High
- Moderate
- Non-Wildland/Non-Urban
- Urban/Unzoned

Geographical extents of these FHSZs in the County can be found on Table 4-86.

Table 4-86 Sutter County – Geographical Extents of Fire Hazard Severity Zones

Fire Hazard Severity Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Very High	0	0.00%	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%	0	0.00%
Moderate	53,253	13.60%	18,477	9.21%	34,775	18.20%
Non-Wildland/Non-Urban	327,058	83.50%	17,2412	85.92%	154,646	80.95%
Urban Unzoned	11,396	2.91%	9,774	4.87%	1,621	0.85%
Total	**391,707**		**200,663**		**191,042**	

Source: CAL FIRE

Fires can have a quick speed of onset, especially during periods of drought. Fires can burn for a short period of time, or may have durations lasting for a week or more.

Post-Wildfire Landslides and Debris Flows

Post-wildfire landslides and debris flows are not generally a concern in Sutter County due to the lack of sloped areas. Fires that burn in sloped areas remove vegetation that holds hillsides together during rainstorms. Once that vegetation is removed, the hillside may be compromised, resulting in landslides and debris flows. The Sutter Buttes area is the primary location in the County where this could be an issue. Currently, there are no post-wildfire areas prone to landslides or debris flows.

Past Occurrences

Disaster Declaration History

A search of FEMA and Cal OES disaster declarations turned up no events, as shown on Table 4-4. The County had no USDA disaster declarations since 2012 related to wildfire, as shown on Table 4-6.

NCDC Events

The NCDC has tracked wildfire events in the County dating back to 1993. Events in Sutter County in the database are shown in Table 4-87.

*Table 4-87 NCDC Wildfire Events in Sutter County 1993 to 4/30/2020**

Event Type	Number of Events	Deaths	Deaths (indirect)	Injuries	Injuries (indirect)	Property Damage	Crop Damage
Wildfire	10	4	0	4	7	$500,000	$0

Source: NCDC

*Deaths, injuries, and damages are for the entire event, and may not be exclusive to the County.

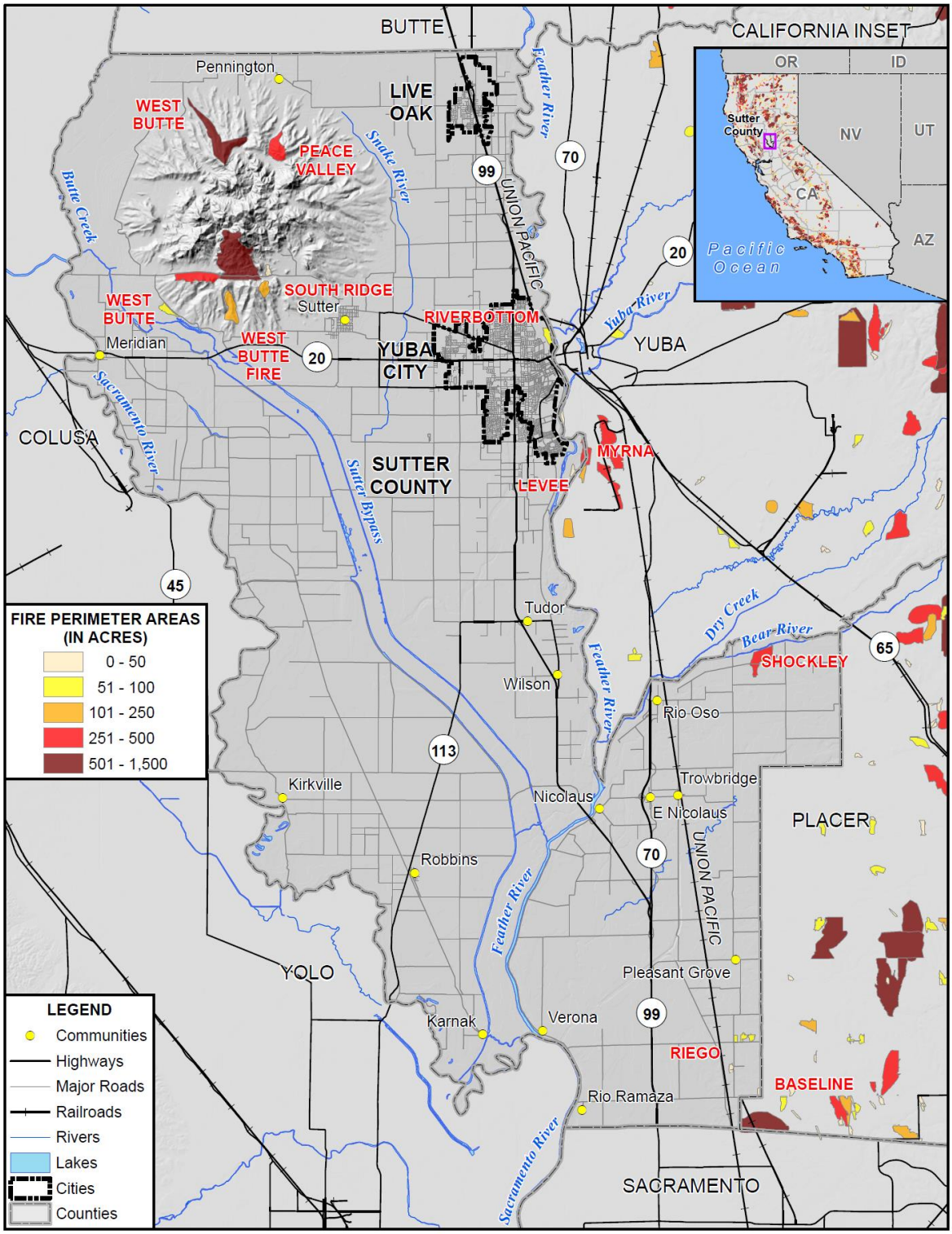
CAL FIRE Events

CAL FIRE, USDA Forest Service Region 5, Bureau of Land Management (BLM), the National Park Service (NPS), Contract Counties and other agencies jointly maintain a comprehensive fire perimeter GIS layer for public and private lands throughout the state. The data covers fires back to 1878 (though the first recorded incident for the County was in 1917). For the National Park Service, Bureau of Land Management, and US Forest Service, fires of 10 acres and greater are reported. For CAL FIRE, timber fires greater than 10 acres, brush fires greater than 50 acres, grass fires greater than 300 acres, and fires that destroy three or more residential dwellings or commercial structures are reported. CAL FIRE recognizes the various federal, state, and local agencies that have contributed to this dataset, including USDA Forest Service Region 5, BLM, National Park Service, and numerous local agencies.

Fires may be missing altogether or have missing or incorrect attribute data. Some fires may be missing because historical records were lost or damaged, fires were too small for the minimum cutoffs, documentation was inadequate, or fire perimeters have not yet been incorporated into the database. Also, agencies are at different stages of participation. For these reasons, the data should not be used for statistical or analytical purposes.

The data provides a reasonable view of the spatial distribution of past large fires in California. Using GIS, fire perimeters that intersect Sutter County since 1950 were extracted and are listed in Table 4-88. Each of them was tracked by CAL FIRE. Figure 4-74 shows the fires in the CAL FIRE database for the County from 1950 to 2020, colored by the size of the acreage burned

Figure 4-74 Sutter County – Wildfire History CAL FIRE 1950 to 2020



Data Source: CAL FIRE Fire History (firep19_1) 5/2020, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table 4-88 Sutter County – Wildfires by Acres Burned 1950-2020

Wildfire Name	Date	Cause Description	GIS Acres
Shockley	7/27/1970	Unknown / Unidentified	285.52
West Butte	7/27/2007	Unknown / Unidentified	83.31
Peace Valley	9/21/2007	Lightning	282.39
Levee	8/18/2008	Unknown / Unidentified	41.10
Myrna	9/1/2008	Unknown / Unidentified	455.48
Riego	9/12/2008	Unknown / Unidentified	26.46
Riverbottom	3/29/2009	Unknown / Unidentified	83.01
West Butte Fire	5/14/2011	Miscellaneous	240.44
South Ridge	7/27/2011	Unknown / Unidentified	109.56
Baseline	9/10/2011	Unknown / Unidentified	31.12
Island	7/16/2012	Unknown / Unidentified	39.42
Butte_2	02/08/2013	Unknown / Unidentified	40.30
Locust	7/27/2015	Arson	644.17
Butte	9/20/2016	Aircraft	631.52
Sankey	6/6/2018	Powerline	77.71
Butte	7/31/2018	Unknown / Unidentified	2,475.14
West Butte	6/8/2019	Unknown / Unidentified	647.99
Grand Total			**6,194.65**

Source: CAL FIRE

Hazard Mitigation Planning Committee

The HMPC noted the following fires to affect the County:

Not included in the databases, the HMPC noted a fire accruing in 1993 at Grey Lodge area north of Pennington. This fire occurred in a wildlife preserve and caused significant damage.

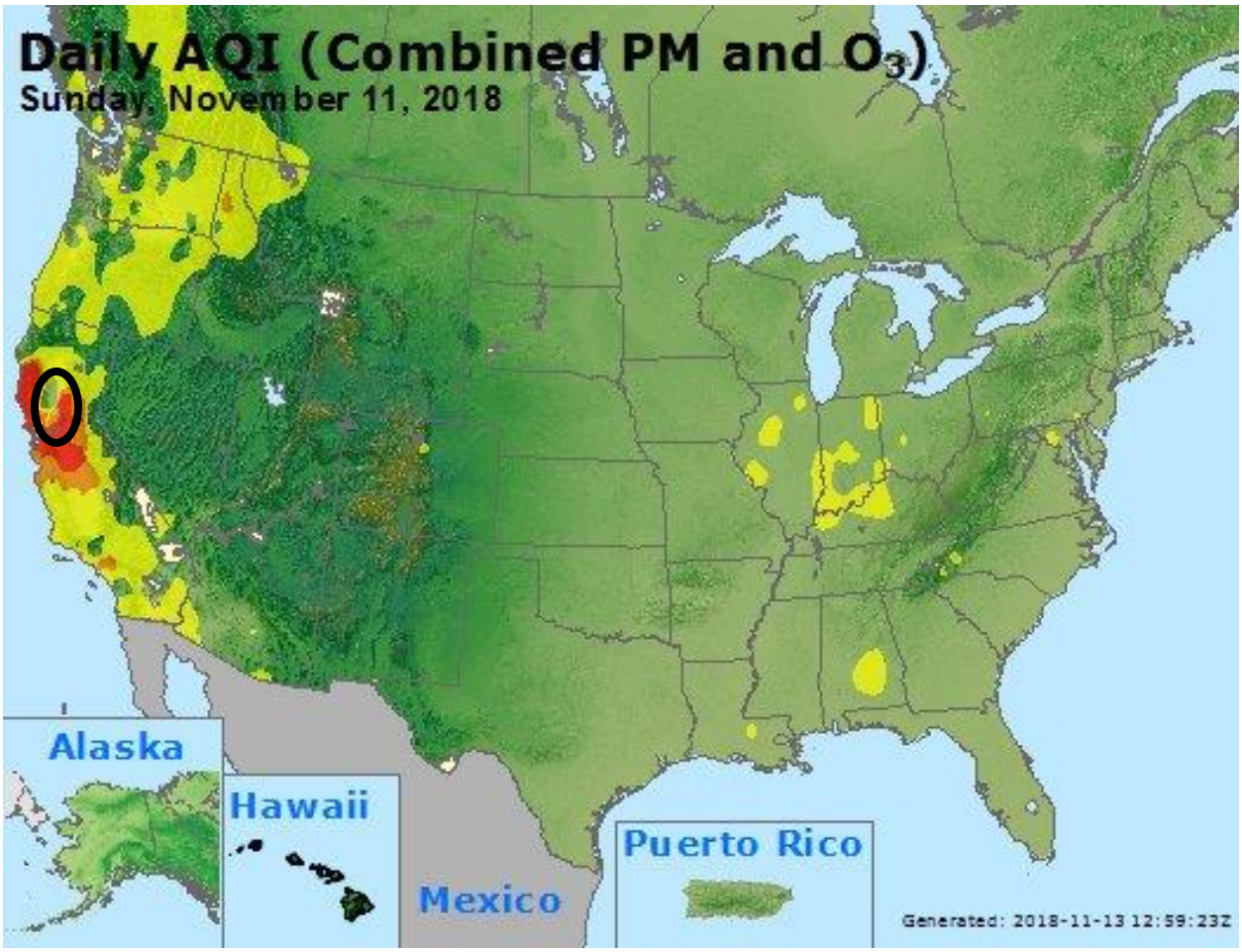
2018 Buttes Fire – In 2018, one of the few moderate FHSZs in the County saw a wildfire. The fire occurred in the Sutter Buttes Area. Almost 2,500 acres were burned. The fire threatened communications towers. This can be seen on Figure 4-75.

Figure 4-75 2018 Buttes Fire

Source: Sutter County Fire Department

November 2018 – November 8th the deadliest and most destructive Wildfire in that State of California began in Butte County. Leading to numerous evacuations of the Pulga, Paradise, Magalia, Oroville and parts of the City of Chico. Yuba and Sutter County emergency managers joined forces to provide a Bi-County response, which ultimately became the largest Mass Care Services response for the incident. Organizations included Yuba County, Sutter County, Yuba Sutter Fairgrounds, Salvation Army, Habitat for Humanity, Field Haven Feline Center, Yuba Sutter Domestic Animal Disaster Assistance (YSDADA). Air quality issues were felt in Sutter County from this event, as shown on . This figure shows a one day snapshot. Air quality issues persisted for weeks.

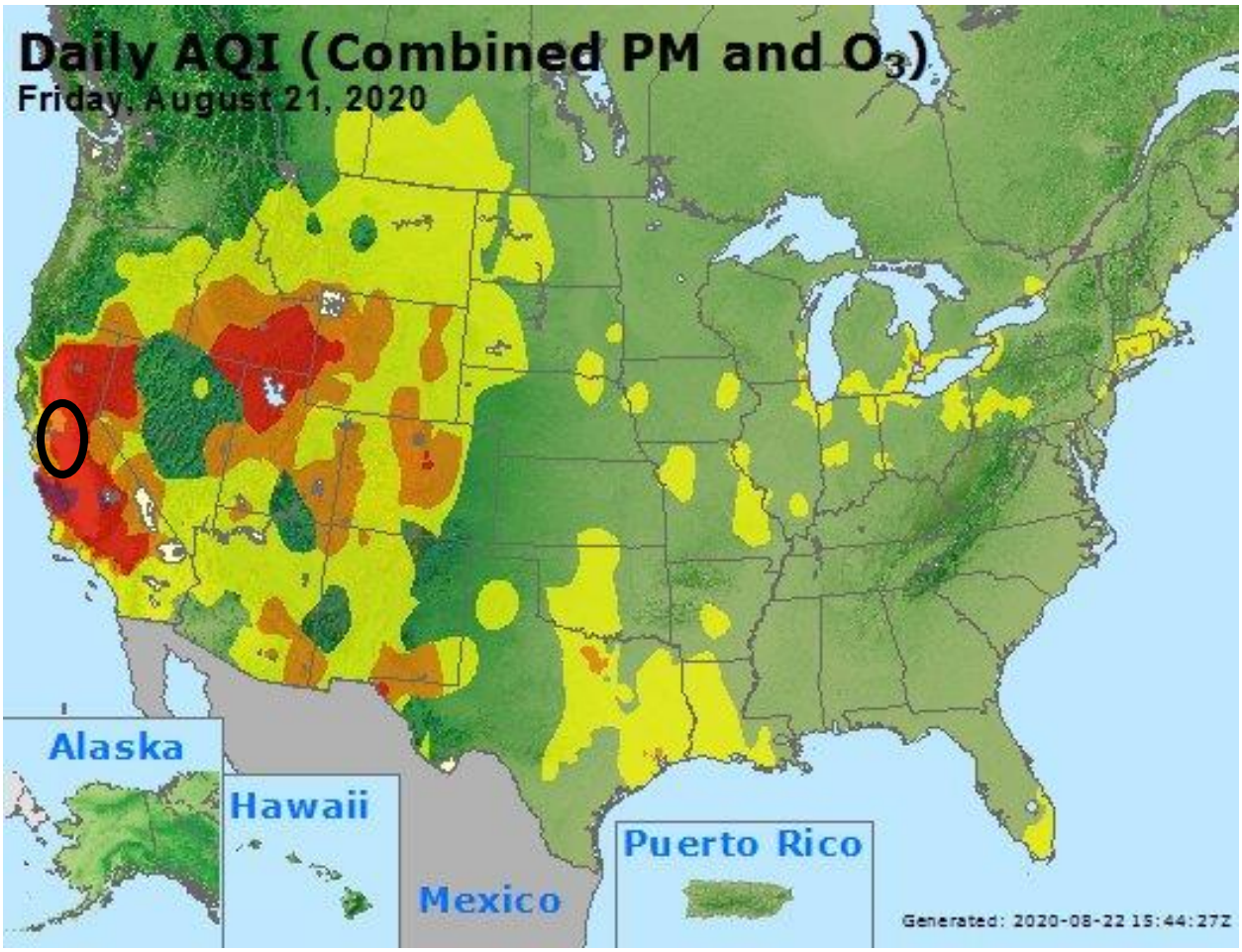
Figure 4-76 Camp Fire – Air Quality Impacts



Source: EAP AirNow website. Retrieved on 1/11/2021.
Map Colors: Green (Good), Yellow (Moderate), Orange (Unhealthy for Sensitive Groups), Red (Unhealthy), Dark Pink (Very Unhealthy), Maroon (Hazardous)

2020 North Complex Fire – though it did not burn areas in the County, wildfire smoke and air quality issues were suffered by County residents. This can be seen on Figure 4-77. This figure shows a one day snapshot. Air quality issues persisted for over a month.

Figure 4-77 North Complex Fires – Air Quality Impacts



Source: EAP AirNow website. Retrieved on 1/11/2021.
Map Colors: Green (Good), Yellow (Moderate), Orange (Unhealthy for Sensitive Groups), Red (Unhealthy), Dark Pink (Very Unhealthy), Maroon (Hazardous)

Public Safety Power Shutoff Events

The County noted that there have been events in the past where wildfires have not occurred, but wildfire conditions were high. During these times of high winds, high temps, and high wildfire risk, a PSPS occurred in the County. Past events of PSPS in the County are discussed below:

INSERT PSPS Events

Likelihood of Future Occurrence

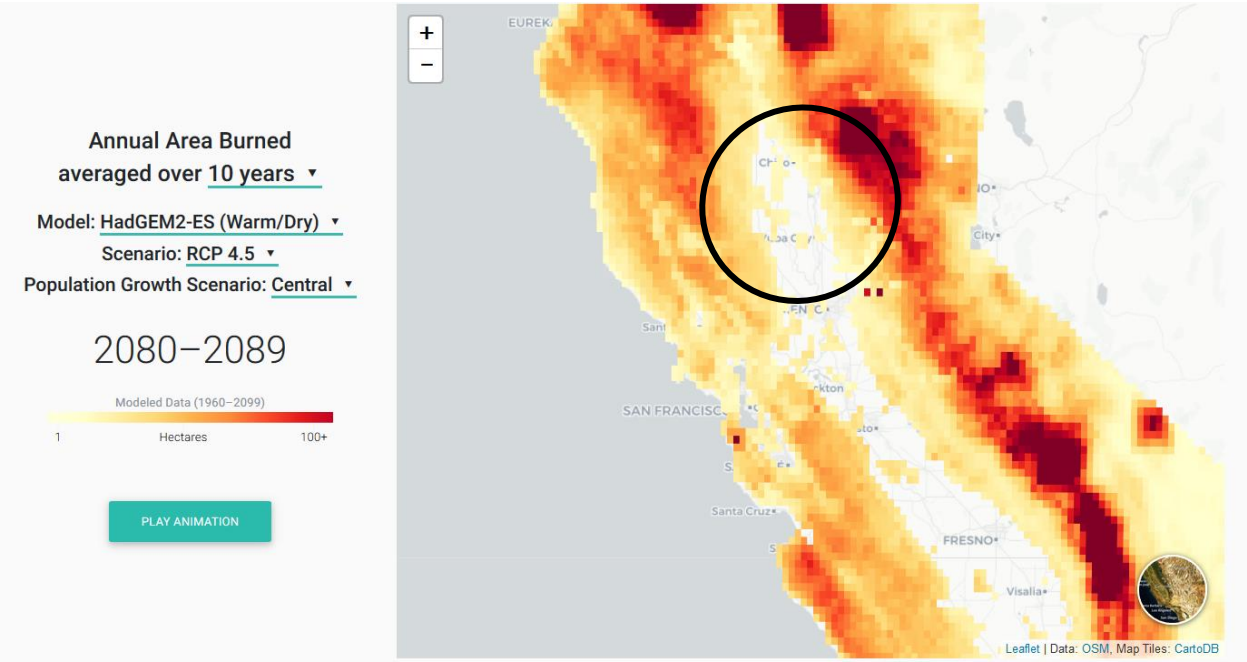
Highly Likely — From May to October of each year, Sutter County faces a wildfire threat. Fires will continue to occur on an almost annual basis in the Sutter County Planning Area. The threat of wildfire and potential losses constantly increase as human development and population increase in the wildland urban interface area in the County. This results in a likely rating of future occurrence. However; the County has

little forested area, so wildfires are generally limited in size and area affected (usually grassland and vegetative fires), and are easier to contain than fires in forested or mountainous areas of California.

Climate Change and Wildfire

Warmer temperatures can exacerbate drought conditions. Drought often kills plants and trees, which serve as fuel for wildfires. Warmer temperatures could increase the number of wildfires and pest outbreaks, such as the western pine beetle. Cal-Adapt's wildfire tool predicts the potential increase in the amount of burned areas for the year 2080-2089, as compared to recent (2010) conditions. This is shown in Figure 4-78. Based on this model, Cal-Adapt predicts that wildfire risk in Sutter County will increase slightly (and much less than other California counties) in the near term and subside during mid-to late-century. However, wildfire models can vary depending on the parameters used. Cal-Adapt does not take landscape and fuel sources into account in their model. In all likelihood, in Sutter County, precipitation patterns, high levels of heat, topography, and fuel load will determine the frequency and intensity of future wildfire.

Figure 4-78 Sutter County – Projected Increase in Wildfire Burn Areas



Source: Cal-Adapt

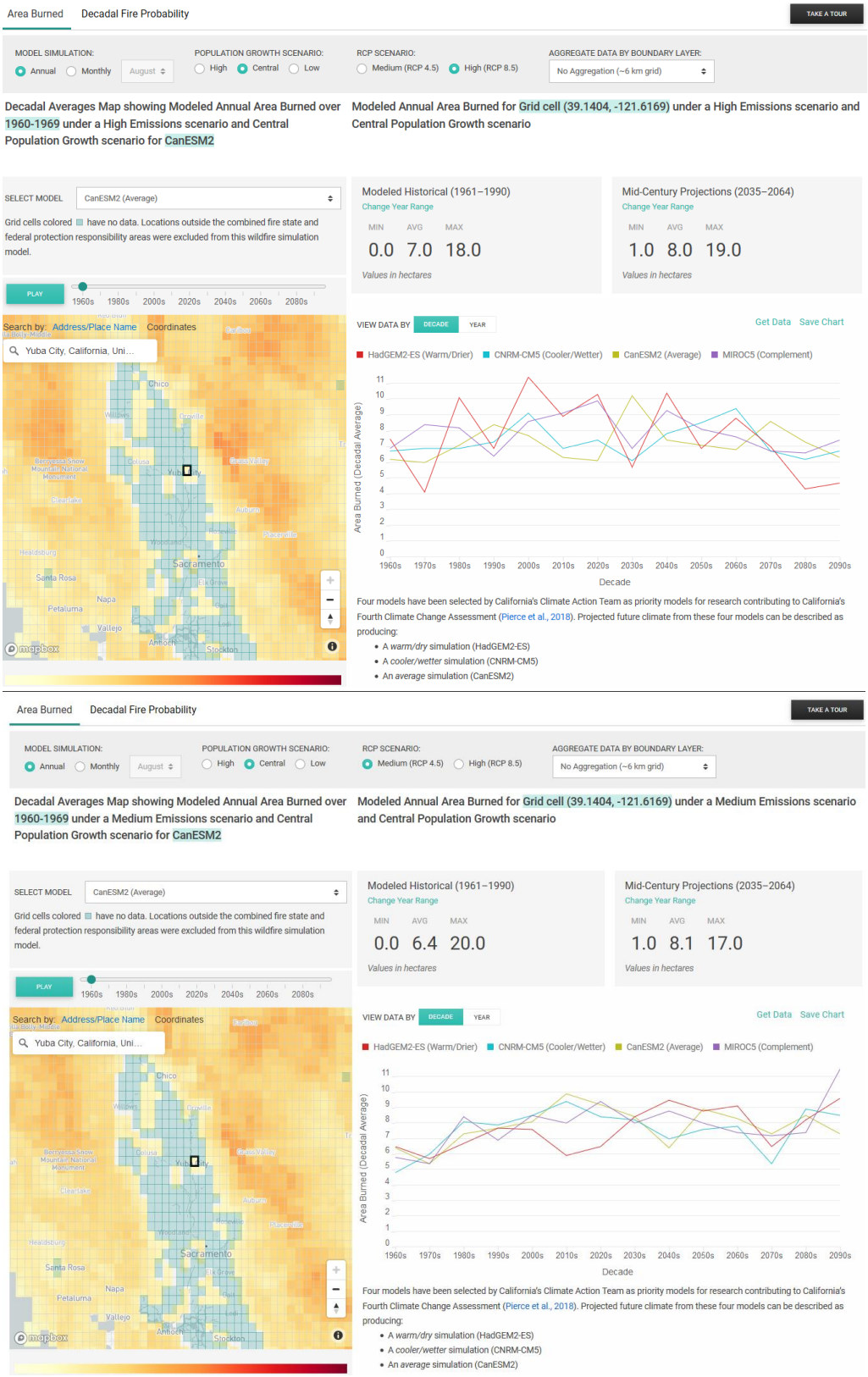
Cal-Adapt has also sought to model annual averages of area burned in the State. Four models have been selected by California's Climate Action Team Research Working Group as priority models for research contributing to California's Fourth Climate Change Assessment. Projected future climate from these four models can be described as producing:

- A warm/dry simulation (HadGEM2-ES) – shown by the red line on the below charts
- A cooler/wetter simulation (CNRM-CM5) – shown by the blue line on the below charts
- An average simulation (CanESM2) – shown by the green line on the below charts
- The model simulation that is most unlike the first three for the best coverage of different possibilities (MIROC5) – shown by the purple line on the below charts

Future modeled annual averages of area burned from Cal-Adapt for the Sutter County Planning (using the quad that contains Yuba City) are shown in Figure 4-79. It shows the following:

- The upper chart shows modeled annual averages of area burned for the selected area on map under the RCP 8.5 scenario in which emissions continue to rise strongly through 2050 and plateau around 2100.
- The lower chart shows modeled annual averages of area burned for the selected area on map under the RCP 4.5 scenario in which emissions peak around 2040, then decline.

Figure 4-79 Sutter County – Future Acreage Burned: High and Low Emission Scenarios



Source: Cal-Adapt – Annual Average of Acres Burned

Vulnerability Assessment

Vulnerability—Medium

Risk and vulnerability to the Sutter County Planning Area from wildfire is of concern, with some areas of the County being at greater risk than others as previously described. Fuel loads in portions of the County, along with geographical and topographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. During the May to October fire season, the dry vegetation and hot and sometimes windy weather results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire. As development continues throughout the County, especially in these interface areas, the risk and vulnerability to wildfires will likely increase.

Impacts

Wildfires can result in loss of life, injuries, damage to structures, and can cause short-term and long-term disruption to the County. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the County by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading water quality. Potential losses from wildfire can also include those to agricultural lands and crops in the County as well as to natural resources such as wildlife and habitat areas.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is important to recognize that they also can cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. In some cases, the economic impact of this loss of services may be comparable to the economic impact of physical damages or, in some cases, even greater. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides and mudflows, and erosion during the rainy season. School closures can also occur.

Wildfires can spread quickly and devastate thousands of acres of land, which may include agricultural lands. This devastation could lead to large losses in crops, forestry, livestock, and agricultural infrastructure.

Wildfire (Smoke) and Air Quality

Smoke and air pollution from wildfires can be a severe health hazard. Significant wildfires occurring in nearby counties since the 2013 LHMP have created significant air pollution affecting area residents County residents have had to breathe wildfire smoke, from fires both within and outside of the County. Smoke from wildfires is made up of gas and particulate matter, which can be easily observed in the air. Air quality standards have been established to protect human health with the pollutant referred to as PM2.5 which

consists of particles 2.5 microns or less in diameter. These smaller sizes of particles are responsible for adverse health effects because of their ability to reach the lower regions of the respiratory tract.

Wildfire and Power Shortage/PSPS

During periods of wildfire (or during periods of elevated risk due to high temperatures, low humidities, and high winds), PSPS events may be declared in the County. More information on power shortage and failure can be found in Section 4.3.3.

Wildfire Analysis

The Sutter County Planning Area has mapped CAL FIRE fire hazard severity zones (FHSZs) based on fire responsibility areas as further described below. GIS was used to determine the possible impacts of wildfire within the County and how the wildfire risk varies across the Planning Area. The wildfire analysis includes an analysis of affected parcels and values by Fire Responsibility areas and by CAL FIRE's FHSZs.

Fire Responsibility Area Analysis

There are various wildland fire protection agencies that have responsibility within the California Counties. There are also numerous fire departments and fire protection districts that serve local areas, many of whom have mutual aid agreements with each other as well as state and federal agencies for fire suppression and protection. Fire Responsibility areas are generally categorized by Federal Responsibility Areas (FRA), State Responsibility Areas (SRA) and Local Responsibility Areas (LRA).

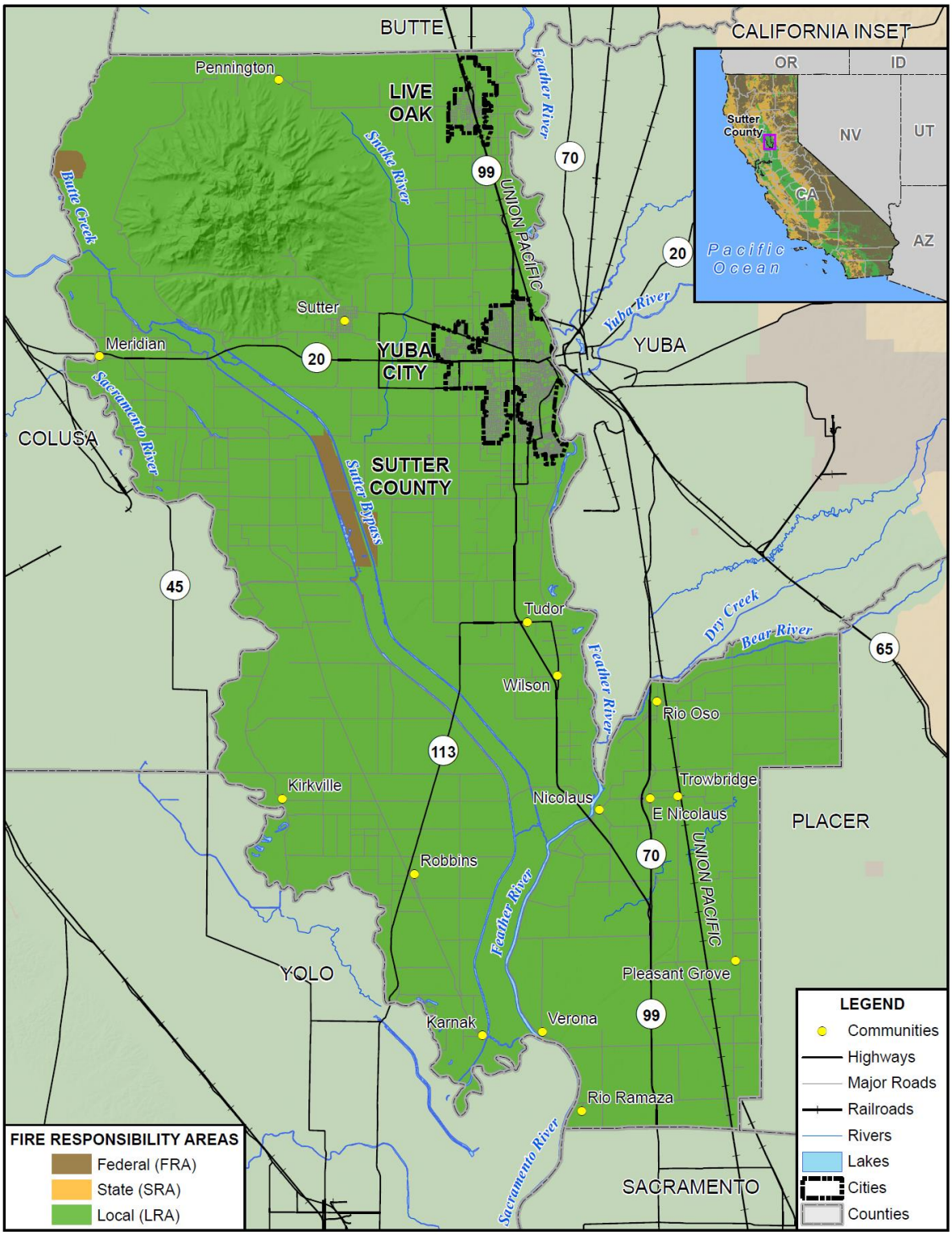
The CAL FIRE data, detailing Fire Responsibility Areas within the County Planning Area, was utilized to determine the locations, numbers, types, and values of land and structures falling within each Fire Responsibility Area. The following sections provide details on the methodology and results for this analysis.

Methodology

CAL FIRE has a legal responsibility to provide fire protection on all SRA lands, which are defined based on land ownership, population density and land use. CAL FIRE's State Responsibility Area layer was used in this analysis to show Sutter County's parcel counts and values by FRA, SRA, and LRA.

The fire responsibility area layer was overlaid with the parcel data. Since it is possible for any given parcel to intersect with multiple fire responsibility areas, for purposes of this analysis, the parcel centroid was used to determine which fire responsibility area to assign to each parcel. Once completed, the parcel boundary layer was joined to the centroid layer and values were transferred based on the identification number in the Assessor's database and the FIS parcel layer. Based on this approach, the fire responsibility areas for the Sutter County Planning Area were determined and further broken out by property use and included information on both land and improved values. Locations of each responsibility area are shown in Figure 4-80.

Figure 4-80 Sutter County Planning Area – Fire Responsibility Areas by FRA, SRA, LRA



Data Source: CAL FIRE (SRA 20_2) 7/2020, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Fire Responsibility Areas and Values at Risk Results

Most all of the physical area of Sutter County falls in the LRA. The LRA has 36,124 improved parcels with $14.65 billion in total value. The FRA contains 35 parcels, of which 1 is improved. There are no parcels in the SRA. It should be noted that fire does not just affect structural values, fire can also affect land values. As such the Assessor's land values and all parcels were accounted for in this analysis to represent total county values at risk. However, it is highly unlikely the whole County will ever be on fire at once. The County parcel inventory and associated values by fire responsibility area are provided in Table 4-89 for the entire Sutter County Planning Area, as described in the Values at Risk in Section 4.2. Also, it is important to keep in mind that these assessed values may be well below the actual market value of improved parcels located within the fire hazard severity zones due primarily to Proposition 13 and to a lesser extent properties falling under the Williamson Act.

Table 4-89 Sutter County Planning Area – Count and Value of Parcels by Local, State, and Federal Responsibility Areas by Property Use

Jurisdiction/ Fire Responsibility Area	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
City of Live Oak						
LRA	2,836	2,334	$129,056,822	$376,507,955	$225,764,558	$731,329,335
SRA	–	–	$0	$0	$0	$0
FRA	–	–	$0	$0	$0	$0
Total	**2,836**	**2,334**	**$129,056,822**	**$376,507,955**	**$225,764,558**	**$731,329,335**
City of Yuba City						
LRA	20,292	18,540	$1,480,747,541	$4,467,117,403	$2,895,777,782	$8,843,642,726
SRA	–	–	$0	$0	$0	$0
FRA	–	–	$0	$0	$0	$0
Total	**20,292**	**18,540**	**$1,480,747,541**	**$4,467,117,403**	**$2,895,777,782**	**$8,843,642,726**
Unincorporated County						
LRA	12,996	8,901	$2,212,449,359	$1,564,853,584	$1,292,984,711	$5,070,287,654
SRA	–	–	$0	$0	$0	$0
FRA	35	1	$3,950,480	$9,000	$9,000	$3,968,480
Total	**13,031**	**8,902**	**$2,216,399,839**	**$1,564,862,584**	**$1,292,993,711**	**$5,074,256,134**
Grand Total	**36,159**	**29,776**	**$3,826,204,202**	**$6,408,487,942**	**$4,414,536,051**	**$14,649,228,195**

Source: CAL FIRE, Sutter County 2020 Parcel/Assessor's Data

Fire Hazard Severity Zone Analysis

As part of the Fire and Resource Assessment Program (FRAP), CAL FIRE was mandated to map areas of significant fire hazards based on fuels, terrain, weather, and other relevant factors. These zones, referred

to as FHSZs, then define the application of various mitigation strategies to reduce risk associated with wildland fires.

Fire hazard is a way to measure the physical fire behavior so that people can predict the damage a fire is likely to cause. Fire hazard measurement includes the speed at which a wildfire moves, the amount of heat the fire produces, and most importantly, the burning fire brands that the fire sends ahead of the flaming front.

The fire hazard model developed by CAL FIRE considers the wildland fuels. Fuel is that part of the natural vegetation that burns during the wildfire. The model also considers topography, especially the steepness of the slopes. Fires burn faster as they burn up-slope. Weather (temperature, humidity, and wind) has a significant influence on fire behavior. The model recognizes that some areas of California have more frequent and severe wildfires than other areas. Finally, the model considers the production of burning fire brands (embers) how far they move, and how receptive the landing site is to new fires.

In 2007, CAL FIRE developed its FHSZ maps for the State of California to provide updated map zones, based on new data, science, and technology that will create more accurate zone designations such that mitigation strategies are implemented in areas where hazards warrant these investments. The zones will provide specific designation for application of defensible space and building standards consistent with known mechanisms of fire risk to people, property, and natural resources. The program is still ongoing with fire hazard severity zone maps being updated based on designated responsibility areas: FRA, SRA, and LRA.

The CAL FIRE data, detailing FHSZs within the Sutter County Planning Area, was utilized to determine the locations, numbers, types, and values of land and structures falling within each FHSZ. The following sections provide details on the methodology and results for this analysis.

Methodology

CAL FIRE mapped the SRA FHSZs, or areas of significant fire hazard, based on fuels, terrain, weather, and other relevant factors. Zones are designated with Very High, High, Moderate, Non-Wildland/Non-Urban and Urban Unzoned hazard classes. The goal of this mapping effort is to create more accurate fire hazard zone designations such that mitigation strategies are implemented in areas where hazards warrant these investments. The FHSZs will provide specific designation for application of defensible space and building standards consistent with known mechanisms of fire risk to people, property, and natural resources.

The "Draft" LRA FHSZ (c6fhszl06_1) dated September 2007 layer and the Adopted SRA FHSZ (fhszs06_3_6) dated November 2007 were used to get a complete coverage of Fire Hazards.

Analysis was performed using the FHSZ datasets, and using GIS, the parcel layer was overlaid on the Draft and Adopted FHSZ layers. For the purposes of this analysis, if the parcel centroid intersects the zone's area, it will be assumed that the entire parcel is in that area. This analysis illustrates the FHSZs specific to the Planning Area and the unincorporated County.

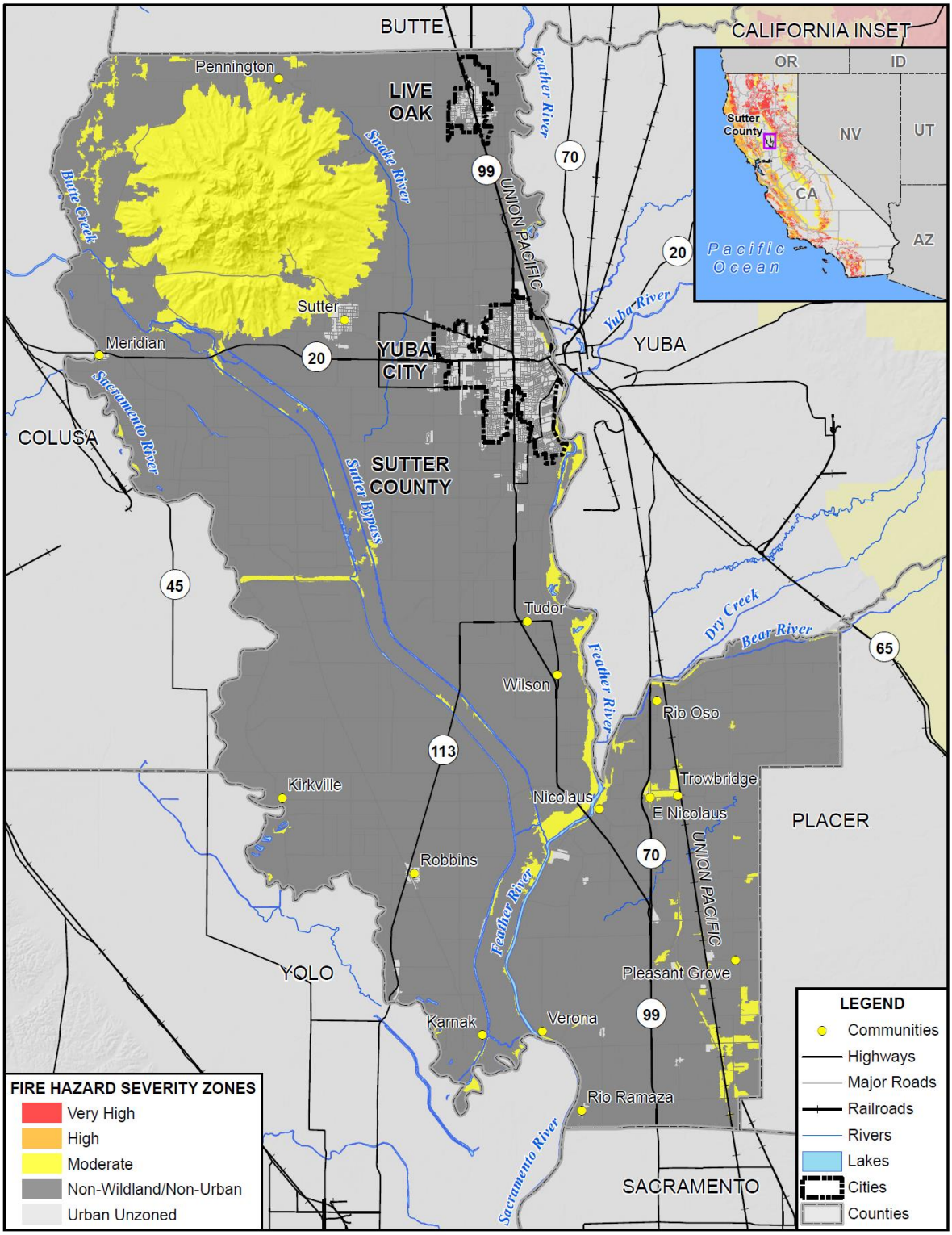
Fire Hazard Severity Zones Analysis Results: Values at Risk

Results are presented in this section for the Sutter County Planning Area and the unincorporated County. Detail tables for the incorporated communities are included in their respective annexes to this LHMP Update.

Sutter County Planning Area

The FHSZs in Sutter County are shown in Figure 4-81. Analysis results for Sutter County are summarized in Table 4-90. These tables summarize total parcel counts, improved parcel counts, and their improved and land values, and the estimated contents replacement values based on the CRV factors detailed in Table 4-7. Details specific to land uses in the incorporated jurisdictions in the County are shown in their respective annexes to this Plan Update.

Figure 4-81 Sutter County Planning Area – Fire Hazard Severity Zones



Data Source: CAL FIRE (Draft 9/2007 - c51fhszl06_1), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table 4-90 Sutter County Planning Area – Count and Value of Parcels in Fire Hazard Severity Zones

Jurisdiction / Fire Hazard Severity Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
City of Live Oak						
Non-Wildland/Non-Urban	163	105	$22,118,421	$34,259,855	$18,774,049	$75,152,325
Urban Unzoned	2,673	2,229	$106,938,401	$342,248,100	$206,990,509	$656,177,010
City of Live Oak Total	**2,836**	**2,334**	**$129,056,822**	**$376,507,955**	**$225,764,558**	**$731,329,335**
City of Yuba City						
Moderate	175	166	$11,064,440	$35,712,304	$18,182,470	$64,959,214
Non-Wildland/Non-Urban	144	114	$71,083,991	$109,798,781	$92,048,859	$272,931,631
Urban Unzoned	19,973	18,260	$1,398,599,110	$4,321,606,318	$2,785,546,454	$8,505,751,882
City of Yuba City Total	**20,292**	**18,540**	**$1,480,747,541**	**$4,467,117,403**	**$2,895,777,782**	**$8,843,642,726**
Unincorporated Sutter County						
Moderate	752	337	$83,144,494	$61,361,546	$52,576,693	$197,082,733
Non-Wildland/Non-Urban	7,874	4,680	$1,895,496,849	$849,926,486	$852,923,688	$3,598,347,023
Urban Unzoned	4,405	3,885	$237,758,496	$653,574,552	$387,493,331	$1,278,826,379
Unincorporated Sutter County Total	**13,031**	**8,902**	**$2,216,399,839**	**$1,564,862,584**	**$1,292,993,711**	**$5,074,256,134**
Grand Total	**36,159**	**29,776**	**$3,826,204,202**	**$6,408,487,942**	**$4,414,536,051**	**$14,649,228,195**

Source: CAL FIRE, Sutter County 2020 Parcel/Assessor's Data

Unincorporated Sutter County

Analysis results for unincorporated Sutter County are broken out by property use in **Error! Not a valid bookmark self-reference.**. This table details total parcel counts, improved parcel counts, and their improved and land values, and the estimated contents replacement values based on the CRV factors detailed in Table 4-7.

Table 4-91 Sutter County Planning Area – Count and Value of Parcels in Fire Hazard Severity Zones by Property Use

Jurisdiction / Fire Hazard Severity Zone/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Moderate						
Agricultural	439	197	$57,542,667	$29,044,036	$29,044,036	$115,630,739
Commercial	16	15	$4,881,493	$8,896,015	$8,896,015	$22,673,523
Industrial	21	9	$3,979,266	$2,721,536	$4,082,304	$10,783,106
Institutional	74	10	$5,447,454	$435,052	$435,052	$6,317,558
Miscellaneous	20	0	$0	$0	$0	$0
Residential	135	105	$10,090,832	$20,238,571	$10,119,286	$40,448,689
Vacant	47	1	$1,202,782	$26,336	$0	$1,229,118
Moderate Total	**752**	**337**	**$83,144,494**	**$61,361,546**	**$52,576,693**	**$197,082,733**
Non-Wildland/Non-Urban						
Agricultural	5,991	3,595	$1,775,404,727	$515,470,585	$515,470,585	$2,806,345,897
Commercial	117	105	$22,897,222	$47,618,760	$47,618,760	$118,134,742
Industrial	167	80	$25,600,384	$134,495,284	$201,742,926	$361,838,594
Institutional	328	49	$12,741,536	$23,843,319	$23,843,319	$60,428,174
Miscellaneous	111	0	$0	$0	$0	$0
Residential	1,041	850	$51,943,751	$128,496,195	$64,248,098	$244,688,044
Vacant	119	1	$6,909,229	$2,343	$0	$6,911,572
Non-Wildland/Non-Urban Total	**7,874**	**4,680**	**$1,895,496,849**	**$849,926,486**	**$852,923,688**	**$3,598,347,023**
Urban Unzoned						
Agricultural	166	133	$17,828,104	$20,250,064	$20,250,064	$58,328,232
Commercial	96	77	$13,783,847	$33,158,675	$33,158,675	$80,101,197
Industrial	44	36	$7,463,308	$18,647,815	$27,971,723	$54,082,846
Institutional	195	53	$14,171,934	$30,710,756	$30,710,756	$75,593,446
Miscellaneous	44	0	$0	$0	$0	$0
Residential	3,609	3,584	$179,997,826	$550,804,227	$275,402,114	$1,006,204,167
Vacant	251	2	$4,513,477	$3,015	$0	$4,516,492
Urban Unzoned Total	**4,405**	**3,885**	**$237,758,496**	**$653,574,552**	**$387,493,331**	**$1,278,826,379**
Unincorporated Sutter County Total	**13,031**	**8,902**	**$2,216,399,839**	**$1,564,862,584**	**$1,292,993,711**	**$5,074,256,134**

Jurisdiction / Fire Hazard Severity Zone/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Grand Total	**36,159**	**29,776**	**$3,826,204,202**	**$6,408,487,942**	**$4,414,536,051**	**$14,649,228,195**

Source: CAL FIRE, Sutter County 2020 Parcel/Assessor's Data

Population at Risk

A separate analysis was performed to determine population that reside in FHSZs. Using GIS, the CAL FIRE FHSZ datasets were overlayed on the improved residential parcel data. Those parcel centroids that intersect each FHSZ were counted and multiplied by the Census Bureau average household size; results were tabulated by FHSZ (see Table 4-92). According to this analysis, there is a population of 886 in the Moderate FHSZ, and 0 in the High and Very High FHSZ in the County.

Table 4-92 Sutter County Planning Area – Residential Populations at Risk in Moderate or Higher Fire Hazard Severity Zones

Jurisdiction	Very High		High		Moderate	
	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk
City of Live Oak	0	0	0	0	0	0
City of Yuba City	0	0	0	0	165	493
Unincorporated Sutter County	0	0	0	0	135	393
Total	**0**	**0**	**0**	**0**	**300**	**886**

Source: CAL FIRE, US Census Bureau Average Household Sizes: City of Live Oak (2.59); City of Yuba City (2.99); unincorporated Sutter County (2.91)

Critical Facilities at Risk

A separate analysis was performed on the critical facility inventory in Sutter County to determine critical facilities in the Fire Hazard Severity Zones. Using GIS, the CAL FIRE, Fire Hazard Severity Zones were overlayed on the critical facility GIS layer. Figure 4-82 shows critical facilities, as well as the Fire Hazard Severity Zones. Table 4-93 details critical facilities by facility type and count for the Planning Area. Details of critical facility definition, type, name and address by flood zone are listed in Appendix F.

Figure 4-82 Sutter County– Critical Facilities in FHSZs

Table 4-93 Sutter County– Critical Facilities in FHSZs

Source: Sutter County GIS, CAL FIRE

Overall Community Impact

The overall impact to the community from a severe wildfire includes:

- Injury and loss of life;
- Commercial and residential structural and property damage;
- Decreased water quality in area watersheds;
- Increase in post-fire hazards such as flooding, sedimentation, and debris flows/mudslides;
- Damage to natural resource habitats and other resources, such as crops, timber and rangelands;
- Loss of water, power, roads, phones, and transportation, which could impact, strand, and/or impair mobility for emergency responders and/or area residents;
- Economic losses (jobs, sales, tax revenue) associated with loss of commercial structures;
- Negative impact on commercial and residential property values;
- Loss of churches, which could severely impact the social fabric of the community;
- Loss of schools, which could severely impact the entire school system and disrupt families and teachers, as temporary facilities and relocations would likely be needed; and
- Impact on the overall mental health of the community.

Future Development

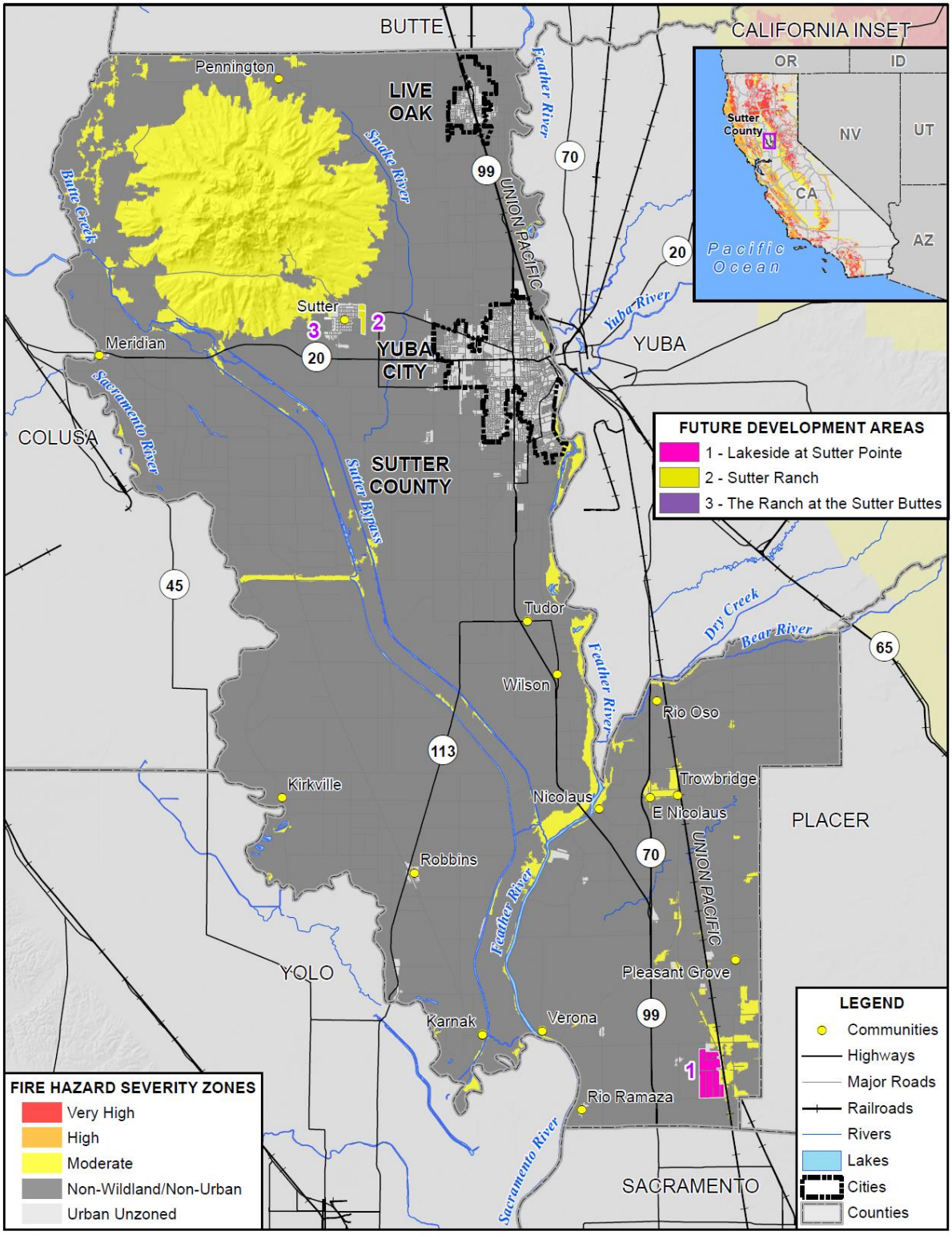
Population growth and development in Sutter County has recently slowed; however, additional growth and development within the WUI and other high fire hazard areas of the County would place additional values at risk to wildfire. County building codes are in effect to reduce this risk.

GIS Analysis

Sutter County's 2020 Parcel/Assessor's data and data from the County planning department were used as the basis for the unincorporated County's inventory of parcels and acres of future development areas. Using the GIS parcel spatial file and the APNs, the three future development projects were mapped.

For the wildfire analysis of future development areas, the parcel data was converted to a point layer using a centroid conversion process, in which each parcel was identified by a central point and linked to the Assessor's data. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts and acreage within each FHSZ. FHSZs and future development areas are shown on Figure 4-83 and parcels and acreages in those areas are shown in Table 4-94.

Figure 4-83 Unincorporated Sutter County – Future Development Areas and FHSZs



Data Source: CAL FIRE (Draft 9/2007 - c51fhszl06_1), Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table 4-94 Unincorporated Sutter County – Future Development Parcels and Acres in FHSZs

Future Development / Fire Hazard Severity Zone	Total Parcel Count	Improved Parcel Count	Total Acres
Moderate			
Lakeside at Sutter Pointe	1	0	50.8
The Ranch at the Sutter Buttes	1	0	0.6
Moderate Total	**2**	**0**	**51.3**
Non-Wildland/Non-Urban			
Lakeside at Sutter Pointe	5	4	820.5
Sutter Ranch	2	1	137.4
The Ranch at the Sutter Buttes	14	2	7.7
Non-Wildland/Non-Urban Total	**21**	**7**	**965.6**
Unincorporated Sutter County Total	**23**	**7**	**1,016.9**

Source: CAL FIRE, Sutter County GIS

4.3.15. Natural Hazards Summary

Table 4-95 summarizes the results of the hazard identification, hazard profile, and vulnerability assessment for the Sutter County Planning Area based on hazards data and input from the HMPC. For each hazard profiled in Section 4.3, this table includes the likelihood of future occurrence and whether the hazard is considered a priority hazard for mitigation actions (as discussed in Chapter 5 of this Plan Update) in the Sutter County Planning Area.

Priority Hazards

As detailed in the hazard identification section, those hazards identified as a high or medium significance in Table 4-3 are considered priority hazards for mitigation planning. Those hazards that occur infrequently or have little or no impact on the Planning Area were determined to be of low significance and not considered a priority hazard. Significance was determined based on the hazard profile, focusing on key criteria such as frequency, extent, and resulting damage, including deaths/injuries and property, crop, and economic damage. The ability of a community to reduce losses through implementation of existing and new mitigation measures was also considered as to the significance of a hazard. This assessment was used by the HMPC to prioritize those hazards of greatest significance to the Sutter County Planning Area, enabling the County to focus resources where they are most needed.

Table 4-95 Hazard Identification/Profile Summary and Determination of Priority Hazards

Hazard	Likelihood of Future Occurrence	Priority Hazard
Aquatic Invasive Species	Highly Likely	N
Climate Change	Likely	Y
Dam Failure	Occasional	Y

Hazard	Likelihood of Future Occurrence	Priority Hazard
Drought & Water shortage	Likely	Y
Earthquake	Unlikely	Y
Floods: 1%/0.5%/0.2% annual chance	Occasional/Unlikely	Y
Floods: Localized Stormwater	Highly Likely	Y
Levee Failure	Occasional	Y
Pandemic	Likely	Y
Severe Weather: Extreme Cold and Freeze	Highly Likely	Y
Severe Weather: Extreme Heat	Highly Likely	Y
Severe Weather: Heavy Rains and Storms	Highly Likely	Y
Wildfire	Highly Likely	Y

4.4 Capability Assessment

Thus far, the planning process has identified the natural hazards posing a threat to the Sutter County Planning Area and described, in general, the vulnerability of the County to these risks. The next step is to assess what loss prevention mechanisms are already in place. This part of the planning process is the mitigation capability assessment. Combining the risk assessment with the mitigation capability assessment results in the County's net vulnerability to disasters, and more accurately focuses the goals, objectives, and proposed actions of this LHMP Update.

A two-step approach was used to conduct this assessment for the County. First, an inventory of common mitigation activities was made through the use of matrixes. The purpose of this effort was to identify policies and programs that were either in place, needed improvement, or could be undertaken if deemed appropriate. Second, an inventory and review of existing policies, regulations, plans, and programs was conducted to determine if they contributed to reducing hazard-related losses or if they inadvertently contributed to increasing such losses.

This section presents the County's mitigation capabilities that are applicable to the County. These are in addition to, and supplement, the many plans, reports, and technical information reviewed and used for this LHMP Update as identified in Chapter 3 and in Chapter 4.

Similar to the HMPC's effort to describe hazards, risks, and vulnerability of the County, this mitigation capability assessment describes the County's existing capabilities, programs, and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This assessment is divided into four sections: regulatory mitigation capabilities are discussed in Section 4.4.1; administrative and technical mitigation capabilities are discussed in Section 4.4.2; fiscal mitigation capabilities are discussed in Section 4.4.3; mitigation education, outreach, and partnerships are discussed in Section 4.4.4, and other mitigation efforts are discussed in Section 4.4.5.

4.4.1. Sutter County's Regulatory Mitigation Capabilities

Table 4-96 lists planning and land management tools typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in Sutter County. Excerpts from applicable policies, regulations, and plans and program descriptions follow to provide more detail on existing mitigation capabilities. FILL OUT REMAINDER OF TABLE

Table 4-96 Sutter County Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
General Plan	Y 2010	Plan addresses hazards and identifies projects and mitigation actions for them. See the discussion below this table.
Capital Improvements Plan	?	
Economic Development Plan	?	
Local Emergency Operations Plan	Y 2021	Plan addresses hazards and identifies projects and mitigation actions for them. See the discussion below this table.
Continuity of Operations Plan	Y 2020	Plan addresses hazards.
Transportation Plan	?	
Stormwater Management Plan/Program	?	
Engineering Studies for Streams	N	
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y	Climate Action Plan (2010) has plans to address climate change, as well as policies and actions to be followed by the County to reach those goals. OTHERS?
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	Y	2019 California Building Code. Code is adequately enforced.
Building Code Effectiveness Grading Schedule (BCEGS) Score	?	3/3
Fire department ISO rating:	?	Rating:
Site plan review requirements	?	
Land Use Planning and Ordinances		
Zoning ordinance	Y	Ordinances are adequately enforced. More information on the ordinances can be found below the table.
Subdivision ordinance	Y	Ordinances are adequately enforced. More information on the ordinances can be found below the table.
Floodplain ordinance	Y	Ordinances are adequately enforced. More information on the ordinances can be found below the table.

Natural hazard specific ordinance (stormwater, steep slope, wildfire)	Y	Stormwater and water well ordinances. Ordinances are adequately enforced. More information on the ordinances can be found below the table.
Flood insurance rate maps	Y	DFIRMs have been supplied by FEMA.
Elevation Certificates	Y	As part of the NFIP CRS program, this is used when necessary.
Acquisition of land for open space and public recreation uses	Y	As part of the NFIP CRS program, this is used when necessary.
Erosion or sediment control program	Y	Ordinances are adequately enforced. More information on the ordinances can be found below the table.
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP YOUR JURISDICTION		

Source: Sutter County

As indicated in the tables above, Sutter County has several plans and programs that guide the County's mitigation of development of hazard-prone areas. Starting with the Sutter County General Plan, which is the most comprehensive of the County's plans when it comes to mitigation, some of these are described in more detail below.

Sutter County General Plan (2011)

A general plan is a legal document, required by state law, that serves as a community's "constitution" for land use and development. The plan must be a comprehensive, long-term document, detailing proposals for the "physical development of the county or city, and of any land outside its boundaries which in the planning agency's judgment bears relation to its planning" (Government Code §65300 et seq.). Time horizons vary, but the typical general plan looks 10 to 20 years into the future. The law specifically requires that the general plan address seven topics or "elements." These are land use, circulation (transportation), housing, conservation, open space, noise, and safety. The plan must analyze issues of importance to the community, set forth policies in text and diagrams for conservation and development, and outline specific programs for implementing these policies.

Goals and policies related to mitigation from the General Plan include the following:

Land Use Element

GOAL:	**Goal LU-1 Promote the efficient and sensitive use of lands to protect and enhance Sutter County's quality of life and meet the needs of existing and future residents and businesses.**
Objective:	Identification of Floodplains. Identify the unincorporated areas of Sutter County that are subject to flooding, and evaluate and regulate development within these areas according to state and federal regulations to minimize the loss of life and damage to property caused by potential flood events.
Objective:	Climate Action Plan. Require new development to demonstrate consistency with the County's Climate Action Plan to reduce greenhouse gas emissions.

GOAL:	GOAL LU 4 Facilitate orderly, well-planned, sustainable, and efficient growth that balances aesthetic, functional, resource, and economic considerations.
Objective:	Growth Areas. Direct future growth and development to the growth areas identified on the land use map.

Agriculture Element

The related mitigation goals and policies of the Agriculture Element are:

GOAL:	Goal AG 1 Preserve and protect high-quality agricultural lands for long-term agricultural production.
Objective:	Interrelationship with Habitat Conservation. Permit agriculturally designated lands to be used for habitat conservation and/or mitigation with approval of a development agreement, provided such use does not interfere or adversely affect existing or planned agricultural uses or impact County flood control operations.
Objective:	Land Mitigation Program. Explore, and if determined feasible, create an Agricultural Land Mitigation Program.

GOAL:	GOAL AG 3 Protect the natural resources needed to ensure that agriculture remains an essential and sustainable part of Sutter County's future.
Objective:	Efficient Water Management. Support the efficient management and use of agricultural water resources where economically feasible to support agriculture.
Objective:	Water Conservation and Recycling. Support the efforts of the multiple water agencies operating in Sutter County to adopt water conservation practices and explore the feasibility of water recycling for agriculture.
Objective:	Water Quality and Quantity. Support efforts to maintain water resource quality and quantity for the irrigation of productive farmland.
Objective:	Water Use Reduction. Implement, as appropriate, reduction measures in the Climate Action Plan targeted to manage agricultural water use. Such measures may include encouraging agricultural water users to conserve water, and providing information on technologies that reduce agricultural water use.
Objective:	Groundwater Resources. Support the efforts of the local water agencies to promote groundwater recharge, conjunctive use, conservation of significant recharge areas, and other activities to protect and manage Sutter County's groundwater resources.

Infrastructure Element

The related mitigation goals and policies of the Infrastructure Element are:

GOAL:	GOAL I 1 Ensure the availability of an adequate, reliable, and safe potable water supply for current and future County residents, businesses, and other water users.
Objective:	Improve Water Availability. Support the creation of new water projects in appropriate locations that improve water availability for urban, rural, and agricultural water uses in Sutter County, including recycled water projects.

GOAL:	GOAL I 1 Ensure the availability of an adequate, reliable, and safe potable water supply for current and future County residents, businesses, and other water users.
Objective:	Water Conservation. Support water conservation programs that increase water use efficiency, and provide incentives for adoption of water-efficiency measures.

GOAL:	GOAL I 3 Ensure stormwater runoff is collected and conveyed safely and efficiently.
Objective:	Availability. Require new development to study, coordinate, and plan the provision of stormwater services to support the new development and demonstrate the availability of long-term, safe, and reliable stormwater collection, and conveyance.
Objective:	Infrastructure Planning. Establish stormwater collection master plans for areas served, or to be served, by County-owned or County-operated stormwater systems. Ensure that the required infrastructure is successfully planned and designed.
Objective:	New Development. Require new development to provide stormwater systems supporting the development based on the following guidelines for stormwater collection and conveyance
Objective:	Mitigation of Stormwater Flows. Require new development to adequately mitigate increases in stormwater flow rates and volume.

Public Services Element

The related mitigation goals and policies of the Public Services Element are:

GOAL:	GOAL PS 2 Protect life and property from the risk of fire, and provide for coordinated emergency medical services.
Objective:	Coordinated Operations. Coordinate operations between County Service Areas, independent Fire Protection Districts, and neighboring fire service agencies to ensure optimum fire protection and efficient use of all fire suppression resources.
Objective:	New Fire Stations. Ensure that new fire stations are located strategically throughout the County to provide optimal response times to all areas.
Objective:	Adequate Fire Flows. Incorporate fire flow requirements into new development design consistent with the California Fire Code and other applicable requirements based on County fire prevention standards.

GOAL:	GOAL PS 3 Minimize risk to life and property resulting from wildland fire hazards.
Objective:	Development Limitation. Limit development in areas of extreme, very high, and high wildfire risk.
Objective:	Defensible Space. Require new and/or existing development to establish adequate defensible space by providing clearance around structures, and using fire-resistant landscaping and roofing materials.
Objective:	Private Properties. Require private property owners to remove excessive/overgrown vegetation and rubbish to prevent and minimize fire risks.
Objective:	Wildfire Management Plan. Require new large-scale development projects (i.e., Specific Plans, Rural Planned Communities) to prepare and implement a County approved wildfire management plan incorporating fire protection measures for developing properties adjacent to undeveloped lands. The wildfire management plan shall be consistent with any adopted Countywide plan and/or regulations in effect at the time of the project's approval.

Environmental Resources Element

The related mitigation goals and policies of the Environmental Resources Element are:

GOAL:	GOAL ER 1 Support a comprehensive approach for the conservation, enhancement, and regulation of Sutter County's significant habitat and natural open space resources.
Objective:	Natomas Basin HCP. Ensure compliance with the adopted Natomas Basin Habitat Conservation Plan to promote biological conservation within the Natomas Basin portion of Sutter County.
Objective:	Yuba-Sutter NCCP/HCP. Participate in the preparation and implementation of the Yuba-Sutter Natural Community Conservation Plan/Habitat Conservation Plan to promote biological conservation within the Plan boundary area in Sutter County.
Objective:	Mitigation. Mitigate biological and open space effects that cannot be avoided in accordance with an applicable Habitat Conservation Plan and federal, state, and local regulations.

GOAL:	GOAL ER 2 Conserve, protect, and enhance Sutter County's significant natural wetland and riparian habitats.
Objective:	No Net Loss. Require new development to ensure no net loss of state and federally regulated wetlands, other waters of the United States (including creeks, rivers, ponds, marshes, vernal pools, and other seasonal wetlands), and associated functions and values through a combination of avoidance, restoration, and compensation.
Objective:	Resource Conservation District. Encourage and support the Sutter County Resource Conservation District's programs that facilitate preservation and restoration of natural wetland environments as long as these programs do not significantly affect Sutter County agricultural lands and flood control operations.
Objective:	Minimize Surface Runoff. Minimize direct discharge of surface runoff into wetland areas and design new development in such a manner that pollutants and siltation will not significantly affect jurisdictional wetlands.
Objective:	Wetland Mitigation Banks. Encourage the creation and use of regional wetland mitigation banks to the extent that they do not conflict with Sutter County agricultural lands and flood control operations.

GOAL:	GOAL ER 6 Preserve and protect the County's surface water and groundwater resources.
Objective:	Integrated Water Management Programs. Integrate water management programs that emphasize multiple benefits and balance the needs of agricultural, rural, and urban users.
Objective:	Surface Water Resources. Protect the surface water resources in the County including the Sacramento, Feather and Bear Rivers and their significant tributaries.
Objective:	Groundwater Sustainability. Protect the sustainability of groundwater resources.
Objective:	Groundwater Recharge Areas. Require new development to preserve areas that provide important groundwater recharge, stormwater management, and water quality benefits such as undeveloped open spaces, natural habitat, riparian corridors, wetlands, and natural drainage areas.

GOAL:	GOAL ER 6 Preserve and protect the County's surface water and groundwater resources.
Objective:	Water Use Reduction. Implement, as appropriate, the reduction measures in the Climate Action Plan targeted to reduce water use. Such measures may include: adopting a per capita water use reduction goal; implementing a water conservation and efficiency program; providing incentives for new development to reduce potable water use; installing water meters for uses not using wells; encouraging water suppliers to adopt a water conservation pricing schedule; encouraging upgrades in water efficiency; providing training and education on water efficiency; and increasing recycled water use.

Public Health & Safety Element

The related mitigation goals and policies of the Public Health and Safety Element are:

GOAL:	GOAL PHS 1 Minimize the potential for loss of life, personal injury, and property damage associated with floods.
Objective:	NFIP. Continue to participate in the National Flood Insurance Program and the Community Rating System.
Objective:	Minimize Risk of Flood Damage. Require a minimum of 100- year flood protection and regulate development in accordance with local, state, and federal requirements to avoid or minimize the risk of flood damage.
Objective:	Flood Protection for New Development. Require new development in urban and/or urbanizing areas to provide 200-year flood protection within 3 years of adoption of the Central Valley Flood Protection Plan in accordance with state regulations, and require new development outside urban or urbanizing areas to provide 100-year flood protection in accordance with federal regulations.
Objective:	Development in Dam Inundation Areas. Require new development located in dam inundation areas to consider the risks from dam failure.
Objective:	Essential Facilities. Require that new essential public facilities (e.g., hospitals, health care facilities, emergency shelters, fire stations, etc.) be located, when feasible, outside of flood hazard zones, as defined by FEMA, or designed to maintain the structural and operational integrity of the facility during flooding events.

GOAL:	GOAL PHS 2 Minimize the risk of personal injury and property damage due to geologic and seismic hazards and adverse soil conditions.
Objective:	Review Standards. Review and enforce seismic and geologic safety standards and require the use of best management practices in site design and building construction methods.
Objective:	Minimize Exposure to Geologic Hazards. Minimize development in areas where geologic hazards exist from landslides and erosion.
Objective:	Site-Specific Geotechnical Analysis. Require the preparation of a County approved site-specific geotechnical analysis prior to approval of development in areas where the potential for geologic or seismic hazards exists (e.g., ground shaking, landslides, liquefaction, expansive soils, steep slopes, subsidence, and erosion) and incorporate recommended project features to avoid or minimize the identified hazards.
Objective:	Essential Facilities. Promote the upgrade, retrofitting, and/or relocation of existing essential facilities (e.g., hospitals, schools, law enforcement and fire stations, etc.) that do not meet current building code standards and are within areas susceptible to seismic or geologic hazards.

GOAL:	GOAL PHS 4 Respond appropriately, effectively, and efficiently to natural and human-made emergencies and disasters.
Objective:	Emergency Operation Plans. Continue to implement and regularly update countywide emergency operation plans to reduce or eliminate long-term risk to life and property from natural or human-made emergencies and disasters.
Objective:	Evacuation Routes. Regularly review established evacuation routes to ensure emergency access to and from all parts of the County.
Objective:	Emergency Access. Require minimum road and driveway widths and clearances around structures consistent with established requirements in order to ensure emergency access.
Objective:	Emergency and Disaster Preparedness Training. Coordinate with local and regional agencies to regularly conduct emergency and disaster preparedness training to test operational and emergency plans.
Objective:	StormReady Program. Continue to be a member of the StormReady Program ensuring a higher level of community awareness to minimize the loss of life and property from severe weather.
Objective:	Coordination. Continue to be responsible for planning, preparedness, emergency response, and recovery activities associated with natural and human-made disasters. Provide communication and coordination between local and federal agencies, medical facilities, schools, local radio stations, and special needs service providers.
Objective:	Public Education. Support public education and awareness regarding emergency response and disaster preparedness.

Other Sutter County Plans/Studies/Programs

Sutter County Climate Change and Health Profile Report (2017)

The Climate Change and Health Profile Report seeks to provide a county-level summary of information on current and projected risks from climate change and potential health impacts. This report represents a synthesis of information on climate change and health for California communities based on recently published reports of state agencies and other public data.

The content of this report was guided by a cooperative agreement between CDPH and the CDC Climate-Ready States and Cities Initiative's program Building Resilience Against Climate Effects (BRACE). The goals of BRACE are to assist state health departments to build capacity for climate and health adaptation planning. This includes using the best available climate science to project likely climate impacts, identifying climate-related health risks and populations vulnerable to these impacts, assessing the added burden of disease and injury that climate change may cause, identifying appropriate interventions, planning more resilient communities, and evaluating to improve the planning effort. Communities with economic, environmental, and social disadvantages are likely to bear disproportionate health impacts of climate change.

This Climate Change and Health Profile Report is intended to inform, empower, and nurture collaboration that seeks to protect and enhance the health and well-being of all California residents. This report is part of a suite of tools that is being developed by the California Department of Public Health to support local, regional, and statewide efforts of the public health sector to build healthy, equitable, resilient, and adaptive communities ready to meet the challenges of climate change. Along with a county-level climate change and health vulnerability assessment and state guidance documents, such as Preparing California for Extreme

Heat: Guidance and Recommendations, the profile provides a knowledge base for taking informed action to address climate change.

Sutter County Emergency Operations Plan (Updated in 2015)

The Sutter County Emergency Operations Plan (EOP) addresses the planned response to emergency situations associated with natural disasters, technological incidents, and national security emergencies in or affecting Sutter County. The EOP has been developed to provide a comprehensive (multi-use) emergency management program for Sutter County. It is designed to establish the framework for implementation of the California Standardized Emergency Management System (SEMS) for Sutter County, a political subdivision of the State of California, located within Mutual Aid Region III (as designated by the Governor's Office of Emergency Services). Further, the EOP and its associated annexes meet those conditions of emergency management and the basic tenets of Incident Command System (ICS) required by the National Incident Management System (NIMS). The annexes to the plan are:

- Annex 1 - Emergency Support Function (ESF) Handbook and Checklists
- Annex 2 - Emergency Operations Center Handbook and Checklists
- Annex 3 - Incident Command System (ICS) Forms
- Annex 4 - Communication Operations (Comm OPS) Plan
- Annex 5 - Floods and Dam Failure
- Annex 6 - Wildland Fire Plan
- Annex 7 - Extreme Weather and Seismic Events Plan
- Annex 8 - Transportation Emergency and Haz Mat Event Plan
- Annex 9 - Evacuation and Mass Care/Shelter
- Annex 10 - Domestic Pets/Livestock Care Plan
- Annex 11 - Volunteer and Donations Management
- Annex 12 - Terrorism
- Annex 13 - Public Health Emergency/Bioterrorism

Sutter County Evacuation Plan (being updated in 2021)

As an annex to the Sutter County EOP mentioned above, the Sutter County Evacuation and Mass Care Annex (Annex 9) deals with evacuations due to natural hazards and other events. In the past, Sutter County has evacuated its residents when threatened by flood. Most notably, the 1997 flood where a majority of the residents were evacuated due to threatening floodwaters. Fortunately, planning and preparedness resulted in minimal problems and the evacuation was successful.

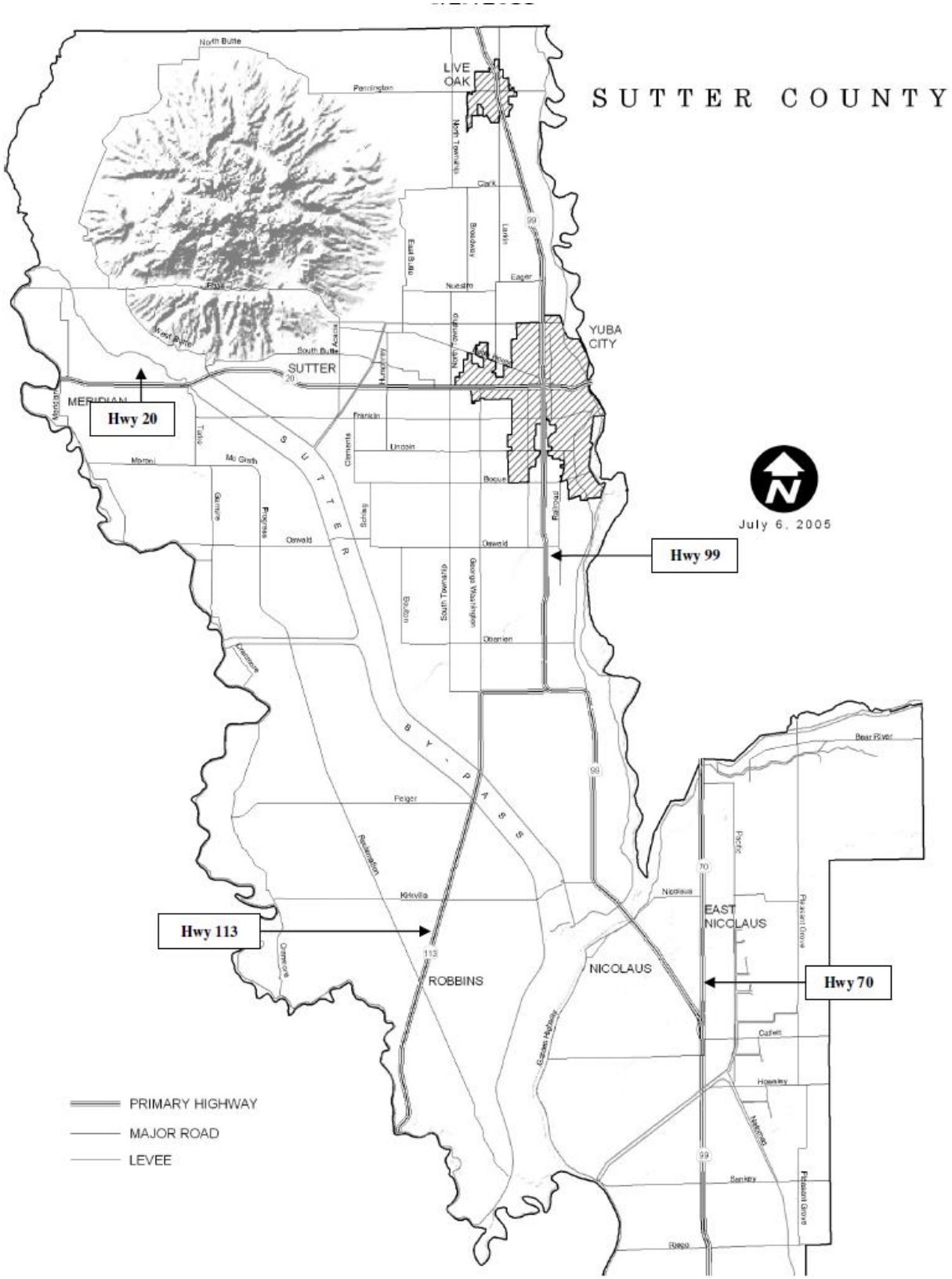
Emergency evacuation planning involves several governmental agencies and private organizations performing such functions as warning, evacuation decision making, communications, traffic control, and shelter management. These agencies and organizations also have an indispensable role in emergency preparedness planning.

The Sutter County Operational Area makes use of two types of evacuations; Advisory and Mandatory Evacuations.

An Advisory Evacuation Notice is issued when conditions exist which indicate a Mandatory Evacuation order may be given in the near future. The threat to lives is not yet imminent, but due to the potential for rapidly changing conditions to develop into a serious threat, the public is advised to prepare for the issue of a Mandatory Evacuation order. Residents are advised to leave the area. Businesses are advised to take whatever precautions they deem necessary for protecting equipment and/or inventory. Access to the area under an Advisory Evacuation is unrestricted.

A Mandatory Evacuation is ordered when conditions exist that seriously imperil or endanger the lives of those in a defined area. The danger is imminent. All non-essential persons are ordered to immediately leave the area via the described evacuation routes. Generally, residents will not be forcibly removed from their own property; however, those found to be on the property of another, or on a public roadway, may be subject to arrest or removal from the area. Once out of the area, people (including residents) will not be permitted to return until conditions permit. Any non-essential persons found by officials traveling through, or loitering in, the area will be escorted out and not permitted to re-enter the area. Those interfering with the disaster response are subject to arrest. Figure 4-84 shows the major highways in Sutter County. In the case of an actual evacuation, notification would be made as to which highway(s) to use. It should be noted that this map is being updated in 2021.

Figure 4-84 Emergency Evacuation Routes



Source: Sutter County Emergency Operations Plan, Annex 9

Yuba-Sutter NCCP/HCP

Portions of the County are within the boundaries of the proposed Yuba-Sutter NCCP/HCP (Natural Community Conservation Plan/Habitat Conservation Plan). The Yuba-Sutter NCCP/HCP is a cooperative planning effort initiated by Yuba and Sutter counties in connection with improvements to Highways 99 and 70 and future development in the area surrounding those highways. The NCCP/HCP is being developed to facilitate ways to:

- continue economic growth and community development;
- retain the economic vitality of the agricultural community;
- maintain recreation, hunting, fishing, and other public uses of open space in the NCCP/HCP area;
- simplify and expedite land use and conservation planning in the NCCP/HCP area; and
- protect threatened and endangered species; and preserve plant and wildlife communities.

Preparation and approval of the NCCP/HCP is expected to take between 3 and 5 years, depending on the complexity of the planning process. Until the NCCP/HCP is approved, there is no requirement for compliance. However, it is prudent for longer term projects, or recently initiated smaller projects within the NCCP/HCP boundaries to give consideration to this planning document.

Natomas Basin Habitat Conservation Plan (NBHCP)

Portions of the County are within the Natomas Basin - a low-lying portion of the County east of the Sacramento River and north of the American River. The Natomas Basin contains incorporated and unincorporated areas within the jurisdictions of Sutter County and Sacramento County. Historically the basin was primarily in agricultural production. The existing water conveyance systems within the Natomas Basin were created for water conveyance and drainage. They provide nesting, feeding, and migration corridor habitat for a variety of species in the basin.

The Natomas Basin contains a variety of habitat types, open water aquatic habitat (including ditches and drains), emergent marsh, riparian forest, riparian scrub-shrub, grassland, vernal pools, and agriculture. A number of special-status species (wildlife and plant), as determined by the California Department of Fish and Game (CDFG) or the U.S. Fish and Wildlife Service (USFWS), inhabit or forage within the Natomas Basin.

Yuba Sutter Regional Conservation Plan

The purpose of the Yuba Sutter Regional Conservation Plan (Plan) is to protect and enhance ecological diversity and function within the rapidly urbanizing region of Yuba County and the more slowly urbanizing region of Sutter County. Yuba and Sutter Counties encompass 405,582 and 389,443 acres, respectively. The Plan Area encompasses a total of 469,271 acres: 141,644 acres in Yuba County and 327,627 in Sutter County. The Plan Area includes the cities of Wheatland, Yuba City, and Live Oak and the spheres of influence of each jurisdiction. The Plan describes how to avoid, minimize, and mitigate, to the maximum extent practicable, impacts on covered species and their habitats while allowing for the growth of selected areas within these counties and the expansion and ongoing maintenance of urban infrastructure. The Plan also describes the responsibilities associated with operating and maintaining the reserves that will be created

to mitigate anticipated future impacts. Natural communities that will be included within the conservation plan include flooded herbaceous cropland and woody cropland; wildland communities including river and stream systems, vernal pool complexes, grasslands and oak savanna-woodland; developed communities. Agricultural land, including rice land will also be included.

Sutter County Climate Action Plan (2011)

The County of Sutter is committed to reducing greenhouse gas (GHG) emissions in an effort to provide a more livable, equitable and economically vibrant community. By using energy more efficiently, harnessing renewable energy to power our buildings, enhancing access to sustainable transportation modes, and recycling our waste, we can keep dollars in our local economy, create new green jobs and improve community quality of life. These efforts toward reducing GHG emissions must be done in coordination with the County of Sutter's (County) land use decisions. The foundation of planning land use decisions are the General Plan policies and programs.

To further this commitment, Sutter County has established policies that incorporate environmental responsibility into its daily management of residential, commercial and industrial growth, education, energy and water use, air quality, transportation, waste reduction, economic development, and open space and natural habitats.

As a foundation in these efforts, the County has developed a baseline GHG emissions inventory, a methodology for tracking and reporting emissions in the future, and recommendations for GHG reduction strategies. An indicator of the success of these efforts will be a measured reduction in greenhouse gas (GHG) emissions using the protocols discussed herein.

Sutter County Ordinances

The Sutter County General Plan provides policy direction for land use, development, open space protection, and environmental quality; however, this policy direction must be carried out through numerous ordinances, programs, and agreements. The following ordinances are among the most important tools for implementing the General Plan and/or are critical to the mitigation of hazards identified in this plan.

Emergency Organization (Chapter 500)

The purpose of this chapter is to provide for the county's preparation for, response to, and recovery from emergencies pursuant to the California Emergency Services Act. There is hereby created the Office of Emergency Management. The Office of Emergency Management shall have responsibilities which include: development and maintenance of county/operational area emergency plans; supervision and maintenance of the county/operational area emergency operations center; coordination of county/operational area disaster mitigation/prevention, preparedness, response, and recovery; serving as the coordination link between the local government level and the regional, state and federal level, as well as liaison between the operational area jurisdictions/agencies, the California Emergency Management Agency (Cal EMA), and the Federal Emergency Management Agency (FEMA); providing training, exercises, and educational outreach to agencies within the operational area; and coordination of resource and information management, public information/warning systems, mutual aid, and damage assessment information.

The Emergency Operations Manager shall be responsible for the development of the Emergency operations plan (EOP) for the County. The Emergency Operations Manager shall have the authority to request documents, training, or information from County departments, special districts, or other entities in the county/operational area necessary to develop and maintain the EOP.

Fire Prevention and Regulation (Chapter 600)

The International Fire Code, 2018 Edition, as approved by the Building Standards Commission with State Amendments, known as the 2019 California Fire Code, including Appendix Chapter 4 and Appendix A, B, BB, C, CC, D, E, F, G, H, I and J, as amended by this Chapter, is hereby adopted for the purpose of prescribing regulations governing conditions hazardous to life and property from fire, hazardous materials or explosion, and the California Fire Code, as amended by this Chapter, and all the provisions thereof are hereby adopted and incorporated as fully as if set out at length herein, and the provisions of such California Fire Code, as amended by this Chapter, shall be in effect in the unincorporated territory of the County.

Water Wells (Chapter 765)

It is the purpose of this Chapter to provide for the construction, repair and reconstruction of water wells, cathodic protection wells, test wells and geophysical wells to the end that the ground water of this county will not be polluted or contaminated and that water obtained from such wells will be suitable for the purpose for which used and will not jeopardize the health, safety or welfare of the people of this county, and for the destruction of abandoned wells or wells found to be public nuisances to the end that such wells will not cause pollution or contamination of ground water or otherwise jeopardize the health, safety or welfare of the people of this county.

No person shall construct, repair, reconstruct, or destroy any well subject to this Chapter which does not conform to the standards established herein. Standards for the construction, repair, reconstruction, or the destruction of water wells shall be as set forth in Chapter II of State Department of Water Resources Bulletin Number 74-81 entitled "Water Wells Standards: State of California", except as otherwise may be provided in this Chapter.

Building Code (Chapter 1300)

This chapter shall be known and cited as "the Sutter County Building Code". The Board of Supervisors expressly finds that the provisions of this Chapter and of the codes adopted hereby constitute minimum standards for the protection of the public health, public safety, and public welfare. This Chapter is adopted pursuant to the authority granted by Section 7 of Article XI of the Constitution of the State to a county to make and enforce within its limits all such local, police, sanitary, and other regulations as are not in conflict with general laws. It is further adopted in conformity with the State Government Code relating to adoption of codes by reference. This chapter shall apply within all the unincorporated territory of the county.

The Board adopts the following:

- That certain building code known and designated as the International Building Code, 2018 Edition, Volumes 1 and 2 and the appendix B and C, thereto as approved by the Building Standards Commission with State Amendments, known as the 2019 California Building Code

- The certain mechanical code known and designated as the International Mechanical Code, 2018 Edition
- That certain plumbing code known and designated as the International Plumbing Code, 2018 Edition", together with Appendices A through L
- That certain Electrical Code known and designated as the National Electrical Code, 2017 Edition
- The certain code known as Uniform Housing Code, 1997 Edition.
- That certain building code known and designated as the International Residential Code, 2018 Edition, as approved by the Building Standards Commission, known as the 2019 California Residential Code
- That certain code known and designated as the California Energy Code, 2019 Edition
- That certain code known and designated as the California Administrative Code, 2019 Edition
- That certain code known and designated as the California Reference Standard Code, 2019 Edition

Subdivision Ordinance (Section 1400)

The purpose of this Chapter is to regulate and control the design and improvement of land for all purposes within the County of Sutter in order to preserve and enhance the health, safety, welfare and amenities of the community. The Sutter County General Plan shall guide the use of all land within the unincorporated area of the County. The size and design of lots, the nature of utilities, the design and improvement of streets, the type and intensity of land use, and the provisions for any special facilities shall conform to the standards established in the General Plan, the zoning ordinance of the County of Sutter, and any applicable specific plan, master plan, community plan, precise plans, and the like.

Zoning Ordinance (Section 1500)

The Zoning Code is adopted to provide for the promotion and protection of the public health, safety' peace, morals, comfort, convenience, and general welfare of the residents of Sutter County; and:

- To implement the Sutter County General Plan, its goals, policies and objectives and to guide the future growth of the County in accordance with said plan.
- To protect the character and the social and economic stability of agricultural, residential, commercial, industrial, recreational, and other areas within the County, and to assure the orderly and beneficial development of such areas.

The Board of Supervisors hereby finds that agriculture is a major industry in the County, and declares that the provisions of this Chapter shall be interpreted liberally as they affect valid agricultural uses and that this chapter shall serve as a means of preventing undesirable encroachments of other land uses upon agricultural lands. Other reasonable and desirable land uses shall receive due consideration.

Stormwater Management and Discharge Control Ordinance (Chapter 1760)

The purpose of this Chapter is to prescribe and regulate the connection of stormwater drainage runoff to the public stormwater system. This Chapter shall apply to all County owned and/or maintained drainage and stormwater facilities. This Chapter does not apply to drainage or stormwater facilities owned and operated by Reclamation Districts or Drainage Districts. No person may connect to or otherwise redirect the flow of water so as to cause additional drainage to enter roadside ditches except in those situations where an exception has been granted by the Director.

Sutter County Land Grading Ordinance (Chapter 1770)

The purpose of this Chapter is to:

- Minimize damage to surrounding properties and public rights-of-way;
- Minimize the degradation of the water quality of watercourses
- Minimize the disruption of natural or County-authorized drainage flows caused by the activities of clearing and grubbing, grading, filling and excavating land;
- Minimize sediment and pollutant runoff from other construction related activities; and,
- Comply with the provisions of National Pollutant Discharge Elimination System (NPDES) permits covering the activities of the County issued by the California Regional Water Quality Control Board

This Chapter shall apply to all persons within the unincorporated area of the County of Sutter and those areas in County drainage districts

Floodplain Management Ordinance (Chapter 1780)

The flood hazard areas of the County of Suffer are subject to periodic inundation which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety, and general welfare. These flood losses are caused by uses that are inadequately elevated, floodproofed, or protected from flood damage. The cumulative effect of obstructions in areas of special flood hazard increase flood heights and velocities also contribute to flood losses.

It is the purpose of this ordinance to promote the public health, safety, and general welfare, and to minimize public and private losses due to flood conditions in specific areas by legally enforceable regulations applied uniformly throughout the community to all publicly and privately owned land within flood prone, mudslide [i.e. mudflow] or flood related erosion areas. These regulations are designed to:

- Protect human life and health;
- Minimize the expenditure of public money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;
- Minimize prolonged business interruptions;
- Minimize damage to public facilities and utilities such as water and gas mains; electric, telephone and sewer lines; and streets and bridges located in areas of special flood hazard;
- Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future blighted areas caused by flood damage;
- Ensure that potential buyers are notified that property is in an area of special flood hazard; and,
- Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.

No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this chapter and other applicable regulations.

All new construction or substantial improvements of residential structures shall have the lowest floor, including basement:

- In AE, AH, A1-30 Zones, elevated at least one foot above the BFE.
- In an AO Zone, elevated above the highest adjacent grade to a height exceeding the depth number specified in feet on the FIRM by at least one foot, or elevated at least three feet above the highest adjacent grade if no depth number is specified.
- In an A Zone, without BFE's specified on the FIRM [unnumbered A zone], elevated at least one foot above the base flood elevation as determined under Section I780-420(c).
- In all other Zones (including Zone X and Zone X500) and in local flood hazard areas, elevated at least one foot above the base flood elevation shown on the flood insurance rate map or one foot above the locally-determined base flood elevation if that elevation is higher. In Zone X and/or Zone X500, a condition of granting any building permit for construction outside a subdivision shall be that the lowest floor shall be placed at an elevation, as determined by a registered engineer, which will protect the structure from inundation as a result of a storm with a 100-year recurrence interval. If the Floodplain Administrator determines that developing data to establish the 100-year storm inundation elevation would be excessively expensive, the Floodplain Administrator may alternatively approve a lowest floor elevation which is one foot above the centerline of the closest county road at a point closest to the building site.

All new construction or substantial improvements of nonresidential structures shall either be elevated to conform with Section 1780-530(a) or:

- Be floodproofed, together with attendant utility and sanitary facilities, below the elevation recommended under Section 1780-530(a), so that the structure is watertight with walls substantially impermeable to the passage of water;
- Have structural components capable of resisting hydrostatic and hydrodynamic loads and effects of buoyancy; and
- Be certified by a registered civil engineer or architect that the standards of Section 1780-520 & Section 1780-525 are satisfied. Such certification shall be provided to the Floodplain Administrator. Certification and verification of floodproofing design shall be in the form of a National Flood Insurance Program - Floodproofing Certificate.
- In Zone X and/or Zone X500, the requirement to elevate the lowest floor of detached garages, accessory buildings and/or agricultural shops to one foot above the 100-year storm inundation elevation or one foot above the centerline of the nearest County road may be waived by the Floodplain Administrator, provided that the owner executes a structure use and indemnity agreement with the County. The Floodplain Administrator may record a copy of the agreement in the Office of the Sutter County Recorder.

4.4.2. Sutter County's Administrative/Technical Mitigation Capabilities

Table 4-97 identifies the County personnel responsible for activities related to mitigation and loss prevention in the County. FILL OUT LAST CELL.

Table 4-97 Sutter County Administrative/Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	Y	As part of this HMPC
Disaster Council	Y	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	As part of normal County operations.
Mutual aid agreements	Y	
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Y FT	Staff is adequately trained on hazards and mitigation. Coordination between agencies is effective.
Floodplain Administrator	Y FT	Staff is adequately trained on hazards and mitigation. Coordination between agencies is effective.
Emergency Manager	Y FT	Staff is adequately trained on hazards and mitigation. Coordination between agencies is effective.
Community Planner	Y FT	Staff is adequately trained on hazards and mitigation. Coordination between agencies is effective.
Civil Engineer	Y FT	Staff is adequately trained on hazards and mitigation. Coordination between agencies is effective.
GIS Coordinator	Y FT	Staff is adequately trained on hazards and mitigation. Coordination between agencies is effective.
Other		
Technical	**Y/N**	**Describe capability Has capability been used to assess/mitigate risk in the past?**
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Code Red
Hazard data and information	Y	
Grant writing	Y	
Hazus analysis	Y	Hazus analysis for earthquake was completed for this Plan.
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP YOUR JURISDICTION		

Source: Sutter County

4.4.3. Sutter County's Fiscal Mitigation Capabilities

Table 4-98 identifies financial tools or resources that the County could potentially use to help fund mitigation activities. VERIFY SECOND COLUMN AND FILL OUT REMAINDER OF TABLE

Table 4-98 Sutter County Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	?
Authority to levy taxes for specific purposes	Y	?
Fees for water, sewer, gas, or electric services	Y	?
Impact fees for new development	Y	?
Storm water utility fee	?	
Incur debt through general obligation bonds and/or special tax bonds	N	
Incur debt through private activities	N	
Community Development Block Grant	N	
Other federal funding programs	N	
State funding programs	N	
Other	Y	LHMP grants have been used in the past.
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP YOUR JURISDICTION		

Source: Sutter County

4.4.4. Sutter County Mitigation Education, Outreach, and Partnerships

Table 4-99 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information. FILL OUT LAST CELL

Table 4-99 Sutter County Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	AFN Working group. This group could help with future mitigation activities.

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	OEM, Sheriff and Fire Departments provide public education
Natural disaster or safety related school programs	N	
StormReady certification	Y	County was certified in 2012 and was updated in 2020.
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	N	
Other	Y	Weather-Ready Nation Ambassador 2021
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP YOUR JURISDICTION		

Source: Sutter County

4.4.5. Other Mitigation Efforts

The County is pursuing multiple other mitigation efforts not captured in this plan. These include:

- The County completed interactive evacuation route maps for an Oroville Dam emergency. These can be found at:
  - ✓ https://suttercounty.maps.arcgis.com/apps/InformationLookup/index.html?appid=db747339f2af4a37934da0a6c1c654ee
- Improvements to wastewater treatment plants, including ways to reduce risk to flooding.
- Installing a backup power supply at the Robbins wastewater treatment plant
- Improving the Robbins Trailer Park septic and wastewater facilities
- The community of Robbins uses nearly four times the national "per capita" average in water consumption, which is not sustainable during periods of drought. The County and the community are also pursuing a project to replace aging water mains that are subject to leaks and breaks when groundwater levels shift.
- The County was certified as a StormReady County by the National Weather Service in January of 2012.
- The County has established a web link (www.bepreparedsutter.org) to allow the public to more readily access the Office of Emergency Management (OEM) webpage. Additionally, the County has been successful with our Facebook webpage for the public at www.facebook.com/suttercountyoem to provide updates on the storm, river levels, and the status of the levee. The OEM alert system, which provides alerts across the County internet/intranet, has been successfully tested.
- The EOP contains actions related to mitigation in the County. These actions are as follows:
  - ✓ Maintenance of mobile/portable equipment located in the Mobile Command Post by the Sutter County - Sheriff's Department
  - ✓ Training will be coordinated as necessary to ensure safe, secure, and effective operations of equipment and procedures

- ✓ Distribution of information to the public in the form of FEMA's Flood Insurance Rate Maps (FIRMs) for Sutter County, flood inundation maps, and information concerning the elevating, floodproofing, or relocation of structures
- ✓ Maintaining records of peak water surface elevations at several key monitoring stations throughout the County
- ✓ Maintaining and sharing information regarding Flood Hazard Analysis and Assessment
- ✓ Development and maintenance of pre-disaster response plans for various scenarios

- In 2011, Sutter County staff and the Sutter-Butte Flood Control Agency continued an aggressive public outreach campaign to raise awareness of the flood hazards facing Sutter County, the flood safety and property protection measures appropriate for these flood hazards, flood-related public information activities implemented within the community, and the anticipated revision of the Flood Insurance Rate Maps (FIRMs) covering all of Sutter County. This annual report evaluates the projects implemented under this public outreach strategy. Overall, the outreach is considered to have been extremely effective, and was comprised of the following elements:
  - ✓ Letters mailed directly to owners of over 3,600 properties located within Special Flood Hazard Areas;
  - ✓ Special workshops held for local government officials; engineers, builders & developers; real estate agents, insurance agents and lenders;
  - ✓ Newspaper interviews and articles published in the local "Appeal Democrat";
  - ✓ Appearances before the Sutter County - Board of Supervisors (all broadcasted on public access channel);
  - ✓ Internal training for County staff;
  - ✓ Public Awareness Month (October); and
  - ✓ Various public outreach letters required under the Community Rating System.
- County staff from the Water Resources Branch responded to over 460 phone inquiries, mostly regarding the flood zone, Base Flood Elevation (BFE), mandatory flood insurance requirements, and construction requirements for local properties.
- Sutter County is currently getting grants to rebuild its weed program. Once it is up and running, the County can begin to identify populations and look into projects to address the aquatic weeds. There are current efforts are being led by landowners or local water districts (reclamation or irrigation). There is a plan to rebuild the weed management area group, bringing in each of these entities, to search out funding and seek cooperative efforts.
- SBFCA is currently finishing construction of the improvements along the Feather River west levee from Thermalito Afterbay to Star Bend (FRWLP). This will result in 200-year flood protection to most of the urban and urbanizing areas of Yuba City, Live Oak, Gridley, and Biggs. The USACE is currently in the process of constructing improvements along the Feather River west levee from Star Bend to Laurel Avenue to bring that reach of levee up to 100-year standards. The USACE is also currently constructing cutoff wall improvements from Laurel Avenue to Highway 99 as part of a PL84-99 repair project, which will bring that reach of levee up to 100-year standards as well. Once the USACE work is complete, large areas of residual floodplains will still remain in the south portion of the basin and in the "Sutter triangle" due to the non-accredited levees along the Sutter Bypass, Wadsworth Canal, and Feather River downstream of Highway 99. In addition, limited residual floodplains will persist for areas north of the Wadsworth Interceptor Canals due to interior drainage flooding. Future projects will be pursued by SBFCA to reduce these residual risks. But in the meantime, 200-Year protection documentation and FEMA 100-Year flood insurance rate maps for the basin will be developed based

on the protection provided by the completion of the FRWLP and USACE work, and the lands and people within the basin will be subject to FEMA and SB 5 compliance based on the post-project floodplain mapping. The Feather River West Levee Project from Star Bend to Thermalito will finish construction in 2020 and the USACE work is scheduled to be complete by June of 2021. Upon completion of the projects SBFCA will provide documentation to support changes to FEMA floodplain maps, and to support cities and counties making findings to demonstrate an urban level of flood protection (ULOP) for urban and urbanizing communities within the basin.

UPDATE THE ABOVE AND ADD ANYTHING ELSE MITIGATION RELATED THAT THE COUNTY DOES THAT HAS NOT BEEN CAPTURED IN THE TABLES AND SECTIONS ABOVE.

Chapter 5 Mitigation Strategy

Requirement §201.6(c)(3) and §201.7(c)(3): [The plan shall include] a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section describes the mitigation strategy process and mitigation action plan for this Sutter County Local Hazard Mitigation Plan (LHMP) Update. It describes how the County and participating jurisdictions met the following requirements from the 10-step planning process:

- Planning Step 6: Set Goals
- Planning Step 7: Review Possible Activities
- Planning Step 8: Draft an Action Plan

5.1 Mitigation Strategy: Overview

The results of the planning process, the risk assessment, the goal setting, the identification of mitigation actions, and the hard work of the Hazard Mitigation Planning Committee (HMPC) led to the mitigation strategy and mitigation action plan for this LHMP Update. As part of the LHMP Update process, a comprehensive review and update of the mitigation strategy portion of the 2013 LHMP was conducted by the HMPC. Some of the initial goals and objectives from the 2013 Sutter County LHMP were refined and reaffirmed, some goals were deleted, and others were added. The end result was a new set of goals, reorganized to reflect the completion of or progress towards the 2013 actions, the updated risk assessment and the new priorities of this 2021 LHMP Update. To support the new LHMP goals, the mitigation actions from 2013 were reviewed and assessed for their value in reducing risk and vulnerability to the Sutter County Planning Area from identified hazards and evaluated for their inclusion in this LHMP Update (See Chapter 2 What's New). Section 5.2 below identifies the new goals and objectives of this LHMP Update and Section 5.4 details the new mitigation action plan.

Taking all of the above into consideration, the HMPC developed the following umbrella mitigation strategy for this LHMP Update:

- Communicate the hazard information collected and analyzed through this planning process as well as mitigation success stories so that the community better understands what can happen where and what they themselves can do to be better prepared.
- Implement the action plan recommendations of this Plan.
- Use existing rules, regulations, policies, and procedures already in existence.
- Monitor multi-objective management opportunities so that funding opportunities may be shared and packaged, and broader constituent support may be garnered.

5.1.1. Continued Compliance with NFIP

Given the flood hazard in the Sutter County Planning Area, an emphasis will be placed on continued compliance with the National Flood Insurance Program (NFIP) by all communities. Detailed below is a description of Sutter County's flood management program to ensure continued compliance with the NFIP. A brief description of the County's CRS program is also provided below. Also to be considered are the numerous flood mitigation actions contained in this LHMP Update that support the ongoing efforts by the County and participating jurisdictions to minimize the risk and vulnerability of the community to the flood hazard and to enhance their overall floodplain management program. A summary of the flood management programs and continued compliance with the NFIP for the incorporated communities are detailed in their jurisdictional annexes.

Sutter County's Flood Management Program

Sutter County entered the NFIP on an emergency basis in 1975 and has participated in the Regular Phase of the NFIP since 1988. Since then, the County has administered floodplain management regulations that meet the minimum requirements of the NFIP. Under that arrangement, residents and businesses paid the same flood insurance premium rates as most other communities in the country.

The Community Rating System (CRS) was created in 1990. Sutter County has been in the CRS program since 1995. The program is designed to recognize floodplain management activities that are above and beyond the NFIP's minimum requirements. CRS is designed to reward a community for implementing public information, mapping, regulatory, loss reduction and/or flood preparedness activities. On a scale of 10 to 1, Sutter County is currently ranked Class 6 community, which gives a 20% premium discount to individuals in the Sutter County Special Flood Hazard Area (SFHA), and a 10% discount to policyholders outside the SFHA.

Presently, the County manages its floodplains in compliance with NFIP/CRS requirements and implements a floodplain management program designed to protect the people and property of the County. Floodplain regulations are a critical element in local floodplain management and are a primary component in the County's participation in the NFIP. As well, the County's floodplain management activities apply to existing and new development areas, implementing flood protection measures for structures and maintaining drainage systems to help reduce the potential of flooding within the County.

The County will continue to manage their floodplains in continued compliance with the NFIP. An overview of the County's NFIP status and floodplain management program are discussed in Table 5-1. Additional information on the County's CRS program follows.

Table 5-1 Unincorporated Sutter County NFIP Status

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	4,029 policies $2,396,072 in annual premiums $1,311746,400 in coverage

NFIP Topic	Comments
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	156 claims $2,741,722 in paid claims 14 substantial damage claims
How many structures are exposed to flood risk within the community?	2,443 in 1% annual chance floodplain 1,333 in 0.2% annual chance floodplain
Number of Repetitive and Severe Repetitive Loss Properties	10 RL structures 0 SRL structures
Describe any areas of flood risk with limited NFIP policy coverage	
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	
What are the barriers to running an effective NFIP program in the community, if any?	
Compliance History	
Is the community in good standing with the NFIP?	Emergency Phase - Regular Phase – 4/5/1988
Are there any outstanding compliance issues (i.e., current violations)?	
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	
Is a CAV or CAC scheduled or needed?	
Regulation	
When did the community enter the NFIP?	Emergency Phase – 10/9/1975 Regular Phase – 4/5/1988
Are the FIRMs digital or paper?	Digital and Paper
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	
Provide an explanation of the permitting process.	
Community Rating System (CRS)	
Does the community participate in CRS?	Yes
What is the community's CRS Class Ranking?	6
What categories and activities provide CRS points and how can the class be improved?	See below
Does the plan include CRS planning requirements?	Yes

Source: FEMA, 8/21/2020/Sutter County

The activities credited by the CRS program provide direct benefits to Sutter County and its residents, including:

- Enhanced public safety;
- A reduction in damage to property and public infrastructure;
- Avoidance of economic disruption and losses;

- Reduction of human suffering; and
- Protection of the environment.

The activities that Sutter County implements and receives CRS credits for and the credits for each activity as of November 2020 include:

- **Activity 310** – Elevation Certificates: The Sutter County Water Resources Department maintains elevation certificates for new and substantially improved buildings. Copies of elevation certificates are made available upon request. Elevation Certificates are also kept for post-FIRM and pre-FIRM buildings. Sutter County receives 29 credits for this Activity.
- **Activity 320** – Map Information Service: Sutter County provides inquirers with basic flood zone information from the community's latest Flood Insurance Rate Map (FIRM) and additional FIRM information, information about problems not shown on the FIRM, and as available, historical flood information. Records are maintained. Sutter County receives 90 credits for this Activity.
- **Activity 330** – Outreach Projects: Credit is provided for informational outreach projects that include brochures in public buildings, general outreach projects that include mailer to the entire community, posts on social media and community events, and targeted outreach projects that include letters to repetitive loss areas and flood prone properties. These projects are disseminated annually. Credit is also provided for having a pre-flood plan for public information. Sutter County receives 196 credits for this Activity.
- **Activity 340** – Hazard Disclosure: Credit is provided for the local real estate agents disclosure of flood hazards to prospective buyers. Credit is also provided for state regulations requiring disclosure of flood hazards. Real estate agents provide a brochure advising prospective buyers about insurance and checking property flood hazards. Sutter County receives 15 credits for this Activity.
- **Activity 350** – Flood Protection Information: Documents relating to floodplain management are available in the reference section of the Sutter County Public Library. Floodplain information is available on the County website. Sutter County receives 78 credits for this Activity.
- **Activity 360** – Flood Protection Assistance: Sutter County provides one-on-one advice for property flood protection and performs site visits as needed. Sutter County receives 55 credits for this Activity.
- **Activity 410** – Floodplain Mapping: Credit is provided for communities that voluntarily adopt and enforce floodplain regulations and maps that are more stringent than the minimum standards of the NFIP. Sutter County receives 63 credits for this Activity.
- **Activity 420** – Open Space Preservation: Credit is provided for preserving approximately 35 percent of the Special Flood Hazard Area (SFHA) as open space, protecting open space land with deed restrictions, and preserving open space land in a natural state. Credit is also provided for regulations and incentives that minimize development in the SFHA. Sutter County receives 711 credits for this Activity.
- **Activity 430** – Higher Regulatory Standards: Credit is provided for enforcing regulations that require development limitations, freeboard for new and substantial improvement construction, foundation protection, cumulative substantial improvement, enclosure limits and local drainage protection. Credit is also provided for the enforcement of building codes, a BCEGS Classification of 3/3, other higher standards, state mandated regulatory standards, and regulations administration. Sutter County receives 233 credits for this Activity.
- **Activity 440** – Flood Data Maintenance: Credit is provided for maintaining and using digitized maps in the day to day management of the floodplain. Credit is also provided for establishing and maintaining a system of benchmarks and maintaining copies of all previous FIRMs and Flood Insurance Study Reports. Sutter County receives 120 credits for this Activity.
- **Activity 450** – Stormwater Management: Sutter County enforces the stormwater ordinance for stormwater management, low impact development, soil and erosion control, and water quality and has a watershed master plan. Sutter County receives 213 credits for this Activity.

- **Activity 630** – Dams: Credit is provided for a State Dam Safety Program. The two Dams operated by the County (Highland Springs and Adobe Creek) are inspected twice per year and we have existing Emergency Action Plans for each. Sutter County receives 45 credits for this Activity.

5.1.2. Integration of Mitigation with Post Disaster Recovery and Mitigation Strategy Funding Opportunities

Hazard Mitigation actions are essential to weaving long-term resiliency into all community recovery efforts so that at-risk infrastructure, development, and other community assets are stronger and more resilient for the next severe storm event. Mitigation measures to reduce the risk and vulnerability of a community to future disaster losses can be implemented in advance of a disaster event and also as part of post-disaster recovery efforts.

Mitigation applied to recovery helps communities become more resilient and sustainable. It is often most efficient to fund all eligible infrastructure mitigation through FEMA's Public Assistance mitigation program if the asset was damaged in a storm event. Mitigation work can be added to project worksheets if they can be proven to be cost-beneficial.

Integration of mitigation into post disaster recovery efforts should be considered by all communities as part of their post disaster redevelopment and mitigation policies and procedures. As detailed in Section 4.4, the Capability Assessment for the unincorporated County and in the Annex's for the other participating jurisdictions, post-disaster redevelopment and mitigation policies and procedures are evaluated and updated as part of the Emergency Operations Plan (EOP) updates and other emergency management plans for each community.

These EOP's, through its policies and procedures, seek to mitigate the effects of hazards, prepare for measures to be taken which will preserve life and minimize damage, enhance response during emergencies and provide necessary assistance, and establish a recovery system in order to return the community to their normal state of affairs. Mitigation is emphasized as a major component of recovery efforts.

Mitigation Strategy Funding Opportunities

An understanding of the various funding streams and opportunities will enable the communities to match identified mitigation projects with the grant programs that are most likely to fund them. Additionally, some of the funding opportunities can be utilized together. Mitigation grant funding opportunities available pre- and post- disaster include the following.

FEMA HMA Grants

Cal OES administers three main types of HMA grants: (1) Hazard Mitigation Grant Program, (2) Building Resilient Infrastructure and Communities (BRIC), replacing the former Pre-Disaster Mitigation (PDM) Program, and (3) Flood Mitigation Assistance Program. Eligible applicants for the HMA include state and local governments, certain private non-profits, and federally recognized Indian tribal governments. While private citizens cannot apply directly for the grant programs, they can benefit from the programs if they are included in an application sponsored by an eligible applicant

FEMA Public Assistance Section 406 Mitigation

The Robert T. Stafford Disaster Relief and Emergency Assistance Act provides FEMA the authority to fund the restoration of eligible facilities that have sustained damage due to a presidentially declared disaster. The regulations contain a provision for the consideration of funding additional measures that will enhance a facility's ability to resist similar damage in future events.

Community Development Block Grants

The California Department of Housing and Community Development administers the State's Community Development Block Grant (CDBG) program with funding provided by the U.S. Department of Housing and Urban Development. The program is available to all non-entitlement communities that meet applicable threshold requirements. All projects must meet one of the national objectives of the program – projects must benefit 51 percent low- and moderate-income people, aid in the prevention or clearance of slum and blight, or meet an urgent need. Grant funds can generally be used in federally declared disaster areas for CDBG eligible activities including the replacement or repair of infrastructure and housing damaged during, or as a result of, the declared disaster.

Small Business Loans

SBA offers low-interest, fixed-rate loans to disaster victims, enabling them to repair or replace property damaged or destroyed in declared disasters. It also offers such loans to affected small businesses to help them recover from economic injury caused by such disasters. Loans may also be increased up to 20 percent of the total amount of disaster damage to real estate and/or leasehold improvements to make improvements that lessen the risk of property damage by possible future disasters of the same kind.

Increased Cost of Compliance

Increased Cost of Compliance (ICC) coverage is one of several resources for flood insurance policyholders who need additional help rebuilding after a flood. It provides up to $30,000 to help cover the cost of mitigation measures that will reduce flood risk. ICC coverage is a part of most standard flood insurance policies available under NFIP.

5.2 Goals and Objectives

Requirement §201.6(c)(3)(i) and §201.7(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Up to this point in the planning process, the HMPC has organized resources, assessed hazards and risks, and documented mitigation capabilities. The resulting goals, objectives, and mitigation actions were developed based on these tasks. The HMPC held a series of meetings and exercises designed to achieve a collaborative mitigation strategy as described further throughout this section. Appendix C documents the information covered in these mitigation strategy meetings, including information on the goals development and the identification and prioritization of mitigation alternatives by the HMPC.

During the initial goal-setting meeting, the HMPC reviewed the results of the hazard identification, vulnerability assessment, and capability assessment. This analysis of the risk assessment identified areas where improvements could be made and provided the framework for the HMPC to formulate planning goals and objectives and to develop the mitigation strategy for the Sutter County Planning Area.

Goals were defined for the purpose of this mitigation plan as broad-based public policy statements that:

- Represent basic desires of the community;
- Encompass all aspects of community, public and private;
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;
- Are future-oriented, in that they are achievable in the future; and
- A time-independent, in that they are not scheduled events.

Goals are stated without regard to implementation. Implementation cost, schedule, and means are not considered. Goals are defined before considering how to accomplish them so that they are not dependent on the means of achievement. Goal statements form the basis for objectives and actions that will be used as means to achieve the goals. Objectives define strategies to attain the goals and are more specific and measurable.

HMPC members were provided with the list of goals from the 2013 LHMP as well as a list of other sample goals to consider. The team was told that they could use, combine, or revise the statements provided or develop new ones, keeping the risk assessment in mind. Each member was asked to provide two goal statements. Goal statements were collected and grouped into similar themes and provided to the HMPC. Some of the statements were determined to be better suited as objectives or actual mitigation actions and were set aside for later use. Next, the HMPC developed objectives that summarized strategies to achieve each goal. Edits and refinements to these new goals and resulting objectives were provided by the HMPC until the team came to consensus on the final goals and objectives for this 2021 LHMP Update.

Based on the risk assessment review and goal setting process, the HMPC identified the following goals and objectives, which provide the direction for reducing future hazard-related losses within the Sutter County Planning Area.

Goal 1: Minimize hazard risk by protecting lives, properties, public health, and the environment in Sutter County

- Minimize risk to life
- Minimize economic and resource impact
- Minimize impact to both existing and future development
- Prevent and reduce flood-related losses
- Continue to improve integrity of levees
- Consider and address Climate Change influence on all hazards

Goal 2: Provide protection from hazards for critical facilities, infrastructure, utilities, and services

- Assign and annually update a simple excel list and/or GIS map of critical facilities and details: Essential Services, At-Risk Populations, Hazardous Materials Facilities

- Identify, protect, and maintain evacuation routes

Goal 3: Improve public awareness and preparedness for hazards that threaten our communities

- Identify existing public outreach for hazards
- Send public preparedness mailers
- Provide public guides for both sheltering in place and evacuations during emergencies
- Provide list of available resources (e.g., shelter locations, equipment, personnel)

Goal 4: Increase Sutter County's ability to be prepared for, respond to, and recover from a disaster event

- Improve interagency (local, state, federal) emergency coordination and communications to ensure effective community preparedness, response and recovery
- Improve accessibility and coordination of plans associated with disaster preparedness and response with local, state, and federal agencies and private partners
- Identify and prioritize risks; draft policies and training that support successful outcomes
- Protect and maintain continuity of operations and services during disasters
- Enhance the use of shared resources/Develop a strong mutual aid support system
- Enhance abilities to communicate and exercise outcomes with neighboring agencies in actual scenario-based training
- Effectively incorporate lessons learned in previous disaster response into future disaster planning
- Create (or expand) Levee Improvement Agency(ies) to plan for the future levee system improvements necessary to address risk reduction, FEMA accreditation, climate change resiliency, and other challenges

Goal 5: Maintain Federal Funding and FEMA Eligibility/Position the communities for grant funding.

- Ensure compliance with FEMA National Flood Insurance Program (NFIP) by training staff as identified by FEMA as liabilities for noncompliance.
- Promote levee project partnerships between local agencies and state agencies (e.g., DWRs Maintenance Yards) to seek grants as some state agencies are ineligible to pursue state grants

5.3 Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii) and §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

In order to identify and select mitigation actions to support the mitigation goals, each hazard identified in Section 4.1 was evaluated at the completion of the risk assessment as part of the second prioritization process to determine which hazards were priorities for mitigation strategy planning. Only those hazards that were determined to be a priority hazard for each participating jurisdiction were considered further in

the development of hazard-specific mitigation actions. Those hazards not considered a priority for mitigation strategy development were eliminated from further consideration because the risk of a hazard event in the County is unlikely, the vulnerability of the county is low, or capabilities are already in place to mitigate negative impacts. Further, the resulting mitigation strategy presented in this Chapter focuses on those mitigation actions that each jurisdiction has the authority, resources, and capacity to consider for implementation over the next 5-years covered by this LHMP Update.

Table 5-2 and Table 5-3 provide a listing of priority hazards by jurisdiction to be addressed in the mitigation strategy portion of this Plan.

Table 5-2 Sutter County Planning Area: Mitigation Action Priority Hazards by Jurisdiction – Unincorporated County and Incorporated Jurisdictions

Priority Hazards for Mitigation Action Development	Sutter County	Live Oak	Yuba City
Aquatic Invasive Species			X
Climate Change	X	X	X
Dam Failure	X	X	X
Drought & Water shortage	X	X	X
Earthquake	X		X
Floods: 1%/0.5%/0.2% annual chance	X	X	X
Floods: Localized Stormwater	X	X	X
Levee Failure	X	X	X
Pandemic	X	X	X
Severe Weather: Extreme Cold and Freeze	X		X
Severe Weather: Extreme Heat	X	X	X
Severe Weather: Heavy Rains and Storms	X		X
Wildfire	X		X

Table 5-3 Sutter County Planning Area: Mitigation Action Priority Hazards by Jurisdiction – Special Districts

Priority Hazards for Mitigation Action Development	LD 1	RD 70	RD 1001	RD 1500	RD 1660	SBFCA	LD 9
Aquatic Invasive Species		X	X	X	X	X	
Climate Change		X	X	X	X	X	
Dam Failure	X	X	X	X	X	X	X
Drought & Water shortage		X		X	X	X	
Earthquake		X			X	X	
Floods: 1%/0.5%/0.2% annual chance	X	X	X	X	X	X	X
Floods: Localized Stormwater			X	X		X	X

Priority Hazards for Mitigation Action Development	LD 1	RD 70	RD 1001	RD 1500	RD 1660	SBFCA	LD 9
Levee Failure	X	X	X	X	X	X	X
Pandemic		X		X	X	X	
Severe Weather: Extreme Cold and Freeze				X		X	
Severe Weather: Extreme Heat				X		X	
Severe Weather: Heavy Rains and Storms		X	X	X	X	X	
Wildfire						X	

It is important to note, however, that all the Hazards addressed in this Plan are included in the countywide multi-hazard public awareness mitigation action as well as in other multi-hazard, emergency management actions, and other hazard-specific actions, providing benefits to all participating jurisdictions to this Plan.

Once it was determined which hazards warranted the development of specific mitigation actions, the HMPC analyzed viable mitigation options that supported the identified goals and objectives. The HMPC was provided with the following list of categories of mitigation actions, which originate from the Community Rating System:

- Prevention
- Property protection
- Structural projects
- Natural resource protection
- Emergency services
- Public information

The HMPC was provided with examples of potential mitigation actions for each of the above categories. The HMPC was also instructed to consider both future and existing buildings in considering possible mitigation actions. A facilitated discussion then took place to examine and analyze the options. Appendix C provides a detailed review and discussion of the six mitigation categories to assist in the review and identification of possible mitigation activities or projects. Also utilized in the review of possible mitigation measures is FEMA's publication on Mitigation Ideas, by hazard type. Prevention type mitigation alternatives were discussed for each of the priority hazards. This was followed by a brainstorming session that generated a list of preferred mitigation actions by hazard.

5.3.1. Prioritization Process

Once the mitigation actions were identified, the HMPC was provided with several decision-making tools, including FEMA's recommended prioritization criteria, STAPLEE sustainable disaster recovery criteria; Smart Growth principles; and others, to assist in deciding why one recommended action might be more important, more effective, or more likely to be implemented than another. STAPLEE stands for the following:

- Social: Does the measure treat people fairly? (e.g., different groups, different generations)
- Technical: Is the action technically feasible? Does it solve the problem?
- Administrative: Are there adequate staffing, funding, and other capabilities to implement the project?
- Political: Who are the stakeholders? Will there be adequate political and public support for the project?
- Legal: Does the jurisdiction have the legal authority to implement the action? Is it legal?
- Economic: Is the action cost-beneficial? Is there funding available? Will the action contribute to the local economy?
- Environmental: Does the action comply with environmental regulations? Will there be negative environmental consequences from the action?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining action priority. Other criteria used to assist in evaluating the benefit-cost of a mitigation action includes:

- Contribution of the action to save life or property
- Availability of funding and perceived cost-effectiveness
- Available resources for implementation
- Ability of the action to address the problem

The initial list of mitigation actions from the 2013 LHMP and new actions identified during this planning process were reviewed and prioritized via an LHMP mitigation action voting website for inclusion in this 2021 LHMP Update. The Sutter County mitigation action voting website established at https://fostermorrison.aweeba.com/ included the list of actions brainstormed during the mitigation strategy meetings and provided a mechanism for everyone to vote on their priority actions for further development as detailed below. This comprehensive review of mitigation measures was performed using the criteria (alternatives and selection criteria) in Appendix C.

With these criteria in mind, HMPC members were each provided with nine weighted votes, indicating High (worth 5 points), Medium (worth 3 points), and Low (worth 1 point) priorities. The team was asked to use the votes to prioritize actions with the above criteria in mind. The point score for each action was totaled. Appendix C contains the total score given to each identified mitigation action.

The process of identification and analysis of mitigation alternatives allowed the HMPC to come to consensus and to prioritize recommended mitigation actions. During the voting process, emphasis was placed on the importance of a benefit-cost review in determining project priority; however, this was not a quantitative analysis. The team agreed that prioritizing the actions collectively enabled the actions to be ranked in order of relative importance and helped steer the development of additional actions that meet the more important objectives while eliminating some of the actions which did not garner much support.

Benefit-cost was also considered in greater detail in the development of the Mitigation Action Plan detailed below in Section 5.4. The cost-effectiveness of any mitigation alternative will be considered in greater detail through performing benefit-cost project analyses when seeking FEMA mitigation grant funding for eligible actions associated with this LHMP Update.

Recognizing the limitations in prioritizing actions from multiple jurisdictions and departments and the regulatory requirement to prioritize by benefit-cost to ensure cost-effectiveness, the HMPC decided to pursue actions that contributed to saving lives and property as first and foremost, with additional consideration given to the benefit-cost aspect of a project. This process drove the development of a

determination of a high, medium, or low priority for each mitigation action, and a comprehensive prioritized mitigation action plan for the Sutter County Planning Area.

5.4 Mitigation Action Plan

Requirement §201.6(c)(3)(iii) and §201.7(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

This mitigation action plan was developed to present the recommendations developed by the HMPC for how the Sutter County Planning Area can reduce the risk and vulnerability of people, property, infrastructure, and natural and cultural resources to future disaster losses. Emphasis was placed on both future and existing development. This mitigation action plan summarizes who is responsible for implementing each of the prioritized actions as well as when and how the actions will be implemented. Each action summary also includes a discussion of the benefit-cost review conducted to meet the regulatory requirements of the Disaster Mitigation Act.

Table 5-4 identifies all mitigation actions for all participating jurisdictions to this LHMP Update. For each mitigation action item included in Table 5-4, a detailed mitigation implementation strategy has been developed. Only those actions where the County is the lead jurisdiction are detailed further in this section. Actions specific to other participating jurisdictions, or where other jurisdictions are taking the lead, are detailed in each respective jurisdictional annex to this Plan.

The mitigation action plan detailed below contains both new action items developed for this LHMP Update as well as old actions that were yet to be completed from the 2013 Plan. Table 5-4 indicates whether the action is new or from the 2013 LHMP and Chapter 2 contains the details for each 2013 mitigation action item indicating whether a given action item has been completed, deleted, or deferred.

As described throughout this LHMP Update, Sutter County has many risks and vulnerabilities to identified hazards. Although many possible mitigation actions, as detailed in Appendix C, were brainstormed and prioritized during the mitigation strategy meetings, the resulting mitigation strategy presented in this Chapter 5 of this LHMP focuses only on those mitigation actions that are both reasonable and realistic for the community to consider for implementation over the next 5-years covered by this 2021 Update. Thus, only a portion of the actions identified in Appendix C have been carried forward into the mitigation strategy presented in Table 5-4. Although many good ideas were developed during the mitigation action brainstorming process, the reality of determining which priority actions to develop and include in this LHMP Update came down to the actual priorities of communities, individuals and departments based in part on department direction, staffing, and available funding. The overall value of the mitigation action table in Appendix C is that it represents a wide-range of mitigation actions that can be consulted and developed for this LHMP Update during annual plan reviews and the formal 5-year update process.

It is also important to note that Sutter County and the participating jurisdictions have numerous existing, detailed action descriptions, which include benefit-cost estimates, in other planning documents, such as

stormwater and drainage plans, flood and water management plans, and capital improvement budgets and reports. These actions are considered to be part of this Plan, and the details, to avoid duplication, should be referenced in their original source document. The HMPC also realizes that new needs and priorities may arise as a result of a disaster or other circumstances and reserves the right to support new actions, as necessary, as long as they conform to the overall goals of this Plan.

Further, it should be clarified that the actions included in this mitigation strategy are subject to further review and refinement; alternatives analyses; and reprioritization due to funding availability and/or other criteria. The participating communities are not obligated by this document to implement any or all of these projects. Rather this mitigation strategy represents the desires of the community to mitigate the risks and vulnerabilities from identified hazards. The actual selection, prioritization, and implementation of these actions will also be further evaluated in accordance with the mitigation categories and criteria contained in Appendix C.

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this Plan.

NEED ACTIONS FROM COUNTY, LIVE OAK, AND RD 1660.

Table 5-4 Sutter County Planning Area Mitigation Actions

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Sutter County						
Multi-Hazard Actions						
Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	Sutter County	2013 Action	X	X		Prevention
Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness	Sutter County and all jurisdictions	2013 Action	X	X	X	Public Information
Action 3. Digitize vulnerable and irreplaceable county records currently located in Sutter County Museum storage building	Sutter County and all jurisdictions	New Action	X	X	X	Prevention Property Protection Public Information
Action 4.						
Action 5.						
Action 6.						
Action 7.						
Action 8.						
Action 9.						
Action 10.						
Action 11.						
Climate Change Actions NEED ACTIONS						
Action 12.						
Dam Failure, Flood: 1%, 0.5%, 0.2% annual chance, Flood: Localized Flood, Levee Failure, and Severe Weather: Heavy Rains and Storms Actions NEED ACTIONS						
Action 13.						
Action 14.						
Action 15.						
Drought & Water Shortage, Severe Weather: Extreme Heat, and Wildfire Actions NEED ACTIONS						

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 16.						
Earthquake Actions NEED ACTIONS						
Action 17.						
Pandemic Actions NEED ACTIONS						
Action 18.						
Severe Weather: Extreme Cold Actions NEED ACTIONS						
Action 19.						
Action 20.						
City of Live Oak						
Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	City of Live Oak	2013 Action	X	X		Prevention
Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness	City of Live Oak	2013 Action	X	X	X	Public Information
NEED ACTIONS						
City of Yuba City						
Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan	City of Yuba City	2013 Action	X	X		Prevention
Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness	City of Yuba City	2013 Action	X	X	X	Public Information
Action 3. Hazard Preparedness Public Outreach for Yuba City	City of Yuba City	New Action	X	X	X	Public Information
Action 4. Establish Backup Power Sources for Critical Facilities within Yuba City	City of Yuba City	2013 Action	X	X	X	Prevention Property Protection Emergency Services
Action 5. Emergency Operations Plan (EOP) for the City of Yuba City	City of Yuba City	New Action	X	X		Prevention Emergency Services

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 6. Enhance Infrastructure to Mitigate Against Climate-Driven Failures	City of Yuba City	New Action	X	X	X	Property Protection Structural Projects
Action 7. Geographic Information Systems (GIS) Update Project	City of Yuba City	New Action				Prevention
Action 8.Prepare a Study to Evaluate Climate-Driven Impacts on Infrastructure	City of Yuba City	New Action			X	Prevention
Action 9. Implementation of CRS Activities	City of Yuba City	New Action	X	X	X	Prevention Property Protection Structural Projects Natural Resource Protection Public Information Emergency Services
Action 10. 200-Year Flood Protection for Sphere of Influence Area	City of Yuba City	2013 Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 11. Alternative Methods to Dispose of Treated Wastewater	City of Yuba City	2013 Action	X	X	X	Property Protection Natural Resource Protection
Action 12. Relocation of Treated Wastewater Effluent Diffuser Line	City of Yuba City	2013 Action	X	X	X	Property Protection Natural Resource Protection
Action 13. Water Treatment Plant Intake Access Road and Intake Structure	City of Yuba City	New Action	X	X	X	Structural Projects
Action 14. Project Improvements to Decrease Localized Flooding	City of Yuba City	New Action	X	X	X	Prevention Property Protection Structural Projects Natural Resource Protection
Action 15. Feather River Habitat Restoration	City of Yuba City	2013 Action	X	X	X	Natural Resource Protection
Action 16. Levee Pipe Crossing Inspection and Reinforcement	City of Yuba City	New Action	X	X	X	Prevention Property Protection Structural Projects
Action 17. Aquifer Storage and Recovery Well Development	City of Yuba City	New Action	X	X		Property Protection Structural Projects

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 18. Develop additional water supplies	City of Yuba City	New Action	X	X		Property Protection Natural Resource Protection
Action 19. Project to Reduce Localized Vulnerability to Sewer System Overflows	City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 20. Fuels Mitigation for High-Risk Wildland Urban Interface (WUI) Areas	City of Yuba City	New Action	X	X		Property Protection Natural Resource Protection
Levee District 1						
Action 1. Access Control	LD 1, unincorporated Sutter County	New Action	X	X	X	Prevention Property Protection Natural Resource Protection Emergency Services
Action 2. Erosion Mitigation at Levee District 1 – Sutter (LD1S) (Various sites; including those near Morse Road, Sullivan Pump, Singh Ranch Bend, and location where river takes an abrupt turn or bend)	LD 1, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection
Reclamation District 70						
Action 1. Water Hyacinth in West Burrow Canal Sutter Bypass	RD 70, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection
Action 2. Prepare for Higher Precipitation	RD 70, unincorporated Sutter County	New Action	X	X	X	Prevention Property Protection Natural Resource Protection
Action 3. Complete Projects from the CVFPP 2022 Update	RD 70, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Reclamation District 1001						
Action 1. Flood Potential from Overgrowth River Bottoms, River Fronts and Levee Sides	RD 1001, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 2. Drainage Canal Cleaning (Sediment and Aquatic Plant Life)	RD 1001, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection
Action 3. Feather River: Seepage, Stability, and Erosion	RD 1001, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 4. Public Signage	RD 1001, unincorporated Sutter County	New Action	X	X		Prevention
Action 5. Controlled Burn or Physical (mechanical) Maintenance of Overgrown (Vegetation) Areas	RD 1001, unincorporated Sutter County	New Action	X	X		Prevention Property Protection
Action 6. Levee access (Maintenance, Monitoring and Emergency)	RD 1001, unincorporated Sutter County	New Action	X	X		Prevention Property Protection Emergency Services
Reclamation District 1500						
Action 1. Karnak Pump Station Rehabilitation	RD 1500, unincorporated Sutter County	New Action	X	X	X	Structural Projects
Action 2. Sacramento River East Levee Improvements	RD 1500, unincorporated Sutter County	New Action	X	X	X	Structural Projects
Action 3. Sediment and Invasive Species Removal	RD 1500, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection
Action 4. Levee Penetration and Encroachments Improvements	RD 1500, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects
Action 5. Sutter Bypass West Levee Improvements	RD 1500, unincorporated Sutter County	New Action	X	X	X	Structural Projects

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 6. Complete Projects from the CVFPP 2022 Update	RD 1500, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Reclamation District 1660						
Action 1. Complete Projects from the CVFPP 2022 Update	RD 1500, unincorporated Sutter County	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
NEED ACTIONS						
SBFCA						
Action 1. Sutter Bypass Multi-Benefit Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 2. Feather River and Sutter Bypass Erosion Repairs	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 3. Levee Penetration and Encroachments Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 4. Lower Feather River West Levee Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 5. Sutter Bypass East Levee Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 6. Oroville Wildlife Area Multi-Benefit Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection

Action Title	Jurisdictions Benefitting from Action (s)	New Action/ 2013 Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 7. Sediment and Invasive Species Removal	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Natural Resource Protection
Action 8. Dam Failure Risk Reduction	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 9. Earthquake Risk Reduction	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects
Action 10. Levee Penetration and Encroachments Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 11. Lower Feather River West Levee Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Action 12. Sutter Bypass East Levee Improvements	Unincorporated County, City of Live Oak, City of Yuba City	New Action	X	X	X	Property Protection Structural Projects Natural Resource Protection
Levee District 9						
Action 1. Access Control	LD 1, unincorporated Sutter County	New Action	X	X	X	Prevention Property Protection Emergency Services
Action 2. Erosion Mitigation at Levee District 9	LD 1, unincorporated Sutter County	New Action	X	X	X	Property Protection Natural Resource Protection

Multi-Hazard Actions

Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan

Hazards Addressed: Multi-hazard (Aquatic Invasive Species, Climate Change, Dam Failure, Drought & Water shortage, Earthquake, Floods: 1%/0.5%/0.2% annual chance, Floods: Localized Stormwater, Levee Failure, Pandemic, Severe Weather: Extreme Cold and Freeze, Severe Weather: Extreme Heat, Severe Weather: Heavy Rains and Storms, Wildfire)

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Local jurisdictional reimbursement for mitigation projects and cost recovery after a disaster is guided by Government Code Section 8685.9 (Assembly Bill (AB) 2140).

Project Description: Specifically, this section requires that each applicable jurisdiction adopt a local hazard mitigation plan (LHMP) in accordance with the federal Disaster Mitigation Act of 2000 as part of the Safety Element of its General Plan. Adoption of the LHMP into the Safety Element of the General Plan may be by reference or incorporation.

Other Alternatives: No action

Existing Planning Mechanisms through which Action will be Implemented: Safety Element of General Plan

Responsible Office/Partners: Sutter County Planning Department and planning departments for each incorporated jurisdiction.

Cost Estimate: Jurisdictional board/staff time

Participating Jurisdictions: County and incorporated cities.

Benefits (avoided Losses): Incorporation of an adopted LHMP into the Safety Element of the General Plan will help jurisdictions maximize the cost recovery potential following a disaster.

Potential Funding: Local budgets

Timeline: 2021-2026

Project Priority: High

Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness

Hazards Addressed: Multi-hazard (Agricultural Hazards: Severe Weather/Insect/Pests, Aquatic Invasive Species, Avalanche, Climate Change, Dam Failure, Drought & Water shortage, Earthquake, Floods: 100/500 year, Floods: Localized Stormwater, Landslide, Mudslide, and Debris Flow, Levee Failure,

Pandemic Severe Weather: Extreme Heat, Severe Weather: Heavy Rain and Storms, Severe Weather: Wind and Tornado, Severe Weather: Winter Storm and Freeze, and Wildfire)

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Sutter County plays a key role in public outreach/education efforts to communicate the potential risk and vulnerability of their community to the effects of natural hazards. A comprehensive multi-hazard public education program will better inform the community of natural hazards of concern and actions the public can take to be better prepared for the next natural disaster event.

Project Description: A comprehensive multi-hazard outreach program will ascertain both broad and targeted educational needs throughout the community. The County will work with other agencies as appropriate to develop timely and consistent annual outreach messages in order to communicate the risk and vulnerability of natural hazards of concern to the community. This includes measures the public can take to be better prepared and to reduce the damages and other impacts from a hazard event. The public outreach effort will leverage and build upon existing mechanisms, will include elements to meet the objectives of Goal 3 of this LHMP Update, and will consider:

- Using a variety of information outlets, including websites, local radio stations, news media, schools, and local, public sponsored events;
- Creating and distributing (where applicable) brochures, leaflets, water bill inserts, websites, and public service announcements;
- Displaying public outreach information in County office buildings, libraries, and other public places and events;
- Developing public-private partnerships and incentives to support public education activities.

Other Alternatives: Continue public information activities currently in place.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Existing County outreach programs will be reviewed for effectiveness and leveraged and expanded upon to reach the broader region.

Responsible Office/Partners: Sutter County, incorporated communities, and other jurisdictions

Participating Jurisdictions: County and all cities.

Priority (H, M, L): High

Cost Estimate: Annual costs to be determined, and will depend on the scope and frequency of activities and events as well as volunteer participation

Benefits (Losses Avoided): Increase residents' knowledge of potential hazards and activities required to mitigate hazards and be better prepared. Protect lives and reduce damages, relatively low cost to implement.

Potential Funding: Local budgets, grant funds

Timeline: Ongoing/Annual public awareness campaign

Action 3. Digitize vulnerable and irreplaceable county records currently located in Sutter County Museum storage building

Hazards Addressed: Multi-Hazard (Agricultural Hazards: Severe Weather/Insect/Pests, Aquatic Invasive Species, Avalanche, Climate Change, Dam Failure, Drought & Water shortage, Earthquake, Floods: 100/500 year, Floods: Localized Stormwater, Landslide, Mudslide, and Debris Flow, Levee Failure, Pandemic Severe Weather: Extreme Heat, Severe Weather: Heavy Rain and Storms, Severe Weather: Wind and Tornado, Severe Weather: Winter Storm and Freeze, and Wildfire)

Issue/Background: Minute books (and indexes for them) for the Sutter County Board of Supervisors meetings dating back to the beginning of Sutter County are currently stored in the Sutter County Museum's storage building, adjacent to their main facility. This storage building is one-story, has fairly good HVAC and metal doors with deadbolts, and is alarmed. These minute books have never been digitized and are used fairly regularly by staff from multiple county departments and by members of the public doing research (always observed by county staff). Potential damage includes routine wear and tear from being handled, being lost after removed from the storage facility, water damage from flooding, fire and/or smoke damage from wildfires, theft from break-ins, etc.

Project Description: Digitization of all minute books with associated indexes, put onto the Sutter County website as a benefit to the public and on the Sutter County Museum's website for the same reason. This ensures that even if there is physical damage to the minute books, the County will still have the information contained within them, which is vitally important to the function of the county.

Other Alternatives: None

Existing Planning Mechanism(s) through which Action Will Be Implemented: None

Responsible Agency/ Department/Partners: Sutter County, Museum and Clerk of the Board

Cost Estimate: Unknown (but may be significant)

Benefits (Losses Avoided): Loss of important historic information; potential legal issues stemming from loss of information.

Potential Funding: Variety of grant sources including FEMA

Timeline: When funding is available

Project Priority (H, M, L): Low

Climate Change Actions NEED ACTIONS

Dam Failure, Flood: 1%, 0.5%, 0.2% annual chance, Flood: Localized Flood, Levee Failure, and Severe Weather: Heavy Rains and Storms Actions NEED ACTIONS

Drought & Water Shortage, Severe Weather: Extreme Heat, and Wildfire Actions

Action 4. Fuels Mitigation for High-Risk Wildland Urban Interface (WUI) Areas

Hazards Addressed: Wildfire-Multi Jurisdictions

Goals Addressed: 1,2, 5

Issue/Background: There are areas in the Sutter County that cross multiple jurisdictions that contain a moderate to high-risk wildland urban interface (WUI) due to unmanaged fuels, which lead to rapid wildfire fire spread. These unmanaged fuels consist of continuous surface, ladder, and aerial of both living and dead matter.

Project Description: Strategically remove living and dead vegetation in high-risk wildland Urban Interface (WUI) area in an effort to decrease the severity and extent of a wildfire to decrease damage and/or risk to life, property, and the environment.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: N/A

Responsible Agency/ Department/Partners: Sutter County/City of Yuba City/Levee District/Yuba City Fire/Sutter County Fire

Cost Estimate: $150,000

Benefits (Losses Avoided): A comprehensive fuels mitigation plan and process will decrease the threat to human and animal life, property, and the impact of emergency response agencies.

Potential Funding: State and Federal Grants, Local Funds

Timeline: 24 Months

Project Priority (H, M, L): High

Earthquake Actions NEED ACTIONS

Pandemic Actions NEED ACTIONS

Severe Weather: Extreme Cold Actions NEED ACTIONS

Chapter 6 Plan Adoption

Requirement §201.6(c)(5) and §201.7(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally approved by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, county commissioner, Tribal Council).

The purpose of formally adopting this LHMP Update is to secure buy-in from Sutter County and participating jurisdictions, raise awareness of the plan, and formalize the plan's implementation. The adoption of this 2020 LHMP Update completes Planning Step 9 of the 10-step planning process: Adopt the Plan, in accordance with the requirements of the Disaster Mitigation Act (DMA) of 2000. For Sutter County and the incorporated communities this adoption also establishes compliance with AB 2140 requiring adoption by reference or incorporation into the Safety Element of the General Plan. Two resolutions were created – one for Sutter County and the two incorporated communities and one for participating Special Districts.

The governing board for each participating jurisdiction has adopted this 2021 Local Hazard Mitigation Plan by passing a resolution. A copy of the generic resolutions and the executed copies are included in Appendix D: Adoption Resolutions.

Chapter 7 Plan Implementation and Maintenance

Requirement §201.6(c)(4): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Implementation and maintenance of this LHMP Update is critical to the overall success of hazard mitigation planning. This is Planning Step 10 of the 10-step planning process. This chapter provides an overview of the overall strategy for plan implementation and maintenance and outlines the method and schedule for monitoring, updating, and evaluating the Plan. The chapter also discusses incorporating the Plan into existing planning mechanisms and how to address continued public involvement.

Chapter 3 Planning Process includes information on the implementation and maintenance process since the 2013 LHMP Update was adopted. This section includes information on the implementation and maintenance process for this 2021 LHMP Update.

7.1 Implementation

Once adopted, this Plan faces the truest test of its worth: implementation. While this Plan contains many worthwhile actions, the County will need to decide which action(s) to undertake first. Two factors will help with making that decision: the priority assigned the actions in the planning process and funding availability. Low or no-cost actions most easily demonstrate progress toward successful Plan implementation.

An important implementation mechanism that is highly effective and low-cost is incorporation of the hazard mitigation plan recommendations and their underlying principles into other plans and mechanisms, such as general plans, stormwater plans, Emergency Operations Plans (EOPS), evacuation plans, and other hazard and emergency management planning efforts for Sutter County. The County already implements policies and programs to reduce losses to life and property from hazards. This Plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms.

Mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. Implementation can be accomplished by adhering to the schedules identified for each action and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits to each program and the Sutter County community and its stakeholders. This effort is achieved through the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. Additional mitigation strategies could include consistent and ongoing enforcement of existing policies and vigilant review of programs for coordination and multi-objective opportunities.

Simultaneous to these efforts, it is important to maintain a constant monitoring of funding opportunities that can be leveraged to implement some of the more costly recommended actions. This could include creating and maintaining a bank of ideas on how to meet local match or participation requirements. When funding does become available, the County will be in a better position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, state and federal programs and earmarked funds, benefit assessments, and other state and federal grant programs, including those that can serve or support multi-objective applications.

Responsibility for Implementation of Goals and Activities

The elected officials and staff appointed to head each department within the County are charged with implementation of various activities in the LHMP Update. During the quarterly reviews as described later in this section, an assessment of progress on each of the goals and activities in the LHMP Update should be determined and noted. At that time, recommendations were made to modify timeframes for completion of activities, funding resources, and responsible entities. On a quarterly basis, the priority standing of various activities may also be changed. Some activities that are found not to be doable may be deleted from the Plan Update entirely and activities addressing problems unforeseen during plan development may be added.

7.1.1. Role of Hazard Mitigation Planning Committee (HMPC) in Implementation and Maintenance

With adoption of this Plan, the participating jurisdictions will be responsible for the LHMP implementation and maintenance. The HMPC identified in Appendix A (or a similar committee) will reconvene quarterly each year to ensure mitigation strategies are being implemented and the County continues to maintain compliance with the NFIP. As such, Sutter County will continue its relationship with the HMPC, and:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high-priority, low/no-cost recommended actions;
- Ensure hazard mitigation remains a consideration for community decision makers;
- Maintain a vigilant monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in the implementation and update of this Plan;
- Report on plan progress and recommended changes to the County Board of Supervisors; and
- Inform and solicit input from the public.

The primary duty of the County is to see the LHMP Update successfully carried out and to report to their governing board and the public on the status of LHPM implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, considering stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the County website.

7.2 Maintenance

Plan maintenance implies an ongoing effort to monitor and evaluate LHMP implementation and to update this Plan as progress, roadblocks, or changing circumstances are recognized.

7.2.1. Maintenance Schedule

The Sutter County Office of Emergency Management (County OEM) is responsible for initiating plan reviews. In order to monitor progress and update the mitigation strategies identified in the mitigation action plan, Sutter County OEM and the HMPC will revisit this plan quarterly each year and following a hazard event. The HMPC will meet quarterly to review progress on Plan implementation and the County as a participating CRS community will provide annual evaluation reports for Activity 510. The HMPC will also submit a five-year written update to the State and FEMA Region IX, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule. With this LHMP Update anticipated to be fully approved and adopted in mid-2021, the next formal LHMP Update for the Sutter County Planning Area will occur in 2026. With a formal FEMA Plan approval required in 2026 for the next LHMP, Sutter County OEM will initiate efforts to obtain a planning grant for the 2026 LHMP Update in 2024, with a new LHMP development process initiated in early 2025.

7.2.2. Maintenance Evaluation Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the Plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions;
- Increased vulnerability as a result of failed or ineffective mitigation actions; and/or
- Increased vulnerability as a result of new development (and/or annexation).
- Increased vulnerability resulting from unforeseen or new circumstances.

Updates to this LHMP will:

- Consider changes in vulnerability due to action implementation;
- Document success stories where mitigation efforts have proven effective;
- Document areas where mitigation actions were not effective;
- Document any new hazards that may arise or were previously overlooked;
- Incorporate new data or studies on hazards and risks;
- Incorporate new capabilities or changes in capabilities;
- Incorporate growth and development-related changes to infrastructure inventories; and
- Incorporate new action recommendations or changes in action prioritization.

Changes will be made to this Plan to accommodate for actions that have failed or are not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. All mitigation actions will be reviewed as well during the monitoring and update of this Plan to determine feasibility of future implementation. Updating of this LHMP will be by written changes and submissions, as the HMPC deems appropriate and necessary, and as approved by the County Board of Supervisors. In keeping with the five-year update process, the HMPC will convene public meetings to

solicit public input on this Plan and its routine maintenance and the final product will be again adopted by the County Board of Supervisors.

Quarterly Plan Review Process

For the LHMP Update review process, Sutter County OEM, as lead along with the County CRS Coordinator, will be responsible for facilitating, coordinating, and scheduling reviews and maintenance of the LHMP. The LHMP is intended to be a living document. The review of the 2021 LHMP Update will normally occur on a quarterly basis each year and will be conducted by the HMPC as follows:

- The Sutter County OEM will place an advertisement in the local newspaper advising the public of the date, time, and place for each quarterly review of the Plan Update and will be responsible for leading the meeting to review the Plan.
- Notices will be mailed to the members of the HMPC, federal, state, and local agencies, non-profit groups, local planning agencies, representatives of business interests, neighboring communities, and others advising them of the date, time, and place for the review.
- County/City/District officials will be noticed by email and telephone or personal visit and urged to participate.
- Members of the County's Planning Commission and other appointed commissions and groups will also be noticed by email and either by telephone or personal visit.
- Prior to the review, department heads and others tasked with implementation of the various activities will be queried concerning progress on each activity in their area of responsibility and asked to present a report at the review meeting.
- The local news media will be contacted, and a copy of the current Plan will be available for public comment at Sutter County.
- After the review meeting, minutes of the meeting and a quarterly report will be prepared by the HMPC and forwarded to the news media (public) and the ISO/CRS specialist for the CRS program. The report will also be presented to the County Board of Supervisors for review, and a request will be made that the Board take action to recognize and adopt any changes resulting from the review.
- A copy of the 2021 LHMP Update will be continually posted on the Internet as will the annual CRS Activity 510 report.

Criteria for Quarterly Reviews

The criteria recommended in 44 CFR 201 and 206 will be utilized in reviewing and updating the Plan. More specifically, the reviews should include the following information:

- Community growth or change in the past quarter.
- The number of substantially damaged or substantially improved structures by flood zone.
- The renovations to public infrastructure including water, sewer, drainage, roads, bridges, gas lines, and buildings.
- Natural hazard occurrences that required activation of the Emergency Operations Center (EOC) and whether or not the event resulted in a presidential disaster declaration.
- Natural hazard occurrences that were not of a magnitude to warrant activation of the EOC or a federal disaster declaration but were severe enough to cause damage in the community or closure of businesses, schools, or public services.
- The dates of hazard events descriptions.
- Documented damages due to the event.

- Closures of places of employment or schools and the number of days closed.
- Road or bridge closures due to the hazard and the length of time closed.
- Assessment of the number of private and public buildings damaged and whether the damage was minor, substantial, major, or if buildings were destroyed. The assessment will include residences, mobile homes, commercial structures, industrial structures, and public buildings, such as schools and public safety buildings.
- Review of any changes in federal, state, and local policies to determine the impact of these policies on the community and how and if the policy changes can or should be incorporated into the Hazard Mitigation Plan. Review of the status of implementation of projects (mitigation strategies) including projects completed will be noted. Projects behind schedule will include a reason for delay of implementation.

7.2.3. Incorporation into Existing Planning Mechanisms

Another important implementation mechanism that is highly effective and low-cost is incorporation of the 2021 LHMP Update recommendations and their underlying principles into other County plans and mechanisms. Where possible, Plan participants will use existing plans and/or programs to implement hazard mitigation actions. As previously stated in Section 7.1 of this plan, mitigation is most successful when it is incorporated into the day-to-day functions and priorities of government and development. The point is re-emphasized here. As described in this LHMP's capability assessment, the County already implements policies and programs to reduce losses to life and property from hazards. This Plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through these other program mechanisms. These existing mechanisms include:

- County general and master plans
- County Emergency Operations Plans and other emergency management efforts
- County ordinances
- Flood/stormwater management/master plans
- Community Wildfire Protection plans
- Capital improvement plans and budgets
- Other plans and policies outlined in the capability assessment
- Other plans, regulations, and practices with a mitigation focus

HMPC members involved in these other planning mechanisms will be responsible for integrating the findings and recommendations of this LHMP with these other plans, programs, etc., as appropriate. As described in Section 7.1 Implementation, incorporation into existing planning mechanisms will be done through the routine actions of:

- monitoring other planning/program agendas;
- attending other planning/program meetings;
- participating in other planning processes; and
- monitoring community budget meetings for other community program opportunities.

The successful implementation of this mitigation strategy will require constant and vigilant review of existing plans and programs for coordination and multi-objective opportunities that promote a safe, sustainable community.

Examples of incorporation of the LHMP into existing planning mechanisms include:

1. As recommended by Assembly Bill 2140, the County should adopt (by reference or incorporation) this LHMP into the Safety Element of their General Plan. Evidence of such adoption (by formal, certified resolution and text within the body of the Safety Element) shall be provided to CAL OES and FEMA.
2. Integration of flood actions identified in this mitigation strategy with implementation priorities in existing Watershed, Flood, and Stormwater Drainage Plans. Key people responsible for development and implementation of the County's Watershed Master Plans, Flood Plans, and Stormwater Master Plan participated on the HMPC. Key projects were identified and integrated specifically into this LHMP, while others currently of lessor priority should be referenced in their source document. Actual implementation of these projects will likely occur through the watershed, flood, and stormwater plans' processes through the efforts of each responsible department.
3. Use of risk assessment information to inform future updates of the hazard analysis in the Sutter County and City(ies) Emergency Operations Plans.

Efforts should continuously be made to monitor the progress of mitigation actions implemented through these other planning mechanisms and, where appropriate, their priority actions should be incorporated into updates of this hazard mitigation plan.

7.2.4. Continued Public Involvement

Continued public involvement is imperative to the overall success of the Plan's implementation. The update process provides an opportunity to solicit participation from new and existing stakeholders and to publicize success stores from the LHMP implementation and seek additional public comment. The Plan maintenance and update process will include continued public and stakeholder involvement and input through attendance at designated committee meetings, web postings, press releases to local media, and through public hearings.

Public Involvement Process for Quarterly Reviews

The public will be noticed by placing an advertisement in the newspaper specifying the date and time for the review and inviting public participation. The HMPC, local, state, and regional agencies will be notified and invited to attend and participate.

Public Involvement for Five-year Update

When the HMPC reconvenes for the next LHMP Update, they will coordinate with all stakeholders participating in the planning process—including those that joined the committee since the planning process began—to update and revise the Plan. In reconvening, the HMPC plan to identify a public outreach subcommittee, which will be responsible for coordinating the activities necessary to involve the greater public. The subcommittee will develop a plan for public involvement and will be responsible for disseminating information through a variety of media channels detailing the plan update process. As part of this effort, public meetings will be held, and public comments will be solicited on the LHMP Update draft. The subcommittee will also coordinate this public outreach process with any public information programs established pursuant to the 2017 guidelines from the Community Rating System (CRS).

Annex A City of Live Oak

A.1 Introduction

This Annex details the hazard mitigation planning elements specific to the City of Live Oak, a previously participating jurisdiction to the 2013 Sutter County Local Hazard Mitigation Plan (LHMP) Update. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the City. This Annex provides additional information specific to Live Oak, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

A.2 Planning Process

As described above, Live Oak followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the City formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table A-1. Additional details on Plan participation and City representatives are included in Appendix A.

Table A-1 City of Live Oak – Planning Team

Name	Position/Title	How Participated
Aaron Palmer	City Manager	Planning meetings, mitigation strategy meetings, risk assessment development and plan development and review.
Ron Walker	Public Works Director	Planning meetings, mitigation strategy meetings, risk assessment development and plan development and review.
Kevin Valentine	Planning Director	Planning meetings, mitigation strategy meetings, risk assessment development and plan development and review.
Scott Rolls	City Engineer	Planning meetings, mitigation strategy meetings, risk assessment development and plan development and review.
Alison Schmidt	Management Analyst	Planning meetings, mitigation strategy meetings, risk assessment development and plan development and review.
John Shalowitz	Fire Chief	Planning meetings, mitigation strategy meetings, risk assessment development and plan review and project management.
Zack Hamill	Sutter County OEM	Planning meetings, mitigation strategy meetings, risk assessment development and plan review and project management.

Coordination with other community planning efforts is paramount to the successful implementation of this LHMP Update. This section provides information on how the City integrated the previously approved 2013 Plan into existing planning mechanisms and programs. Specifically, the City incorporated into or implemented the 2013 LHMP through other plans and programs shown in Table A-2.

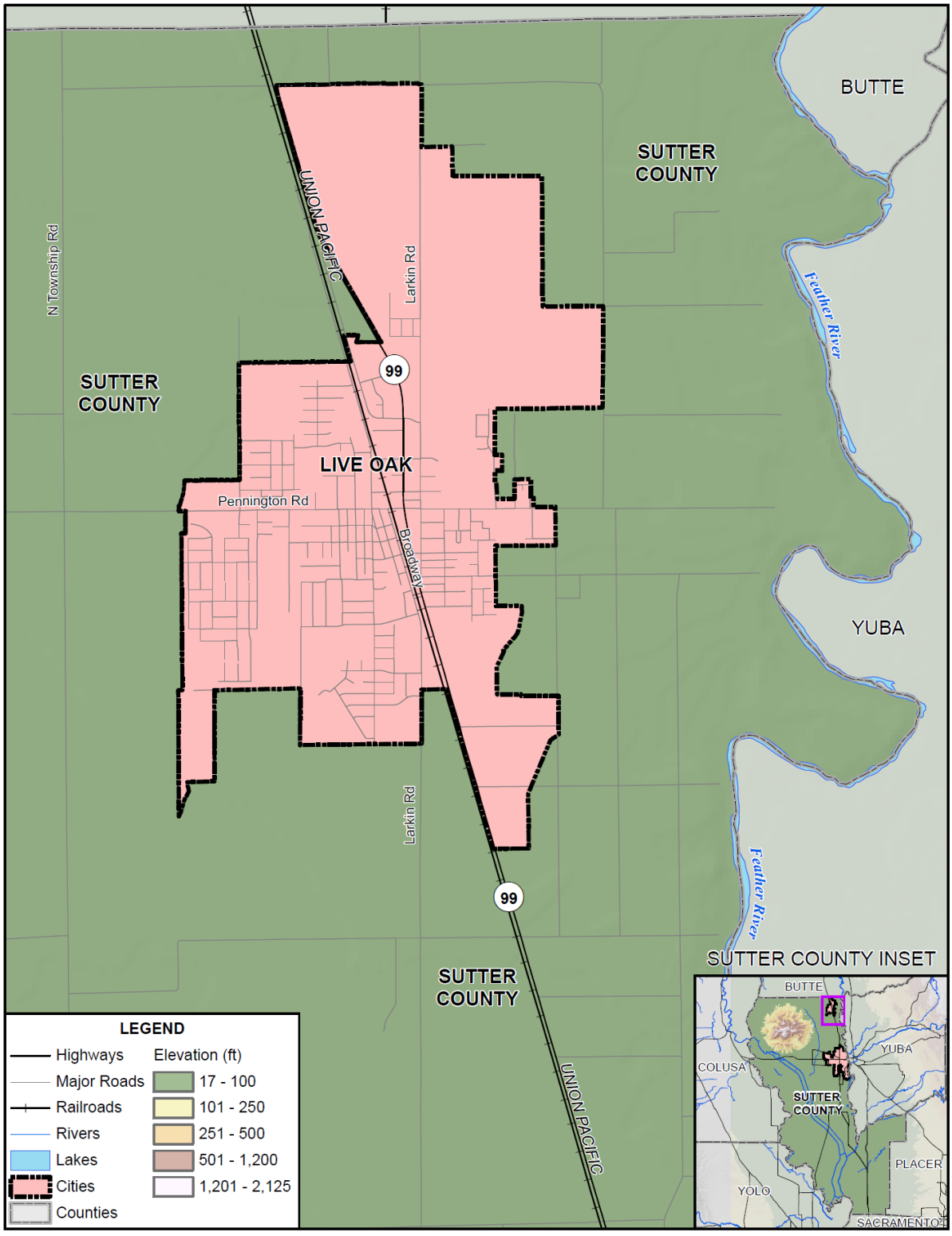
Table A-2 2013 LHMP Incorporation

Planning Mechanism 2013 LHMP Was Incorporated/Implemented In.	Details: How was it incorporated?
PLAN NAMES?	LHMP was referred to during the planning period as a reference to apply for funding opportunities.

A.3 Community Profile

The community profile for the City of Live Oak is detailed in the following sections. Figure A-1 displays a City map and the location of Live Oak within Sutter County.

Figure A-1 City of Live Oak



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

A.3.1. Geography and Climate

Located in Sutter County, Live Oak is a small but growing city located along State Highway 99 and a mainline Union Pacific railroad line in a mostly agricultural area of the Sacramento Valley. Named for the beautiful groves of live oak trees, the town was first settled in 1866 by A.M. McGrew. The town is located within a portion of the Rancho Boga Mexican land grant on the west side of the Feather River. The City has a range of residential, commercial, industrial, civic, and other land uses. Most commercial properties are located along Highway 99, which divides the eastern portion and western portions of the community. The City is surrounded by orchards and other agricultural-related land uses.

Topography in the City of Live Oak is very flat due to its location in the Sacramento Valley, near the Feather River. Soils in most of the City of Live Oak consist of the Conejo-Tisdale soil classification, which is deep to very deep, level to very level well-drained loam and clay loam typically found on terraces. These soils are classified as soils of statewide importance. The remaining areas of the city are comprised of Live Oak sandy clay loam and Marcum-Gridley clay loam soil complex. Sutter County and Live Oak share the mild climate of their San Joaquin and Sacramento Valley neighbors.

A.3.2. History

The Town of Live Oak was first settled in 1866 and named for the beautiful groves of oak trees. The Town grew with the advent of the California-Oregon Railroad in the 1870's and became the main point in Sutter County for shipping agricultural produce. With the construction of the Butte County Canal, agricultural practices flourished around Live Oak. Live Oak was the second city to be established in Sutter County and was incorporated in 1947. Live Oak's population has increased dramatically since 1950 (1,770 population) and was one of the fastest growing cities in the area between 1990 and 2000. Throughout its history, the northern Sacramento Valley has been a primarily agricultural area, as it still is. However, urban growth is changing the metropolitan centers of the valley, particularly in areas near Sacramento, which is the closest metropolitan area to Live Oak.

A.3.3. Economy and Tax Base

US Census estimates show economic characteristics for the City of Live Oak. These are shown in Table A-3 and Table A-4. Mean household income in the City was $100,138. Median household income in the City was $79,570.

Table A-3 City of Live Oak – Civilian Employed Population 16 years and Over

Industry	Estimated Employment	Percent
Agriculture, forestry, fishing and hunting, and mining	76	0.9%
Construction	650	7.5%
Manufacturing	569	6.5%
Wholesale trade	135	1.6%
Retail trade	894	10.3%

Industry	Estimated Employment	Percent
Transportation and warehousing, and utilities	332	3.8%
Information	305	3.5%
Finance and insurance, and real estate and rental and leasing	310	3.6%
Professional, scientific, and management, and administrative and waste management services	1,057	12.2%
Educational services, and health care and social assistance	2,335	26.9%
Arts, entertainment, and recreation, and accommodation and food services	1,166	13.4%
Other services, except public administration	589	6.8%
Public administration	272	3.1%

Source: US Census Bureau American Community Survey 2013-2017 Estimates

Table A-4 City of Live Oak – Income and Benefits

Income Bracket	Percent
<$10,000	3.9%
$10,000 – $14,999	3.7%
$15,000 - $24,9999	7.8%
$25,000 – $34,999	7.6%
$35,000 – $49,999	8.5%
$50,000 – $74,999	15.2%
$75,000 – $99,999	14.3%
$100,000 – $149,999	18.5%
$150,000 – $199,999	11.4%
$200,000 or more	9.0%

Source: US Census Bureau American Community Survey 2018 Estimates

Top ten employers in the City are shown below:

- Live Oak Unified School District
- Live Oak Manor
- City of Live Oak
- E-Center Head Start
- Sunsweet Dryers
- Tower Supermarket
- USPS
- Live Oak Medical Clinic
- Live Oak Pharmacy
- Gold Country Bank

A.3.4. Population

The California Department of Finance estimated the January 1, 2020 total population for the City of Live Oak was 9,200.

A.4 Hazard Identification

Live Oak's identified the hazards that affect the City and summarized their location, extent, likelihood of future occurrence, potential magnitude, and significance specific to Live Oak (see Table A-5).

Table A-5 City of Live Oak—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Extensive	Unlikely	Negligible	Low	Medium
Climate Change	Extensive	Likely	Limited	Medium	–
Dam Failure	Extensive	Unlikely	Catastrophic	Medium	Medium
Drought & Water shortage	Significant	Likely	Critical	Medium	High
Earthquake	Extensive	Unlikely	Negligible	Low	Low
Floods: 1%/0.5%/0.2% annual chance	Significant	Unlikely	Limited	Medium	Medium
Floods: Localized Stormwater	Limited	Likely	Limited	Medium	Medium
Levee Failure	Extensive	Unlikely	Critical	High	Medium
Pandemic	Extensive	Occasional	Negligible	Medium	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Occasional	Negligible	Low	Medium
Severe Weather: Extreme Heat	Extensive	Occasional	Limited	Medium	High
Severe Weather: Heavy Rains and Storms	Extensive	Unlikely	Negligible	Low	Medium
Wildfire	Significant	Unlikely	Negligible	Low	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

A.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile Live Oak's hazards and assess the City's vulnerability separate from that of the Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the City is included in this Annex. This vulnerability assessment analyzes the property, population, critical facilities, and other assets at risk to hazards ranked of medium or high significance specific to the City (as identified in the Significance column of Table A-5) and also includes a vulnerability assessment to the three primary hazards to the State of California: earthquake, flood, and wildfire. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

A.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section A.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard affects the City and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Planning Area.

A.5.2. Vulnerability Assessment and Assets at Risk

This section identifies Live Oak's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within the community.

Values at Risk

The following data from Sutter County utilizes the 2020 Assessor's data and parcel layer. The methodology used to derive parcel counts and property values is the same as in Section 4.3.1 of the Base Plan. This data should only be used as a guideline to overall values in the County and City, as the information has some limitations. The most significant limitations are created by Proposition 13 and the Williamson Act as detailed in the Base Plan. With respect to Proposition 13, instead of adjusting property values annually, the values are not adjusted or assessed at fair market value until a property transfer occurs. As a result, overall value information is most likely low and does not reflect current market value of properties within the County. It is also important to note, in the event of a disaster, it is generally the value of the infrastructure or improvements to the land that is of concern or at risk. Generally, the land itself is not a loss. However, depending on the type of hazard and impact of any given hazard event, land values may be adversely affected; thus, land values are included as appropriate. Table A-6 shows the 2020 Assessor's values and content replacement values (e.g., the values at risk) broken down by property use for the City.

Table A-6 City of Live Oak – Total Values at Risk by Property Use

Jurisdiction / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	73	32	$15,064,066	$3,575,049	$3,575,049	$22,214,164
Commercial	88	64	$8,153,949	$23,233,608	$23,233,608	$54,621,165
Industrial	10	9	$2,283,276	$8,301,026	$12,451,539	$23,035,841
Institutional	85	41	$3,016,510	$31,610,452	$31,610,452	$66,237,414
Miscellaneous	81	0	$0	$0	$0	$0
Residential	2,241	2,188	$91,253,299	$309,787,820	$154,893,910	$555,935,029
Vacant	258	0	$9,285,722	$0	$0	$9,285,722
Total	**2,836**	**2,334**	**$129,056,822**	**$376,507,955**	**$225,764,558**	**$731,329,335**

Source: Sutter County 2020 Parcel/Assessor's Data

Critical Facilities and Infrastructure

Critical facilities and infrastructure are those buildings and infrastructure that are crucial to a community. Should these be damaged, it makes it more difficult for the community to respond to and recover from a disaster. For purposes of this plan, a critical facility is defined as:

> ***Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.***

Additional information on the three classes of critical facilities is described further in Section 4.3.1 of the Base Plan.

INSERT ANALYSIS

Natural Resources

Natural resources are unique to each area and are difficult to replace. Should a natural disaster occur, a community's natural resources are also at risk. The City of Live Oak and the areas surrounding it include a rich and diverse range of biological resources. The majority of the land within the City has either been converted to agricultural use or disturbed in some way. Most of the vegetation within this area is dominated by non-native species. The remaining riparian vegetation is found in narrow patches along the west bank of the Feather River and contains most of the native plant species within the City. Due to its location in the Sacramento Valley, Live Oak is located in an area with high levels of waterfowl activity.

Historic and Cultural Resources

Historic and cultural resources are difficult to replace. Should a natural disaster occur, these properties and locations can be at risk.

The City of Live Oak has a stock of historically significant homes, public buildings, and landmarks. To inventory these resources, the HMPC collected information from a number of sources. The California Department of Parks and Recreation Office of Historic Preservation (OHP) was the primary source of information. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs. Each program has different eligibility criteria and procedural requirements. These requirements are detailed in Section 4.3.1 of the Base Plan. Table A-7 lists the historical buildings in the City.

Table A-7 City of Live Oak – Historical Resources

Resource Name (Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/ Community
Live Oak Historic Commercial District (N2012)	X				1/23/1998	Live Oak

Source: California Department of Parks and Recreation Office of Historic Preservation, http://ohp.parks.ca.gov/

Additionally, Live Oak has a local historic district. The historic district represents the development of local commerce in the City of Live Oak between 1875 and 1930. It comprises 12 structures, as well as a row of palm trees planted along Broadway circa 1900. This district also includes a three block long parcel currently owned by the Union Pacific Railroad, with an 1882 depot.

It should be noted that these lists may not be complete, as they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by CEQA and NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Growth and Development Trends

As part of the LHMP update process, changes in growth and development, both past and future, were evaluated and examined in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability over time. Information from the City of Live Oak General Plan Housing Element, the California Department of Finance, the US Census Bureau form the basis of this discussion.

Population Trends and Special Populations

Population growth can increase the number of people living in hazard prone areas. Live Oak has generally seen steady growth. Live Oak has seen growth rates as shown in Table A-8.

Table A-8 City of Live Oak – Population Changes Since 1950

Year	Population	Change	% Change
1950	1,770	-	-

Year	Population	Change	% Change
1960	2,276	506	28.6%
1970	2,645	369	16.2%
1980	3,103	458	17.3%
1990	4,320	1,217	39.2%
2000	6,229	1,909	44.2%
2010[1]	8,392	2,163	34.7%
2020[2]	9,200	808	9.6%

Source: [1]US Census Bureau, [2]California Department of Finance

Special Populations and Disadvantaged Communities

The City Planning Team noted that there are several populations in the City that may have access and functional needs as well as disadvantaged communities such as:

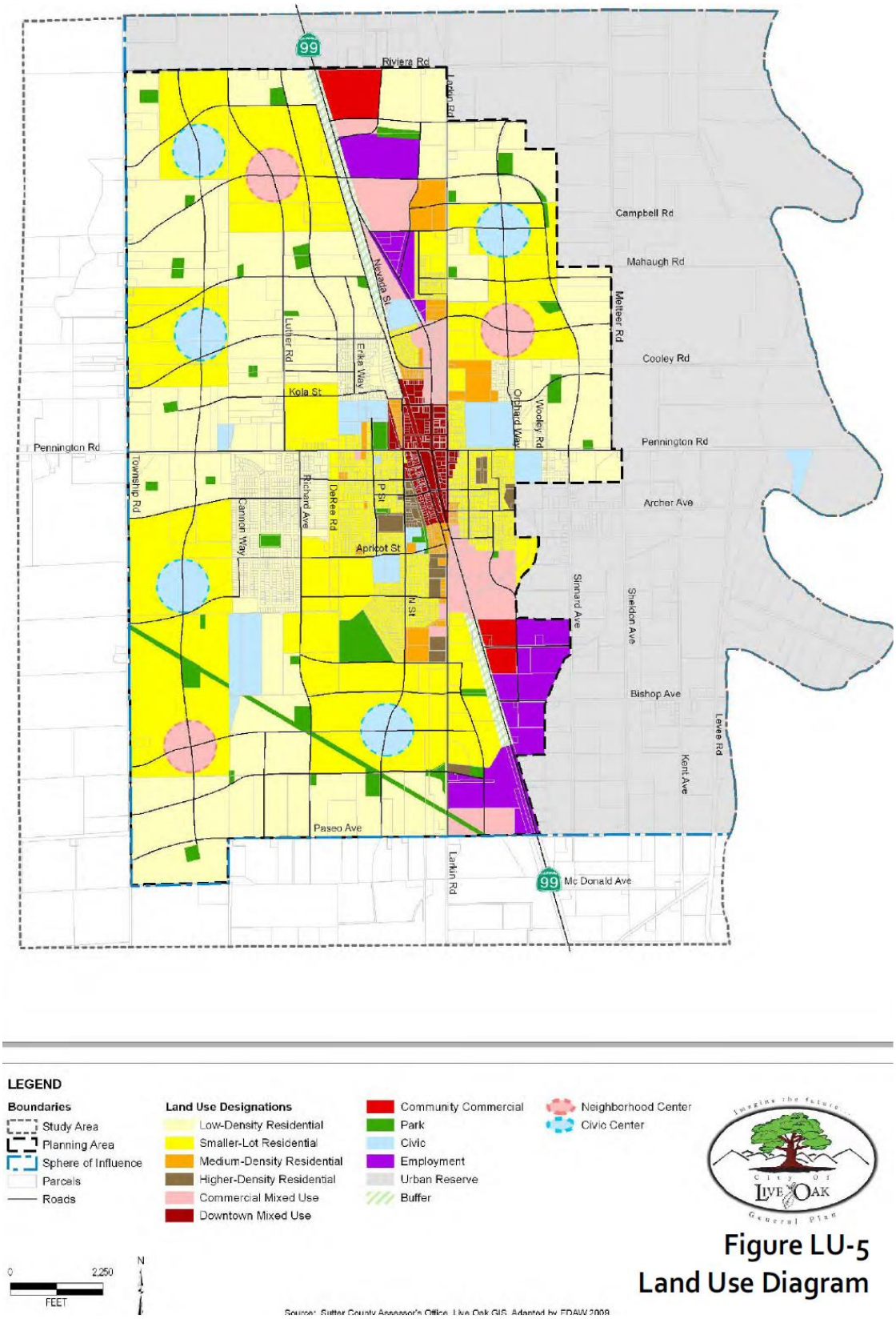
- Maple Park Senior Apartments
- Senior Mobile Home Park
- Low income individuals in all apartment complexes in Live Oak
- Live Oak Manor

Land Use

State planning law requires that the land use element of a general plan include a statement of the standard population density, building intensity, and allowed uses for the various land use designations in the plan (Government Code Section 65302(a)). The City's land use designations are generally described below and mapped on the Land Use Diagram (Figure A-2). The Live Oak Municipal Code provides detailed land use and development standards for development.

The 2030 City of Live Oak General Plan noted that the historic district represents the development of local commerce in the City of Live Oak between 1875 and 1930. It comprises 12 structures, as well as a row of palm trees planted along Broadway circa 1900. This district also includes a three block long parcel currently owned by the Union Pacific Railroad, with an 1882 depot. Future land use for the City of Live Oak from the City of Live Oak 2030 General Plan Land Use Element is shown on Figure A-2.

Figure A-2 City of Live Oak – Land Use Diagram



Source: City of Live Oak 2030 General Plan Land Use Element

Development since 2013 Plan

As discussed in Section 4.3.1 of the Base Plan, future development has occurred in the County since the last plan. Some of this has occurred in hazard prone areas. The City Building Department tracked total building permits issued since 2013 for the City. These are tracked by total development, property use type, and hazard risk area. These are shown in Table A-9 and Table A-10.

Table A-9 City of Live Oak – Total Development Since 2013

Property Use	2014	2015	2016	2017	2018	2019	2020
Agricultural	0	0	0	0	0	0	0
Commercial	0	2	1	1	2	0	0
Industrial	0	0	0	0	1	0	0
Residential	2	94	2	2	52	75	73
Unknown	0	0	0	0	0	0	0
Total	**2**	**96**	**3**	**3**	**55**	**75**	**73**

Source: City of Live Oak Building Department

Table A-10 City of Live Oak – Development in Hazard Areas since 2013

Property Use	1% Annual Chance Flood	Levee Protected Area	Wildfire Risk Area[1]	Other
Agricultural	0	0	0	0
Commercial	0	6	0	0
Industrial	0	1	0	0
Residential*	0	301	0	0
Unknown	0	0	0	0
Total	0	**308**	0	0

Source: City of Live Oak Building Department

[1]Moderate or higher wildfire risk area

*The residential permit numbers are comprised of single family units and apartment units.

Future Development

The City of Live Oak currently has two residential subdivisions under construction, three approved Tentative Subdivision Maps, and two Tentative Subdivision Maps that are currently in the approval process.

- Residential Subdivisions Currently Under Construction
  - ✓ Phase Four of the Pennington Ranch Project - The fourth phase of the Pennington Ranch Project, known as the Oak Knoll development, consists of 97 single-family residential homes that are currently under construction.

Garden Glen Residential Project - The Garden Glen Residential Project consists of 170 single-family homes that are currently under construction.

- Approved City of Live Oak Tentative Subdivision Maps

- ✓ Phase Five of the Pennington Ranch Project - The fifth phase of the Pennington Ranch Project consists of 72 single-family residential lots and is located north of Treatment Plant Road and is identified by Sutter County Assessor Parcel Number (APN) 06-640-008.
- ✓ Oak Grove Tentative Subdivision Map - The Oak Grove Tentative Subdivision Map consists of 117 single-family residential lots and is located northwest of Treatment Plant Road, and is identified by Sutter County APN 06-640-014.
- ✓ Silver Oaks Subdivision - The Silver Oaks Tentative Subdivision Map consists of 93 residential lots (104 units - 82 single-family detached units and 11 duplex units) and is located south of Apricot Street and east of Treatment Plant Access Road, and is identified by Sutter County APN 06-470-035.

➢ Proposed City of Live Oak Tentative Subdivision Maps

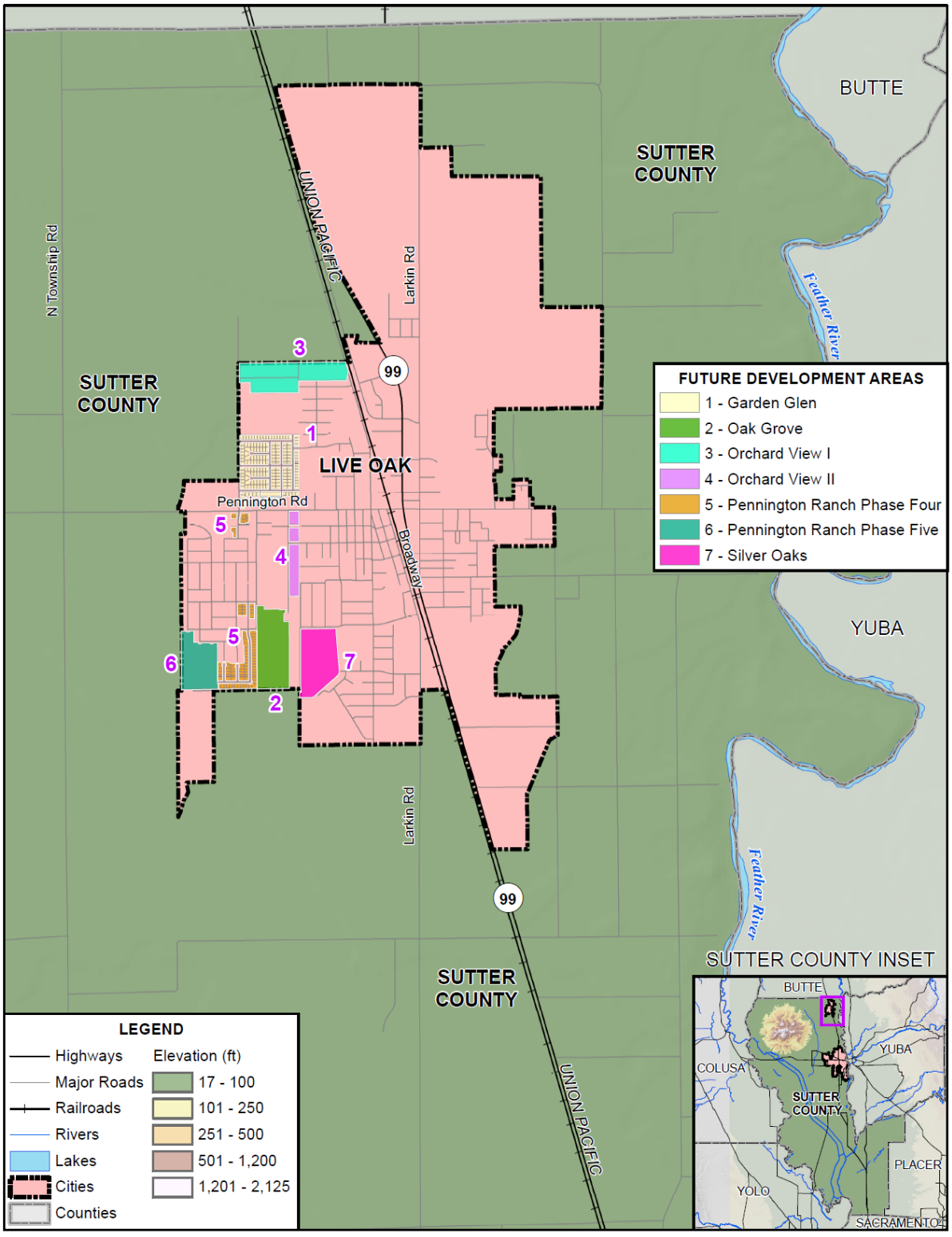
- ✓ Orchard View I - The Orchard View I Tentative Subdivision Map consists of 129 single-family residential lots and is located east of Luther Road extending to Hampton Road and is identified by Sutter County APNs 06-010-001, 06-600-006, and 06-600-007.
- ✓ Orchard View II - The Orchard View II Tentative Subdivision Map consists of 43 single-family residential lots and is located south of Pennington Road and east of De Ree Road and is identified by Sutter County APNs 06-400-002, 06-400-003, and 06-400-004.

The City of Live Oak currently does not have any commercial or industrial areas in the City that are expected to be developed within the next five years.

GIS Analysis

Using GIS, the following methodology was used in determining parcel counts and acreages with future development projects in the City of Live Oak. Future development areas in the City were provided in mapped format by the City. 7 areas were provided. Using the GIS parcel spatial file for each of these areas, the 7 areas and 298 parcels associated with future development projects for which the analysis was to be performed were identified. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts within each area. Figure A-3 shows the locations of future development areas the City is planning to develop. Table A-11 shows the parcels and acreages of each future development area in the City.

Figure A-3 City of Live Oak – Future Development Areas



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table A-11 City of Live Oak – Future Development Areas with Parcel Counts and Acreages

Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Garden Glen	192	0	31.6
Oak Grove	1	0	28.1
Orchard View I	3	0	28.5
Orchard View II	3	0	8.9
Pennington Ranch Phase Four	97	92	16.3
Pennington Ranch Phase Five	1	0	20.3
Silver Oaks	1	0	25.2
Live Oak Total	**298**	**92**	**158.9**

Source: City of Yuba City GIS

A.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table A-5 as high or medium significance hazards. Impacts of past events and vulnerability of the City to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the City to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, populations at risk, critical facilities and infrastructure, and future development.

Climate Change

Likelihood of Future Occurrence–Unlikely
Vulnerability–Medium

Hazard Profile and Problem Description

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

In Sutter County and the City, the HMPC noted that each year it seems to get a bit warmer each year. It was also noted that 2017 was one of the wettest and 2019 one of the hottest years on record.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the City, Sutter County, and State of California. There is no scale to measure the extent of climate change. Climate change exacerbates other hazards, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Climate change has never been directly linked to any declared disasters. While the City noted that climate change is of concern, no specific impacts of climate change could be recalled. The City and HMPC members noted that the strength of storms does seem to be increasing and the temperatures are getting hotter.

Vulnerability to and Impacts from Climate Change

The California Adaptation Planning Guide (APG) prepared by California OES and California Natural Resource Agency was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change. California's APG: Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Sutter County and the City of Live Oak fall within the North Sierra Region characterized as a sparsely settled mountainous region where the region's economy is primarily tourism-based. The region is rich in natural resources, biodiversity, and is the source for the majority of water used by the state. This information can be used to guide climate adaptation planning in the City and Sutter County Planning Area.

The California APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Sutter County Planning Area is part of:

- Temperature increases
- Decreased precipitation
- Reduced snowpack
- Reduced tourism
- Ecosystem change
- Sensitive species stress
- Increased wildfire

Future Development

The City could see population fluctuations as a result of climate impacts relative to those experienced in other regions, and these fluctuations are expected to impact demand for housing and other development. While there are currently no formal studies of specific migration patterns expected to impact the City and County region, climate-induced migration was recognized within the UNFCCC Conference of Parties Paris Agreement of 2015 and is expected to be the focus of future studies.

Dam Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–Medium

Hazard Profile and Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

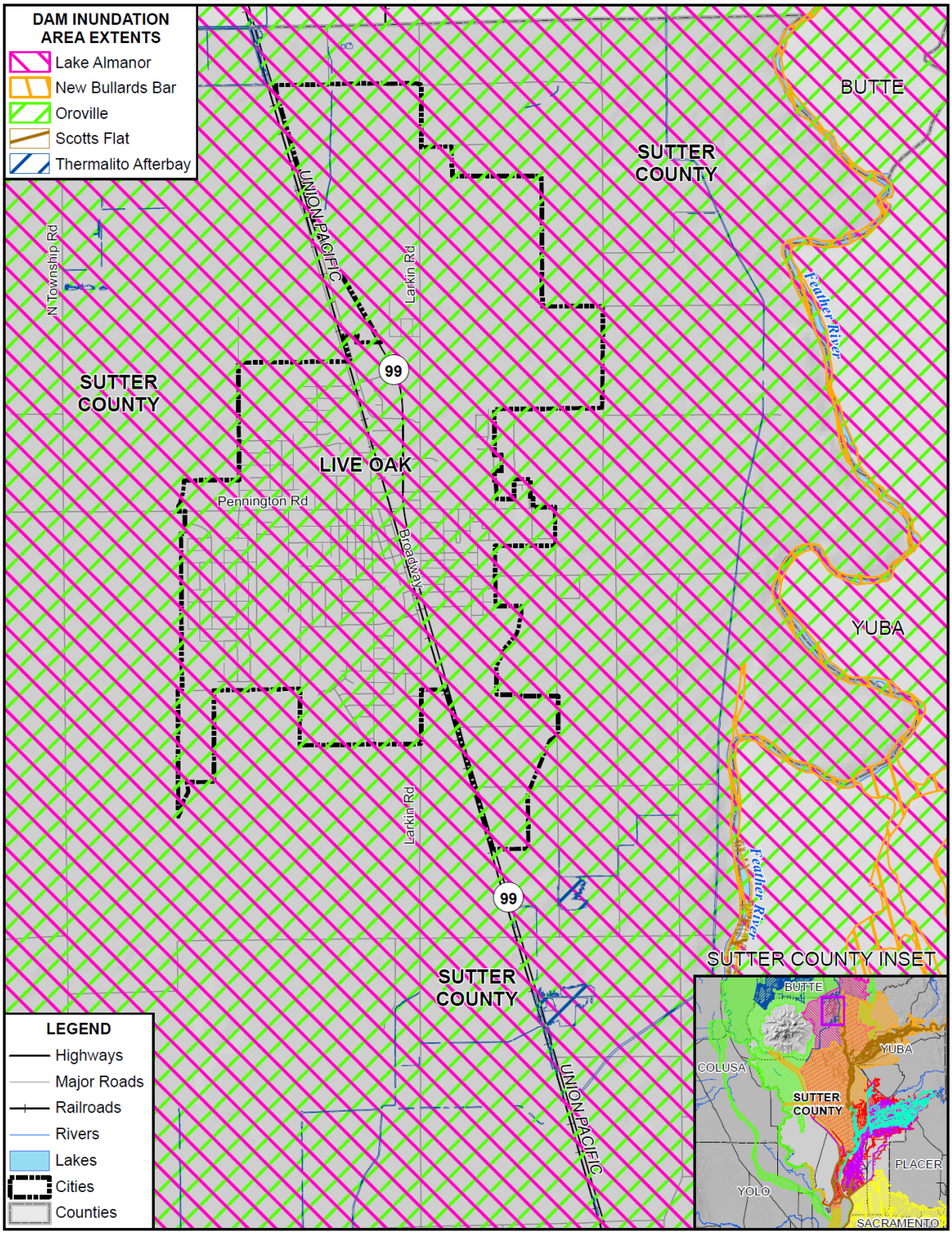
Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, CA DWR Division of Safety of Dams (DSOD) assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.2.10 of the Base Plan. High and Extremely High hazard dams can result and loss of life, thus dams with these classifications are the focus of this risk assessment.

While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The City would be affected for as long as the flood waters from the dam failure took to drain downstream.

Geographic flood extent from the Cal OES dam inundation areas is shown in Table A-12. Based on available data, the City falls within the inundation areas of two extremely high hazard dams: Lake Almanor Dam and Oroville Dam. The City falls in no high hazard dam inundation areas. These can be seen on Figure A-4.

Figure A-4 Live Oak – Extremely High Hazard Dam Inundation Areas



Data Source: CAL FIRE (Draft 9/2007 - c51fhszl06_1), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table A-12 City of Live Oak – Geographical Dam Inundation Extents

Dam Inundation Area	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Extreme High Hazard Dam Inundation Areas						
Lake Almanor	1,828.46	100.0%	1,037.26	100.0%	791.20	100.0%
Oroville	1,828.46	100.0%	1,037.26	100.0%	791.20	100.0%

Source: Cal OES

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident occurring in nearby Butte County. This can be seen on Table A-13.

Table A-13 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

2017 Oroville Spillway Incident. There were several impacts from the 2017 Oroville Spillway incident to the City of Live Oak such as various evacuations and closures, extraordinary costs for staffing and displaced individuals due to the evacuation orders.

The City noted no other dam failure occurrences that have affected the City.

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Due to the relatively flat topography surrounding the City, dam failure would result in sheet flow. This is opposed to the "bowl effect" of the southern portions of the County. Impacts to the City from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant.

Assets at Risk

Based on the vulnerability of Live Oak to the dam failure hazard, the sections that follow describes significant assets at risk in the City of Live Oak. This section includes the values at risk, inundated acres, population at risk, and critical facilities at risk.

Values at Risk

GIS was used to determine the possible impacts of dam failure flooding within the City of Live Oak. The methodology described in Section 4.3.4 of the Base Plan was followed in determining structures and values at risk. Multiple analysis tables were created:

- Table A-14 shows the total parcel counts, improved parcel counts, their improved structure and land values in the Lake Almanor dam inundation area.
- Table A-15 shows the total parcel counts, improved parcel counts, their improved structure and land values in the Oroville dam inundation area.

Table A-14 City of Live Oak – Count and Value of Parcels in Lake Almanor Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	73	32	$15,064,066	$3,575,049	$3,575,049	$22,214,164
Commercial	88	64	$8,153,949	$23,233,608	$23,233,608	$54,621,165
Industrial	10	9	$2,283,276	$8,301,026	$12,451,539	$23,035,841
Institutional	85	41	$3,016,510	$31,610,452	$31,610,452	$66,237,414
Miscellaneous	81	–	$0	$0	$0	$0
Residential	2,241	2,188	$91,253,299	$309,787,820	$154,893,910	$555,935,029
City of Live Oak Total	**2,578**	**2,334**	**$119,771,100**	**$376,507,955**	**$225,764,558**	**$722,043,613**

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Table A-15 City of Live Oak – Count and Value at Risk in Oroville Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	73	32	$15,064,066	$3,575,049	$3,575,049	$22,214,164
Commercial	88	64	$8,153,949	$23,233,608	$23,233,608	$54,621,165
Industrial	10	9	$2,283,276	$8,301,026	$12,451,539	$23,035,841
Institutional	85	41	$3,016,510	$31,610,452	$31,610,452	$66,237,414
Miscellaneous	81	–	$0	$0	$0	$0
Residential	2,241	2,188	$91,253,299	$309,787,820	$154,893,910	$555,935,029
City of Live Oak Total	**2,578**	**2,334**	**$119,771,100**	**$376,507,955**	**$225,764,558**	**$722,043,613**

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Population at Risk

The Cal OES dam inundation areas were overlayed on the parcel layer. Those residential parcel centroids that intersect the dam inundation areas were counted and multiplied by the 2020 Census Bureau average household factors for Live Oak – 2.59. According to this analysis, there is a total population of 5,667 residents of the City at risk to dam failure flooding from both dams. This is shown in Table A-28.

Table A-16 City of Live Oak – Count of Improved Residential Parcels and Population by Dam Inundation Area

Jurisdiction	Lake Almanor Dam Inundation Area		Oroville Dam Inundation Area	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Live Oak	2,188	5,667	2,188	5,667

Source: Cal OES, Sutter County 2020 Parcel/Assessor's Data, US Census Bureau

Critical Facilities at Risk

An analysis was performed on the critical facility inventory in Live Oak in identified dam inundation areas. GIS was used to determine whether the critical facility locations intersect a Cal OES or DSOD dam inundation area. Details of critical facilities in mapped dam inundation areas in the City of Live Oaks are shown in Figure A-5 and detailed in Table A-17. Details of critical facility definition, type, name and address and jurisdiction by dam inundation area are listed in Appendix F.

Figure A-5 City of Live Oak – Critical Facilities in Dam Inundation Areas

Table A-17 City of Live Oak – Critical Facilities in Dam Inundation Areas

Critical Facility Category/Dam Inundation Area	Facility Count

Source: Cal OES, Sutter County GIS

Future Development

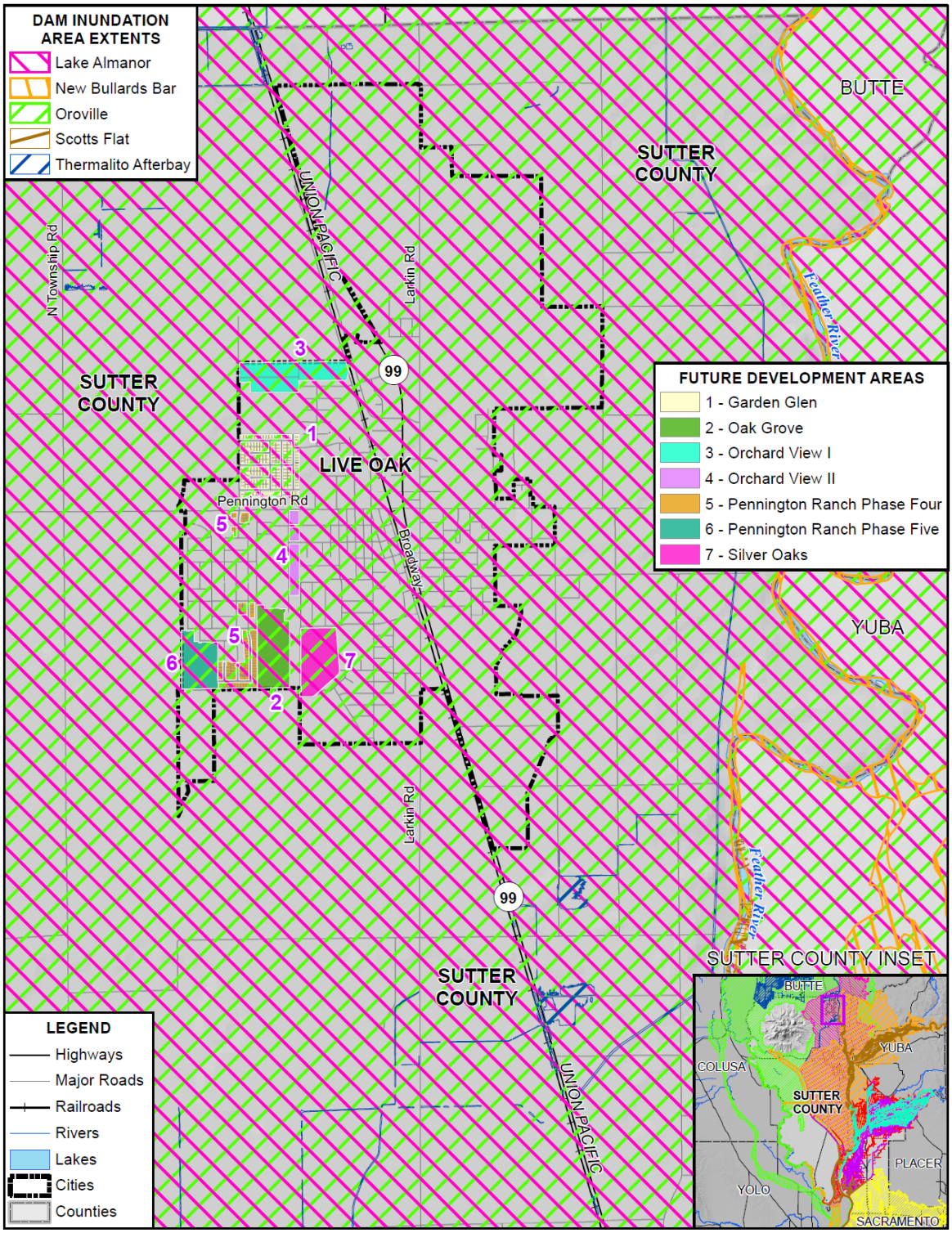
Given the high number of potentially affected parcels and the numerous dams of concern to Yuba City, future development in the City could be affected by dam failures and associated flooding. Siting of future development areas should take dam failure flooding into account.

GIS Analysis

The City provided future development areas were used as the basis for the inventory of future development areas for the City. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts within each individual mapped dam inundation area. Figure A-6 shows the locations of future development areas the City is planning to develop and the extremely high hazard dam inundation area that they intersect. Table A-18 shows the parcels and acreages of each future

development area in the City by extremely high hazard dam inundation area. It should be noted that there are no future development areas in high hazard dam inundation areas; as such, no map or tabular analysis is shown.

Figure A-6 City of Live Oak –Critical Facilities in Extremely High Hazard Dam Inundation Areas



Data Source: CAL FIRE (Draft 9/2007 - c51fhszl06_1), Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table A-18 City of Live Oak – Future Development Areas Parcel Counts and Acreages in Extremely High Hazard Dam Inundation Areas

Dam Inundation/Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Lake Almanor Dam			
Garden Glen	192	0	31.6
Oak Grove	1	0	28.1
Orchard View I	3	0	28.5
Orchard View II	3	0	8.9
Pennington Ranch Phase Four	97	92	16.3
Pennington Ranch Phase Five	1	0	20.3
Silver Oaks	1	0	25.2
Lake Almanor Total	**298**	**92**	**158.9**
Oroville Dam			
Garden Glen	192	0	31.6
Oak Grove	1	0	28.1
Orchard View I	3	0	28.5
Orchard View II	3	0	8.9
Pennington Ranch Phase Four	97	92	16.3
Pennington Ranch Phase Five	1	0	20.3
Silver Oaks	1	0	25.2
Oroville Total	**298**	**92**	**158.9**

Source: Cal OES, DSOD, City of Yuba City GIS

Drought & Water Shortage

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects. Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue and is critical for agriculture, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

Location and Extent

Drought and water shortage are regional phenomenon. The whole of the County, as well as the whole of the City, is at risk. The US Drought Monitor categorizes drought conditions with the following scale:

- None
- D0 – Abnormally dry
- D1 – Moderate Drought
- D2 – Severe Drought
- D3 – Extreme drought
- D4 – Exceptional drought

Drought has a slow speed of onset and a variable duration. Drought can last for a short period of time, which does not usually affect water shortages and for longer periods. Should a drought last for a long period of time, water shortage becomes a larger issue. Current drought conditions in the City and the County are shown in Section 4.3.8 of the Base Plan.

Past Occurrences

There have been 2 state and 1 federal disaster declarations from drought. This can be seen in Table A-19.

Table A-19 Sutter County – State and Federal Drought Disaster Declarations 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Drought	2	1976, 2014	1	1976

Source: Cal OES, FEMA

Since drought is a regional phenomenon, past occurrences of drought for the City are the same as those for the County and includes 5 multi-year droughts over a 85-year period. Details on past drought occurrences can be found in Section 4.3.8 of the Base Plan.

During the recent 2012-2016 drought, the City was affected by lowering pumps 1 & 2 because of the drop in the water levels; water use ordinance to reduce usage.

Vulnerability to and Impacts from Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the City, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users.

The vulnerability of the City to drought is City-wide, but impacts may vary and include reduction in water supply and quality, and an increase in dry fuels. The potential for a reduction in water supply during drought conditions generally leads to both mandated and voluntary conservations measures during extended droughts. During these times, the costs of water can also increase. The increased dry fuels and fuel loads

associated with drought conditions can also result in an increased fire danger. In areas of extremely dry fuels, the intensity and speed of fires can be significant. Water supply and flows for fire suppression can also be an issue during extended droughts.

Other qualitative impacts associated with drought in the Planning Area are those related to water intensive activities such as, municipal usage, commerce, tourism, recreation and agricultural use. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

With more precipitation likely falling as rain instead of snow in the Sierra's, and warmer temperatures causing decreased snowfall to melt faster and earlier, water supply is likely to become more unreliable. In addition, drought and water shortage is predicted to become more common. This means less water available for use over the long run, and additional challenges for water supply reliability, especially during periods of extended drought.

Future Development

As the population in the area continues to grow, so will the demand for water. Water shortages in the future may be worsened by drought, as the City relies primarily on surface water for its water source. Ongoing planning will be needed by the City and local water agencies to account for population growth and increased water demands.

Earthquake

Likelihood of Future Occurrence–Unlikely
Vulnerability–Low

Although considered a low significance hazard by the HMPC, due to the significance of earthquake in the State of California, earthquake vulnerability for the City of Live Oak is detailed here.

Hazard Profile and Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction.

Indirect seismic hazards include ground failure, tsunamis, seiches, and dam failure. Ground failure occurs when the stresses in the ground exceed the resistance of earth materials to deformation or rupture. Instability comes about when stresses are increased by natural or human-made causes, such as by

earthquakes, fills, and ground water withdrawal. Various types of ground failure can occur including liquefaction, lateral spreading, landslides, differential settlement, subsidence, and erosion. The liquefaction potential of soils in the Live Oak area is generally moderate, though areas of higher potential exist in areas parallel to the Feather River. Landslide risks are low because of the low level of topographical relief in the area. Other hazards related to ground failure, such as differential settlement, subsidence, and erosion, can be addressed through appropriate soil investigation before construction, as specified in the City's goals and policies.

Location and Extent

Since earthquakes are regional events, the whole of the City is at risk to earthquake. Live Oak's geologic context and geographic location increase the risk of certain seismic hazards and reduce the risk of others. Earthquakes can result in direct hazards or in indirect hazards. Direct hazards include surface ruptures, fault displacement, and ground shaking. The nearest active fault to Live Oak is the Cleveland Hills Fault, located at Lake Oroville more than 15 miles away. The lack of active faults in the Planning Area means that the community faces little to no threat of surface rupture and fault displacement. On the other hand, the alluvium soils found within the Sacramento Valley and the City are capable of effectively conducting seismic waves. Ground shaking can occur at some distance from the epicenter of an earthquake and has historically been the dominant form of seismic activity affecting the City.

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales, as discussed in Section 4.3.9 of the Base Plan. The faults identified in Sutter County include the Quaternary Faults, located in the northern section of the County within the Sutter Buttes, and the Pre Quaternary Fault, located in the southeastern corner of the Planning Area, just east of where Highway 70 enters in to the County. Both faults are listed as non active faults, but have the potential for seismic activity.

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. The City is located in an area where few earthquakes of significant magnitude occur, so both magnitude and intensity of earthquakes are expected to remain low. Seismic shaking maps for the area show Sutter County and the City fall within a low to moderate shake risk.

Past Occurrences

The City noted no past occurrences of earthquakes or that affected the City in any meaningful way.

Vulnerability to and Impacts from Earthquake

The combination of plate tectonics and associated California coastal mountain range building geology generates earthquake as a result of the periodic release of tectonic stresses. Sutter County's mountainous terrain lies in the center of the North American and Pacific tectonic plate activity. There have been earthquakes as a result of this activity in the historic past, and there will continue to be earthquakes in the future of the California north coastal mountain region.

Fault ruptures itself contributes very little to damage unless the structure or system element crosses the active fault; however, liquefaction can occur further from the source of the earthquake. In general, newer construction is more earthquake resistant than older construction due to enforcement of improved building codes. Manufactured housing is very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Locally generated earthquake motions and associated liquefaction, even from very moderate events, tend to be more damaging to smaller buildings, especially those constructed of unreinforced masonry (URM) and soft story buildings. The HMPC noted that there is one three story brick apartment building in the City that is constructed of unreinforced masonry that may be at risk to earthquake. This building is of special note as it is a senior citizen housing complex. This building according to the planning team was reinforced in the late 80s early 90s.

The Uniform Building Code (UBC) identifies four seismic zones in the United States. The zones are numbered one through four, with Zone 4 representing the highest level of seismic hazard. The UBC establishes more stringent construction standards for areas within Zones 3 and 4. All of California lies within either Zone 3 or Zone 4. The City of Live Oak is within the less hazardous Zone 3.

Impacts from earthquake in the City will vary depending on the fault that the earthquake occurs on, the depth of the earthquake strike, and the intensity of shaking. Earthquakes can cause both structural and non-structural damages. Large events could cause damages to infrastructure, critical facilities, residential and commercial properties, and possible injuries or loss of life.

Earthquake Analysis

Due to the regional effects of an earthquake, a probabilistic Hazus earthquake analysis was performed on a countywide basis. This can be found in Section 4.3.9 of the Base Plan. While this Hazus run was not done specific to the City, maps showing damage in the County show greater areas of damage near the cities in the County where the greatest development occurs.

Future Development

Existing structures in the City could be affected by the types of earthquake-induced effects listed above, but to varying degrees based on length, intensity, and distance of the earthquake from a given building. New structures are required to adhere to current California Uniform Building Code (CUBC) standards, providing adequate design, construction and maintenance of structures to prevent exposure of people and structures to major geologic hazards. In particular, any critical facilities such as hospitals, fire and police stations, and emergency communications and operations centers must be adequately designed, constructed and maintained with the goal of remaining functional after a large seismic event. The use of flexible utility connections, building anchors, and adequately reinforced concrete can reduce the loss of life and damage to buildings for human occupancy.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–Medium

Hazard Profile and Problem Description

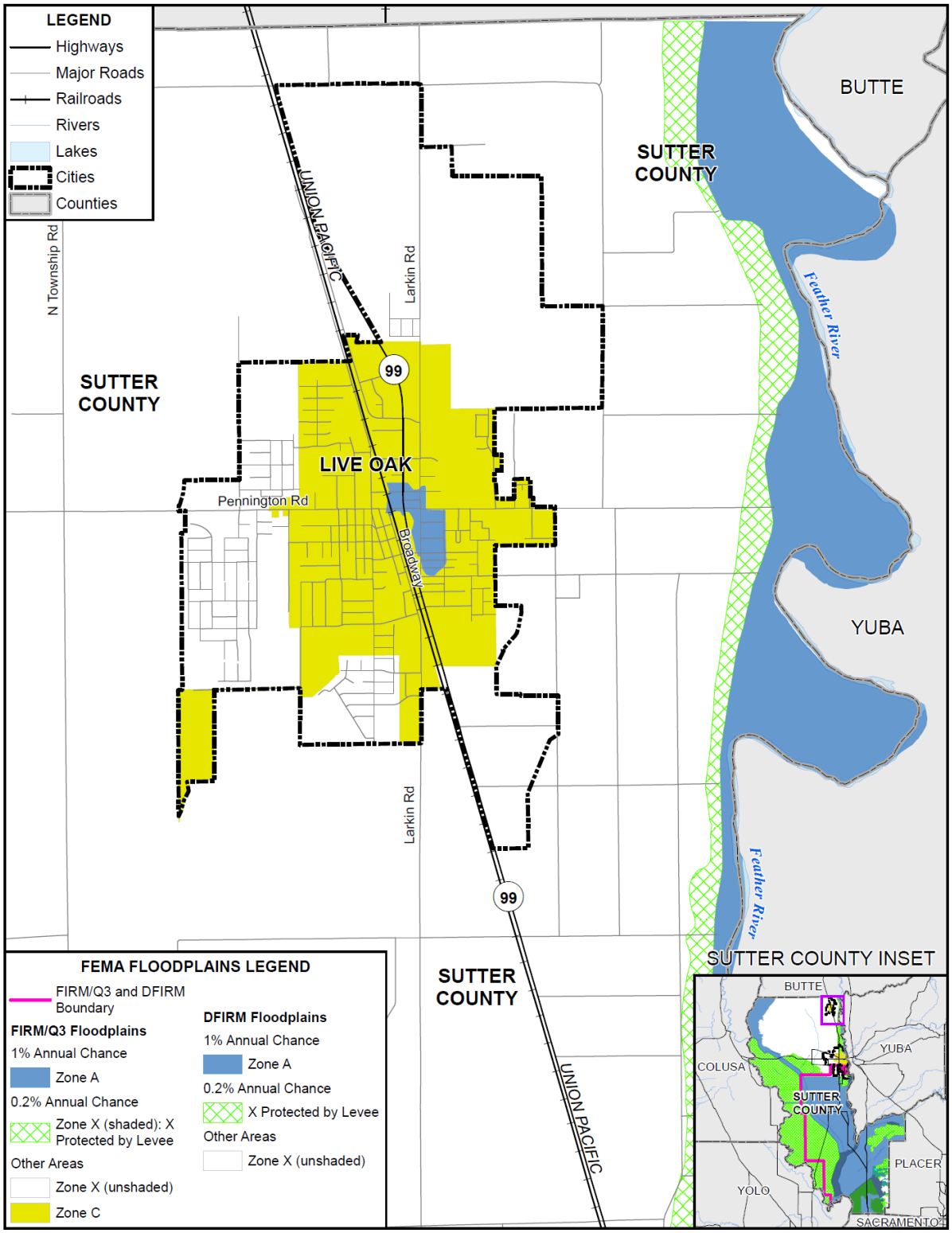
This hazard analyzes FEMA's 1% and 0.2% annual chance floods, as well as the 0.5% (200-year) annual chance flood. These tend to be the larger floods that can occur in the County and City, and have caused damages in the past. Flooding is a significant problem in Sutter County and the City. Historically, the City has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures, including a vast system of levees. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1%, 0.5%, and 0.2% annual chance floodplains and in other localized areas.

As previously described in Section 4.3.10 of the Base Plan, the Sutter County Planning Area and the City of Live Oak have been subject to historical flooding.

Location and Extent

FEMA flood maps show the City of Live Oak has areas located in the 1% annual chance flood zone and Zone C (from Q3). This is seen in Figure A-7. However, it was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.

Figure A-7 City of Live Oak – FEMA Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table A-20 details the Q3/DFIRM mapped flood zones located within the City.

Table A-20 City of Live Oak– Q3/DFIRM Flood Hazard Zones

Flood Zone	Description	Present in Live Oak
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	Shown on map, but removed by 2014 LOMR
AE	1% annual chance flood: Base flood elevations provided	
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	
X (unshaded)	No flood hazard	
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	
AE	100-year Flood: Base flood elevations provided	
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	
X (unshaded)	No flood hazard	X
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	X

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the City vary, depending on the nature and extent of a flood event; specific flood depths vary by location. Flood durations in the City tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the City tends to have a shorter speed of onset, due to the amount of water that flows through the City.

Geographical flood extent from the FEMA Q3/DFIRMs is shown in Table A-21.

Table A-21 City of Live Oak – Geographical Flood Hazard Extents in FEMA Q3/DFIRM Flood Zones

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance Flood Hazard*	22	1.22%	18	1.70%	5	0.60%
0.2% Annual Chance Flood Hazard	0	0.00%	0	0.00%	0	0.00%
Other Areas	1,806	98.78%	1,020	98.30%	786	99.40%
Total	**1,828**	**100.00%**	**1,037**	**100.00%**	**791**	**100.00%**

Source: Sutter County 6/16/2015 DFIRM, FEMA 1998 Q3 data

*it was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table A-22. These events also likely affected the City to some degree.

Table A-22 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

The City noted no other past occurrences of flooding.

Vulnerability to and Impacts from Flood

Floods have been a minor part of the City's historical past and will continue to be limited in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain, though the FEMA floodplain in the City has been removed based on a 2014 LOMR. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Public schools may also be required to close or be placed on a delayed start schedule. Roads

can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

Assets at Risk

Based on the vulnerability of Live Oak to the flood hazard, the sections that follow describes significant assets at risk in the City of Live Oak. This section includes the values at risk, flooded acres, population at risk, and critical facilities at risk.

Values at Risk

GIS was used to determine the possible impacts of flooding within the City of Live Oak. The methodology described in Section 4.3.10 of the Base Plan was followed in determining structures and values at risk to the 1% (100-year) and 0.2% (500-year) annual chance flood event. Table A-23 is a summary table for the City of Live Oak. Parcel counts, values, estimated contents, and total values in the City are shown for the 1% and 0.2% annual chance flood zones, as well as for those properties that fall outside of the mapped FEMA DFIRM flood zones. As previously mentioned, there are no areas of the City within the 1% annual chance flood. Table A-24 breaks down Table A-23 and shows the property use, improved parcel count, improved values, estimated contents, and total values that fall in FEMA flood zones in the City.

Table A-23 City of Live Oak – Count and Value of Parcels in Summary DFIRM Flood Zones*

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard**	101	84	$3,930,576	$9,210,157	$6,781,951	$19,922,684
0.2% Annual Chance Flood Hazard***	0	0	$0	$0	$0	$0
Other Areas	2,735	2,250	$125,126,246	$367,297,798	$218,982,607	$711,406,651
City of Live Oak Total	**2,836**	**2,334**	**$129,056,822**	**$376,507,955**	**$225,764,558**	**$731,329,335**

Source: FEMA 6/16/2015 DFIRM, FEMA 1998 Q3 data , Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

***it was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.

***This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

Table A-24 City of Live Oak – Count and Values of Parcels by Detailed Flood Zone and Property Use*

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard**						
Zone A						
Agricultural	0	0	$0	$0	$0	$0
Commercial	15	11	$1,455,028	$3,877,829	$3,877,829	$9,210,686
Industrial	1	1	$77,318	$35,144	$52,716	$165,178
Institutional	7	4	$107,714	$405,628	$405,628	$918,970
Miscellaneous	4	0	$0	$0	$0	$0
Residential	68	68	$2,147,525	$4,891,556	$2,445,778	$9,484,859
Vacant	6	0	$142,991	$0	$0	$142,991
Zone A Total	**101**	**84**	**$3,930,576**	**$9,210,157**	**$6,781,951**	**$19,922,684**
1% Annual Chance Flood Hazard Total	**101**	**84**	**$3,930,576**	**$9,210,157**	**$6,781,951**	**$19,922,684**
Other Areas						
Zone X (unshaded)						
Agricultural	57	26	$13,266,380	$3,358,425	$3,358,425	$19,983,230
Commercial	1	1	$318,363	$106,121	$106,121	$530,605
Industrial	1	1	$365,000	$130,000	$195,000	$690,000
Institutional	13	1	$1,265,111	$150,000	$150,000	$1,565,111
Miscellaneous	3	0	$0	$0	$0	$0
Residential	869	860	$41,751,079	$171,896,741	$85,948,371	$299,596,191
Vacant	203	0	$6,627,235	$0	$0	$6,627,235
Zone X (unshaded) Total	**1,147**	**889**	**$63,593,168**	**$175,641,287**	**$89,757,917**	**$328,992,372**
Zone C						
Agricultural	16	6	$1,797,686	$216,624	$216,624	$2,230,934
Commercial	72	52	$6,380,558	$19,249,658	$19,249,658	$44,879,874
Industrial	8	7	$1,840,958	$8,135,882	$12,203,823	$22,180,663
Institutional	65	36	$1,643,685	$31,054,824	$31,054,824	$63,753,333
Miscellaneous	74	0	$0	$0	$0	$0
Residential	1,304	1,260	$47,354,695	$132,999,523	$66,499,762	$246,853,980
Vacant	49	0	$2,515,496	$0	$0	$2,515,496
Zone C Total	**1,588**	**1,361**	**$61,533,078**	**$191,656,511**	**$129,224,691**	**$382,414,280**
Other Areas Total	**2,735**	**2,250**	**$125,126,246**	**$367,297,798**	**$218,982,607**	**$711,406,651**
City of Yuba City Total	**2,836**	**2,334**	**$129,056,822**	**$376,507,955**	**$225,764,558**	**$731,329,335**

Source: FEMA 6/16/2015 DFIRM, FEMA 1998 Q3 data, Sutter County 2020 Parcel/Assessor's Data
*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone
***it was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.

Table A-25 summarizes Table A-24 above and shows City of Live Oak loss estimates and improved values at risk by FEMA 1% and 0.2% annual chance flood zones.

Table A-25 City of Live Oak – Flood Loss Estimates

Flood Zone	Total Parcel* Count	Improved Parcel* Count	Improved Structure Value	Other Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance**	101	84	$3,930,576	$9,210,157	$6,781,951	$15,992,108	$3,198,422	0.03%
0.2% Annual Chance***	0	0	$0	$0	$0	$0	$0	0.00%
Grand Total	**101**	**84**	**$3,930,576**	**$9,210,157**	**$6,781,951**	**$15,992,108**	**$3,198,422**	**0.03%**

Source: FEMA 6/16/2015 DFIRM, Sutter County 2020 Parcel/Assessor's Data
*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone
***it was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.
***This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

According to Table A-24 and Table A-25, the City of Live Oak has 84 parcels and $15.9 million of structure and contents values or values in the 1% annual chance floodplain, and no improved parcels in the 0.2% annual chance floodplain. These values can be refined a step further. Applying the 20 percent damage factor as previously described in Section 4.3.10 of the Base Plan, there is a 1% chance in any given year of a flood event causing $3.2 million in in damage in the City of Live Oak. The loss ratio of 0.03% and 0.00% indicates that flood losses for 1% and 0.2% annual chance flooding, respectively, would be limited and relatively easy to recover from.

Flooded Acres

Also of interest is the land area affected by the various flood zones. The following is an analysis of flooded acres in the City in comparison to total area within the City limits. The same methodology, as discussed in Section 4.3.10 of the Base Plan, was used for the City of Live Oak as well as for the County as a whole. Table A-26 represents a summary analysis of total acres for each FEMA DFIRM flood zone in the City.

Table A-26 City of Live Oak – Flooded Acres by Flood Zone

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance Flood Hazard*	22	0.01%	18	0.01%	5	0.00%
0.2% Annual Chance Flood Hazard	0	0.00%	0	0.00%	0	0.00%
Other Areas	1,806	0.45%	1,020	0.48%	786	0.41%
Total	**1,828**	**0.45%**	**1,037**	**0.49%**	**791**	**0.41%**

Source: FEMA DFIRM 6/16/2015, FEMA 1998 Q3 data

**it was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.

Table A-27 City of Live Oak – Flooded Acres by Flood Zone

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance Flood Hazard						
Zone A*						
Agricultural	0	0.00%	0	0.00%	0	0.00%
Commercial	4.4	0.001%	3.5	0.002%	0.8	0.000%
Industrial	1.2	0.000%	0.5	0.000%	0.7	0.000%
Institutional	2.0	0.000%	1.4	0.001%	0.6	0.000%
Miscellaneous	1.6	0.000%	0	0.00%	1.6	0.001%
Residential	12.2	0.003%	12.2	0.006%	0	0.00%
Vacant	0.9	0.000%	0	0.00%	0.9	0.000%
Zone A Total	**22.3**	**0.006%**	**17.6**	**0.008%**	**4.7**	**0.002%**
1% Annual Chance Flood Hazard Total	**22.3**	**0.006%**	**17.6**	**0.008%**	**4.7**	**0.002%**
Other Areas						
Zone X (unshaded)						
Agricultural	847.8	0.211%	378.5	0.180%	469.3	0.245%
Commercial	2.1	0.001%	2.1	0.001%	0.0	0.000%
Industrial	9.3	0.002%	9.3	0.004%	0	0.00%
Institutional	50.5	0.013%	26.6	0.013%	24.0	0.012%
Miscellaneous	2.2	0.001%	0	0.00%	2.2	0.001%
Residential	165.0	0.041%	164.2	0.078%	0.8	0.000%
Vacant	83.6	0.021%			83.6	0.044%

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Zone X (unshaded) Total	**1,160.5**	**0.288%**	**580.6**	**0.276%**	**579.9**	**0.302%**
Zone C						
Agricultural	89.7	0.022%	19.5	0.009%	70.2	0.037%
Commercial	35.1	0.009%	29.1	0.014%	6.0	0.003%
Industrial	19.9	0.005%	18.9	0.009%	1.0	0.001%
Institutional	171.5	0.043%	108.4	0.051%	63.1	0.033%
Miscellaneous	19.5	0.005%			19.5	0.010%
Residential	266.6	0.066%	263.1	0.125%	3.5	0.002%
Vacant	43.4	0.011%			43.4	0.023%
Zone C Total	**645.7**	**0.160%**	**439.1**	**0.209%**	**206.6**	**0.108%**
Other Areas Total	**1,806.1**	**0.449%**	**1,019.7**	**0.484%**	**786.5**	**0.410%**
City of Live Oak Total	**1,828.5**	**0.454%**	**1,037.3**	**0.493%**	**791.2**	**0.412%**

Source: FEMA DFIRM 6/16/2015, FEMA 1998 Q3 data

**it was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.

Population at Risk

The DFIRM flood zones were overlayed on the parcel layer. Those residential parcel centroids that intersect the flood zones were counted and multiplied by the 2010 Census Bureau average household factors for Live Oak – 2.59. According to this analysis, there is a total population of 176 and 0 residents of the City at risk to flooding in the 1% and 0.2% annual chance floodplains, respectively. This is shown in Table A-28.

Table A-28 City of Live Oak – Count of Improved Residential Parcels and Population by Flood Zone

Jurisdiction	1 % Annual Chance Flooding		0.2% Annual Chance Flooding	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Live Oak	68*	176	0	0

Source: FEMA DFIRM 6/16/2015, FEMA 1998 Q3 data, Sutter County 2020 Parcel/Assessor's Data, US Census Bureau

**it was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.

Critical Facilities at Risk

INSERT

Insurance Coverage, Claims Paid, and Repetitive Losses

The City of Live Oak joined the National Flood Insurance Program (NFIP) on March 23,1984. The City participates in Community Rating System (CRS) program and is a Class 10. NFIP data indicates that as of March 24, 2020, there were 1,309 flood insurance policies in force in the City with $436,514,200 of coverage. Of the 1,309 policies, 1,138 were residential (single-family homes), 50 were multi-family, 26 were other residential, and 95 were non-residential. All 1,309 policies are in the B, C, or X zones. There have been 21 paid losses with $15,570.82 in losses paid. 20 of these losses were on single family homes, while one was on a non-residential property. The GIS parcel analysis detailed above identified 84 improved parcels in the 1% annual chance flood zone. 84 parcels are covered by 1,309 policies in the City. There have been no substantial damage claims. NFIP data further indicates that there are no repetitive loss (RL) or severe repetitive loss (SRL) buildings in Live Oak.

California Department of Water Resources Best Available Maps (BAM)

The FEMA regulatory maps provide just one perspective on flood risks in Sutter County. Senate Bill 5 (SB 5), enacted in 2007, authorized the California DWR to develop the Best Available Maps (BAM) displaying 100- and 200-year floodplains for areas located within the Nevada-San Joaquin (SAC-SJ) Valley watershed. This effort was completed by DWR in 2008. DWR has expanded the BAM to cover all counties in the State and to include 500-year floodplains.

Different than the FEMA DFIRMs which have been prepared to support the NFIP and reflect only the 100-year event risk, the BAMs are provided for informational purposes and are intended to reflect current 100-, 200-(as applicable), and 500-year event risks using the best available data. The 100-year floodplain limits on the BAM are a composite of multiple 100-year floodplain mapping sources. It is intended to show all currently identified areas at risk for a 100-year flood event, including FEMA's 100-year floodplains. The BAM are comprised of different engineering studies performed by FEMA, Corps, and DWR for assessment of potential 100-, 200-, and 500-year floodplain areas. These studies are used for different planning and/or regulatory applications, and for each flood frequency may use varied analytical and quality control criteria depending on the study type requirements.

The value in the BAMs is that they provide a bigger picture view of potential flood risk to the City than that provided in the FEMA DFIRMs. The BAM map for Live Oak is shown in Figure A-8.

Figure A-8 City of Live Oak – Best Available Map

Source: California DWR

Legend explanation: Blue - FEMA 1%, Orange – Local 1% (developed from local agencies), Red – DWR 1%r (Awareness floodplains identify the 1% annual chance flood hazard areas using approximate assessment procedures.), Pink – USACE 1% (2002 Sac and San Joaquin River Basins Comp Study), Yellow – USACE 0.5% (2002 Sac and San Joaquin River Basins Comp Study), Tan – FEMA 0.2%, Grey – Local 0.2% (developed from local agencies), Purple – USACE 0.2%(2002 Sac and San Joaquin River Basins Comp Study).

Future Development

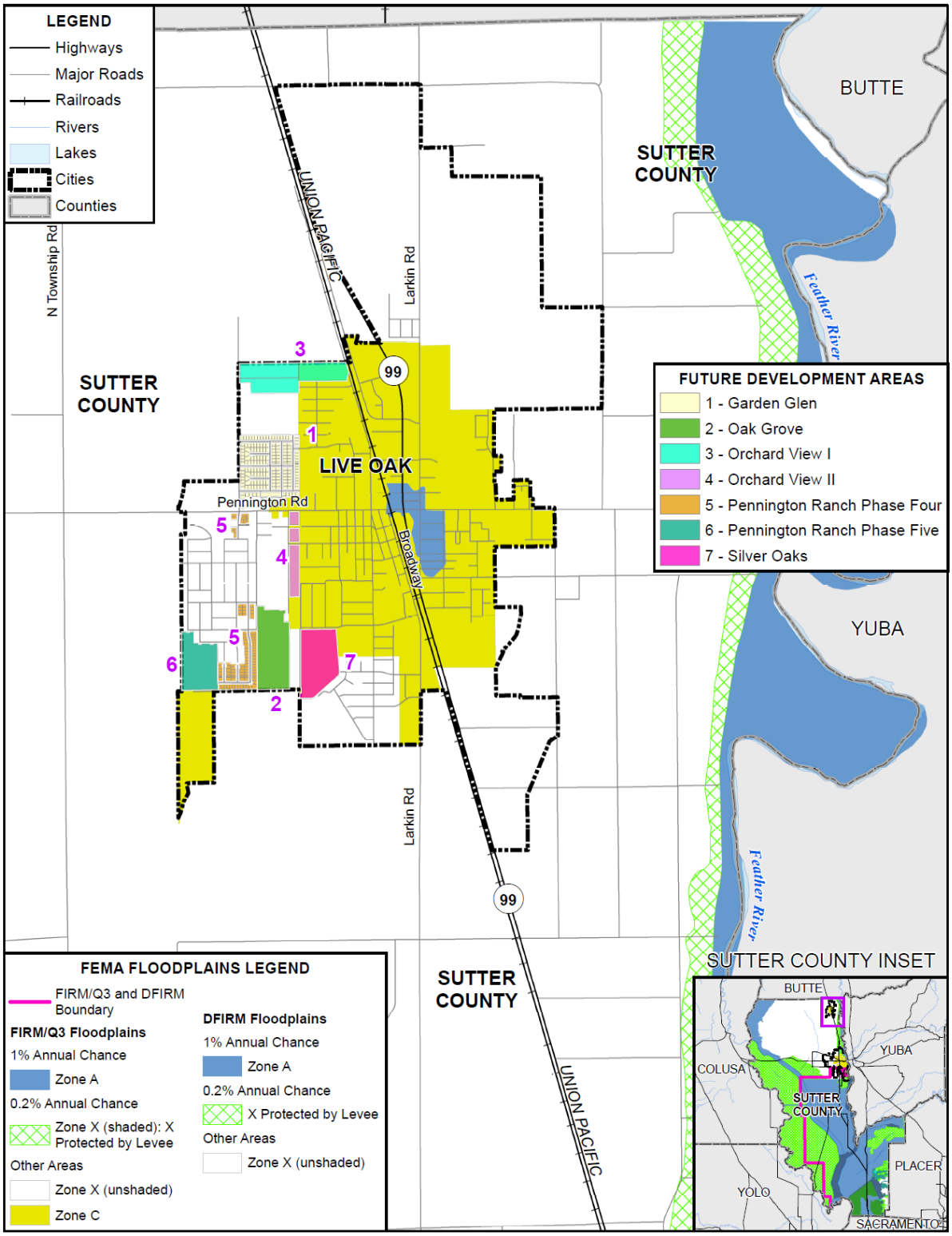
The potential for flooding may increase as floodwaters are channeled due to land development. Such changes can exacerbate flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. Floodplain modeling and master planning should be based on build out property use to ensure that all new development remains safe from future flooding. While local floodplain management, stormwater management, and water quality regulations and policies address these changes on a site-by-site basis, their cumulative effects can have a negative impact on the overall floodplain.

GIS Analysis

The City provided Future Development Areas were used as the basis for the inventory of future development areas for the City. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts within each area. Figure A-9 shows the locations of future development areas the City is planning to develop on the FEMA DFIRM. Table A-29 shows the parcels and acreages of each future development area in the City by DFIRM flood zone.

It was noted by the City that Zone A in central Live Oak depicted on this map has been removed through a Letter of Map Revision (LOMR) approved by FEMA in 2014.

Figure A-9 City of Live Oak – Future Development and DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table A-29 City of Live Oak – Future Development Parcels and Acres in DFIRM Flood Zones

Dam Inundation/Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Other Areas			
Garden Glen	192	0	31.6
Oak Grove	1	0	28.1
Orchard View I	3	0	28.5
Orchard View II	3	0	8.9
Pennington Ranch Phase Four	97	92	16.3
Pennington Ranch Phase Five	1	0	20.3
Silver Oaks	1	0	25.2
Live Oak Total	**298**	**92**	**158.9**

Source: FEMA 6/16/2015 DFIRM, City of Live Oak GIS

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Flooding occurs in areas other than the FEMA mapped 1% and 0.2% annual chance floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate maintenance. Localized, stormwater flooding occurs throughout the County during the rainy season from November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration.

Location and Extent

CAN THE BELOW BE UPDATED? BRENNA HAD A NOTE HERE STATING "NEED TO ADD TO THIS AND UPDATE ADD SOCCER PARK DETENTION BASIN". Scott Rowles submitted the new map showing the detention basin but had not comments on the narrative. FOSTER MORRISON HAS NOT SEEN THIS MAP

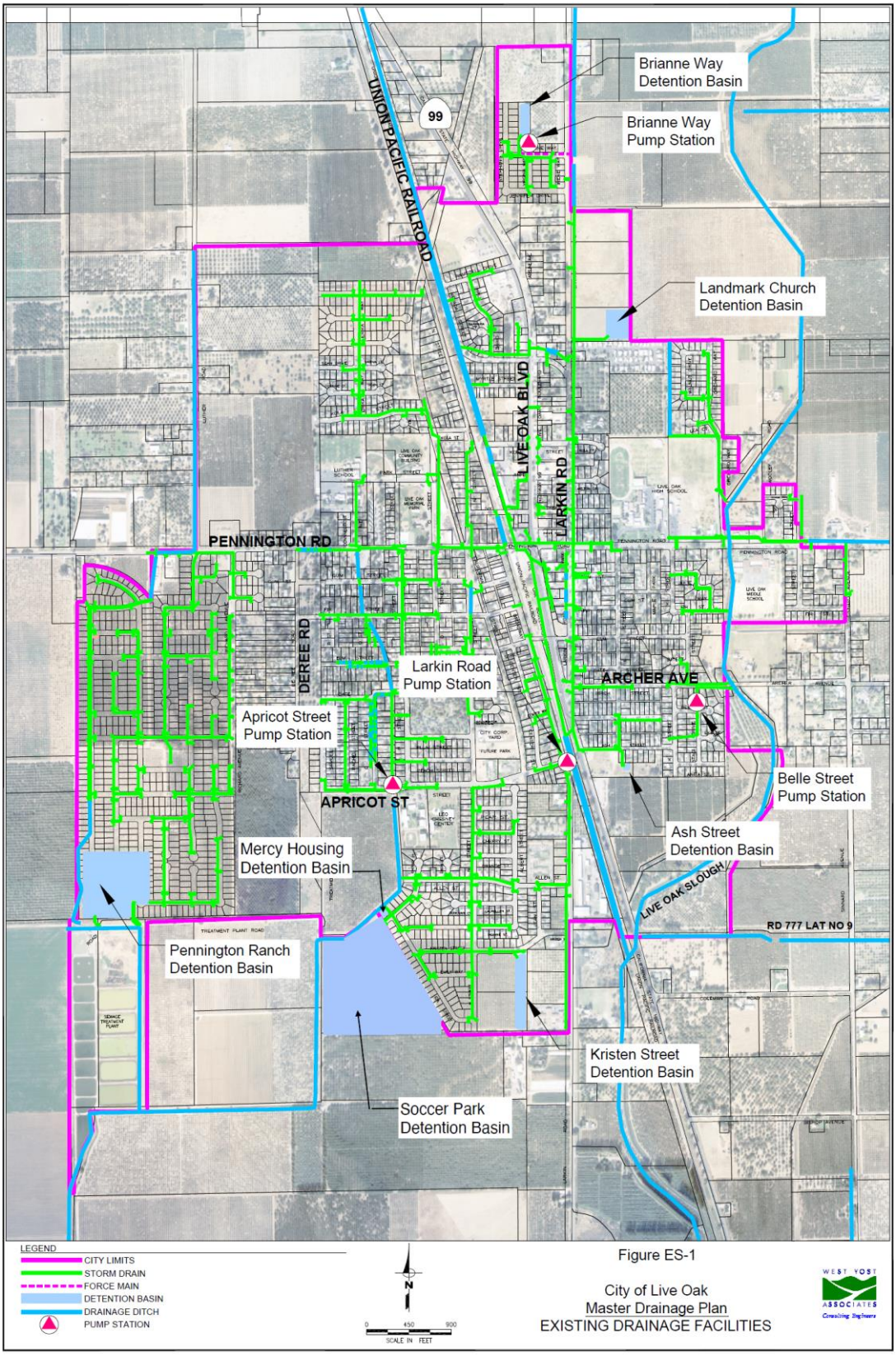
There are two primary sources of stormwater runoff that are of concern to the City: regional runoff, which originates outside the City, and runoff from properties located inside the City. The City owns and maintains storm drain pipe systems, detention basins, and pump stations to provide drainage and prevent flooding within the City and convey runoff to the Reclamation District 777 (RD 777) open channel drainage system. The existing drainage facilities are shown in Figure A-10. The existing City and most of the City at buildout of the 2030 General Plan are within the RD 777 service area. RD 777's facilities consist of a series of drainage channels along with culverts and some piping. RD 777's system conveys flows to the south and

west to the East Interceptor Canal and then to the Wadsworth Canal. The Wadsworth Canal flows to the Sutter Bypass, which in turn flows to the Sacramento River.

Minor street flooding occurs, although infrequently, in the City of Live Oak. Some of these locations include De Ree Road, Luther School, L Street (between Date Street and Pennington Road), and at several Highway 99 cross culverts that do not have connections to the City's storm drain systems. Many of the road and streets within the City of Live Oak were constructed without curbs and gutters, which contributes to minor nuisance ponding of storm water.

At buildout of the City of Live Oak 2030 General Plan, the northwest corner of the City will be within RD 2056 service area. This area drains to the west into Morrison Slough. Morrison Slough also drains to the south and west into the East Interceptor Canal and then to Wadsworth Canal, the Sutter Bypass, and ultimately to the Sacramento River.

Figure A-10 City of Live Oak Drainage Facilities



Source: 2011 Live Oak Drainage Study

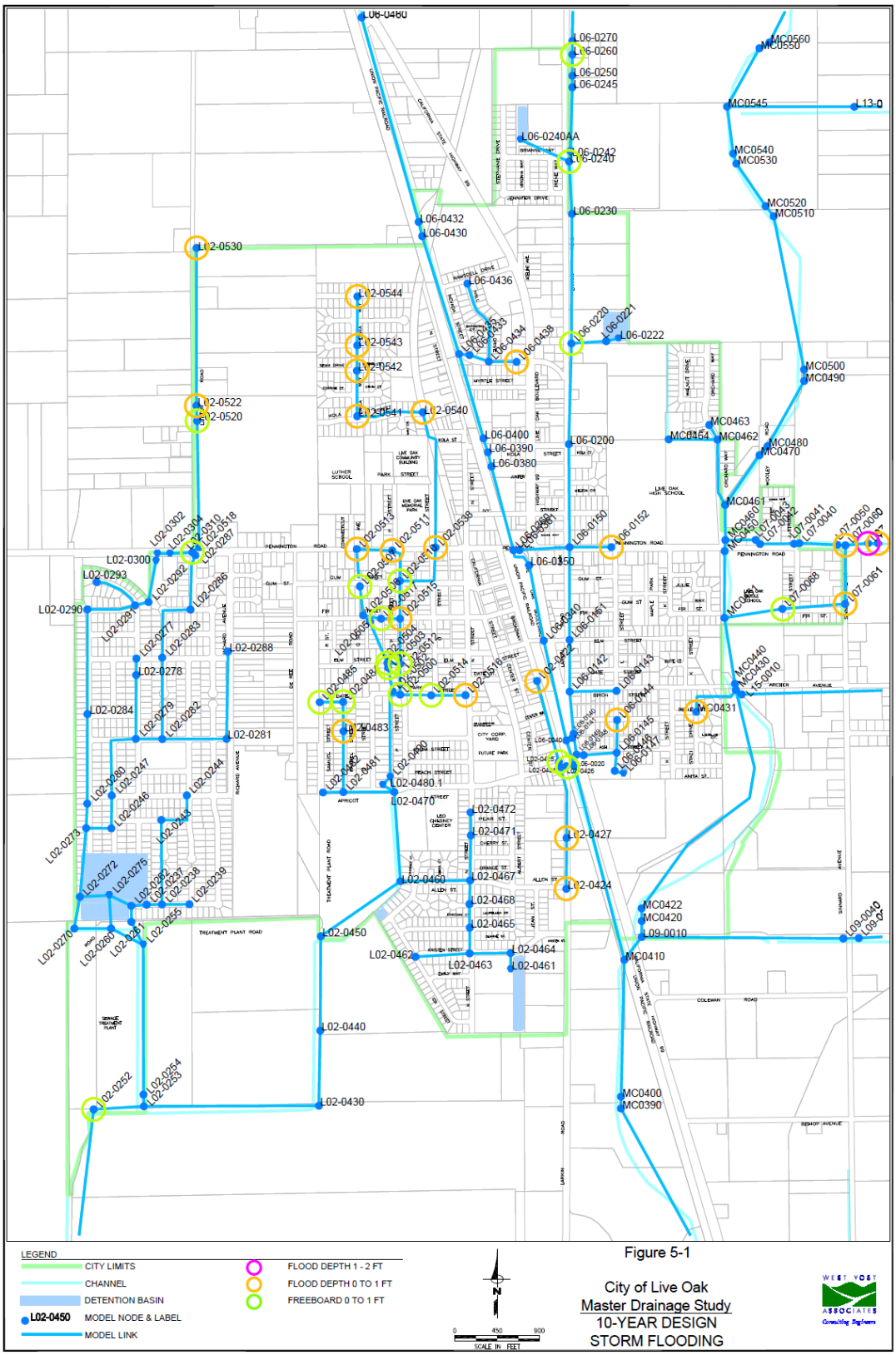
In the 2011 Live Oak Drainage Study, an analysis of existing drainage infrastructure was performed. The drainage criteria used in this evaluation are the following:

- **10-Year Storm** – Pipeline conveyance systems shall maintain the hydraulic grade line a minimum of 1-foot below the gutter line.
- **100-Year Storm –** Flow shall be conveyed or detained in the street section while maintaining a water surface at least 1-foot below the adjacent building pad elevations.

A schematic of the 10-year flooding is shown in Figure A-11. The following flooding problems appear to occur during the 10-year storm:

- Apricot Street Pump Station and tributary storm drains: Model results indicate that in the 10-year storm much of this pump station-storm drain system would flood up to a depth of 1-foot.
- Larkin Street Pump Station and tributary storm drains: Model results indicate that in the 10-year storm much of this pump station-storm drain system would have less than 1-foot of freeboard with flooding at drain inlets.
- J Street and Fir Street: Model results indicate that in the 10-year storm flooding along J Street, Fir Street, and Sinnard Avenue will occur at depths of up to 1-foot.

Figure A-11 City of Live Oak 10 year Localized Flooding Areas and Depths



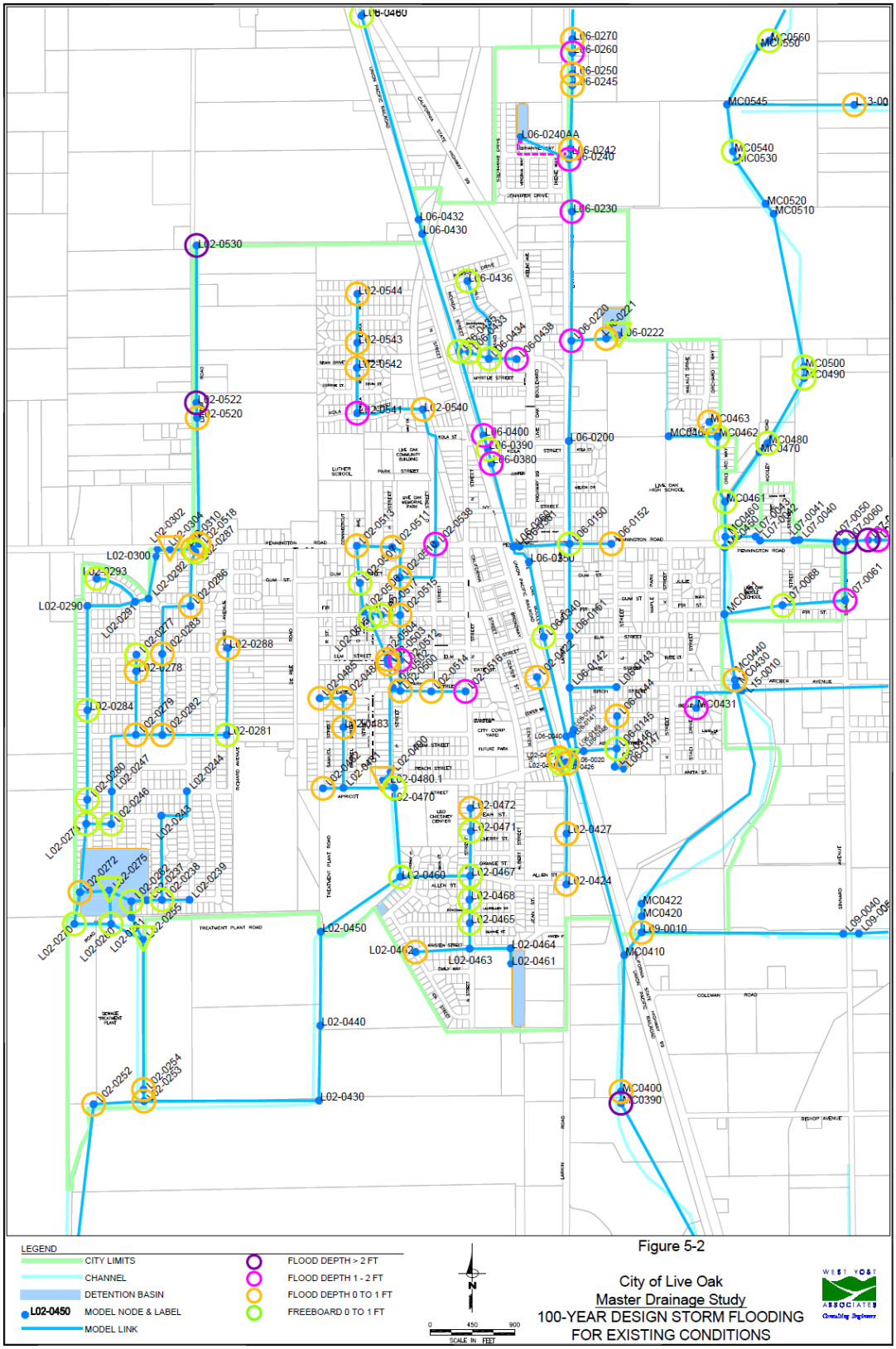
Source: 2011 Live Oak Drainage Study

A comparison of the modeled 100-year storm water surface elevation, ground elevation, invert elevation, and freeboard for each model node is shown in Figure A-12 using the same color scheme as for the 10-year storm. The elevations of the building pads were not available as part of the drainage study. As determined through field observation, the elevations of the homes along many of the flooded storm drain systems are not significantly above the ground surface at the drain inlets. However, many houses are built on raised foundations, so flooding depths of less than 1-foot may not actually enter the houses. Modeled flooding depths of over 2 feet would likely cause actual flood damage at the node where the flooding is reported or at nearby locations. Model results indicate that during the 100-year storm, much of the City would experience flooding problems with flooding depths of up to 1 foot being common. The following is a summary of areas where flooding has previously occurred and the model results indicate flooding would occur.

- De Ree Road – The observed flooding along De Ree Road occurs because the area does not have a storm drain system. This flooding may be exacerbated by flooding from the storm drain systems on Apricot and Date Streets. As shown in Figure A.12, the Apricot and Date Street storm drains near the De Ree Road area would flood up to 1-foot deep for the 100-year storm.
- Luther School - The Luther School area drains to the storm drain along Pennington Road at Connecticut Street. The model shows that this storm drain system would be flooded up to 1-foot deep during the 10-year and 100-year storms.
- L Street between Birch Street and Pennington Road – The observed flooding along much of L Street (between Date Street and Pennington Road) occurs because this area does not have a storm drain system. The model shows up to 1-foot of flooding during the 10-year storm at L Street and Pennington Road, and at Birch Street. Thus, inadequate capacity in the storm drains in this area would contribute the flooding between Pennington Road and Date Street. The model results show up to 1-foot of flooding in this area during the 100-year storm.
- J Street south of Pennington Road – This area lacks storm drains, which causes the observed flooding. The model results show that this area and the adjacent drains/roadside ditches would experience flooding up to 1-foot deep during the 10-year storm and over 2 feet deep during the 100-year storm. This area drains to a roadside ditch along Pennington Road that will be flooded during the 10-year and 100-year storms. This ditch's limited capacity will cause the Sinnard Street storm drain system to back up.
- Highway 99 - The observed flooding along Highway 99 occurs because there are only bubble-up systems crossing Highway 99 and several intersecting roads. No full storm drain systems serve the Highway 99 area. The model shows that the drain inlet at Nevada Street and Highway 99 would flood up to a depth of 1-foot for the 10- and 100-year storms. Lateral 6, located west of Highway 99, mostly has over 1-foot of freeboard in the 10-year storm. In the 100-year storm, the model results indicate that the Lateral 6 water levels range from under 1-foot of freeboard to flooding depths of over 1-foot.
- West of P Street from Pennington Road to Date, Gum, Fir, and Elm Streets – The observed flooding in this area is partially due to the use of a small ditch to drain storm water. The model shows that the Apricot Street Pump Station - tributary storm drain system (in this area) would experience less than 1-foot of flooding during the 10-year storm and over 1-foot of flooding in the 100-year storm at a few locations.
- Larkin Road Storm Drain – The City and RD 777 have expressed concern that the Larkin Road storm drain does not have adequate capacity from the City limits to the open ditch between Ash and Birch Street. The model shows that the Larkin Road storm drain system appears to convey 10-year storm flows. However, the 1-foot minimum freeboard requirement would not be met along the northern portion of the storm drain system in the 10-year storm. For the 100-year storm, the model shows that there would be up to 2 feet of flooding along the Larkin Street storm drain. Many of the culverts serving the Larkin Road roadside ditches are partially to fully plugged with sediment. These plugged culverts

reduce the flow reaching the Larkin Road storm drain. If the culverts were cleared, the model results would likely indicate significant flooding along the Larkin Road storm drain even in the 10-year storm.

Figure A-12 City of Live Oak 100 year Localized Flooding Areas and Depths



Source: 2011 Live Oak Drainage Study

The City of Live Oak is subject to localized flooding throughout the City. Flood extents are usually measured in areas affected, velocity of flooding, and depths of flooding. Expected flood depths in the City vary by location. Flood durations in the City tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Localized flooding in the City tends to have a shorter speed of onset, especially when antecedent rainfall has soaked the ground and reduced its capacity to absorb additional moisture.

Past Occurrences

The City noted the following past occurrences of localized flooding:

- Localized flooding occurs annually along Highway 99.
- In 2017, localized flooding occurred throughout the City. The City Planning Team noted an area of Larkin Road south of Brubaker Road where there was damaged. During the incident period January 3 and January 12, 2017, flooding and mud slides caused damage to a 185-FT long, 18-IN diameter section of corrugated metal pipe 110-FT long segment was washed out; and 75-FT long segment was clogged with vegetative debris). This caused flooding as water could not escape. The cost to replace the culvert was almost $21,000.

Vulnerability to and Impacts from Localized Flooding

Historically, much of the growth in the City and County has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff.

Primary concerns associated with stormwater flooding include impacts to infrastructure that provides a means of ingress and egress throughout the community. Ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Objects can also be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt services. Standing water can cause damage to crops, roads, and foundations. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Future Development

Future development in the City will add more impervious surfaces causing an increase in stormwater runoff and the continued need to drain these waters. The City will need to be proactive to ensure that increased development has proper siting and drainage for stormwaters. The risk of localized flooding to future development can also be minimized by accurate recordkeeping of repetitive localized storm activity. Mitigating the root causes of the localized stormwater flooding will reduce future risks of losses. The City has a track record of addressing localized flooding in the past, and will continue those efforts in the future.

Levee Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–High

Hazard Profile and Problem Description

THERE WAS A NOTE ON THIS TO REVISE BASED ON COMPLETION OF FEATHER RIVER WEST LEVEE PROJECT. With the addition of the new map Scott Rowles had no further comment. FOSTER MORRISON HAS NOT SEEN THIS MAP

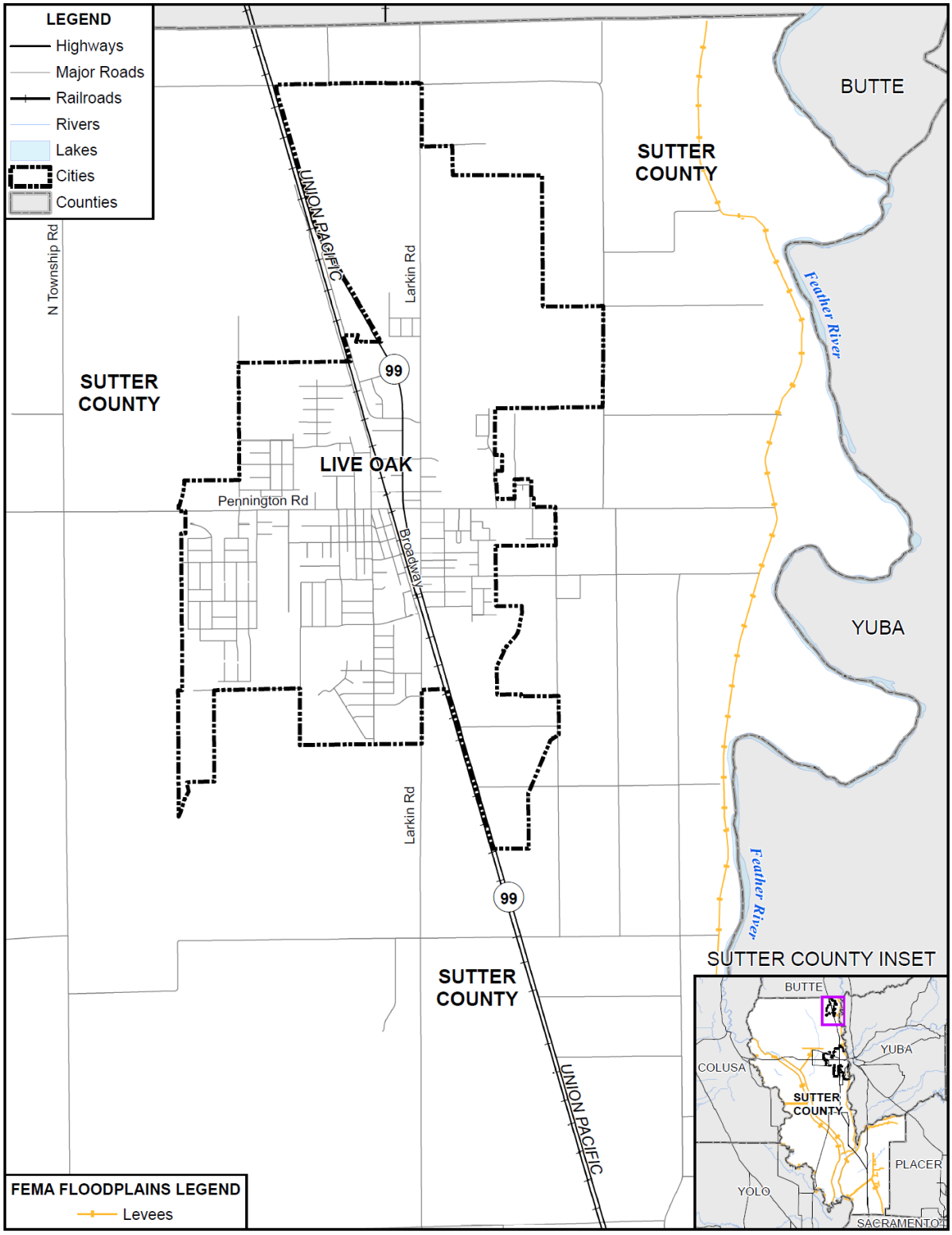
A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main channel of a stream. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% and 0.5% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

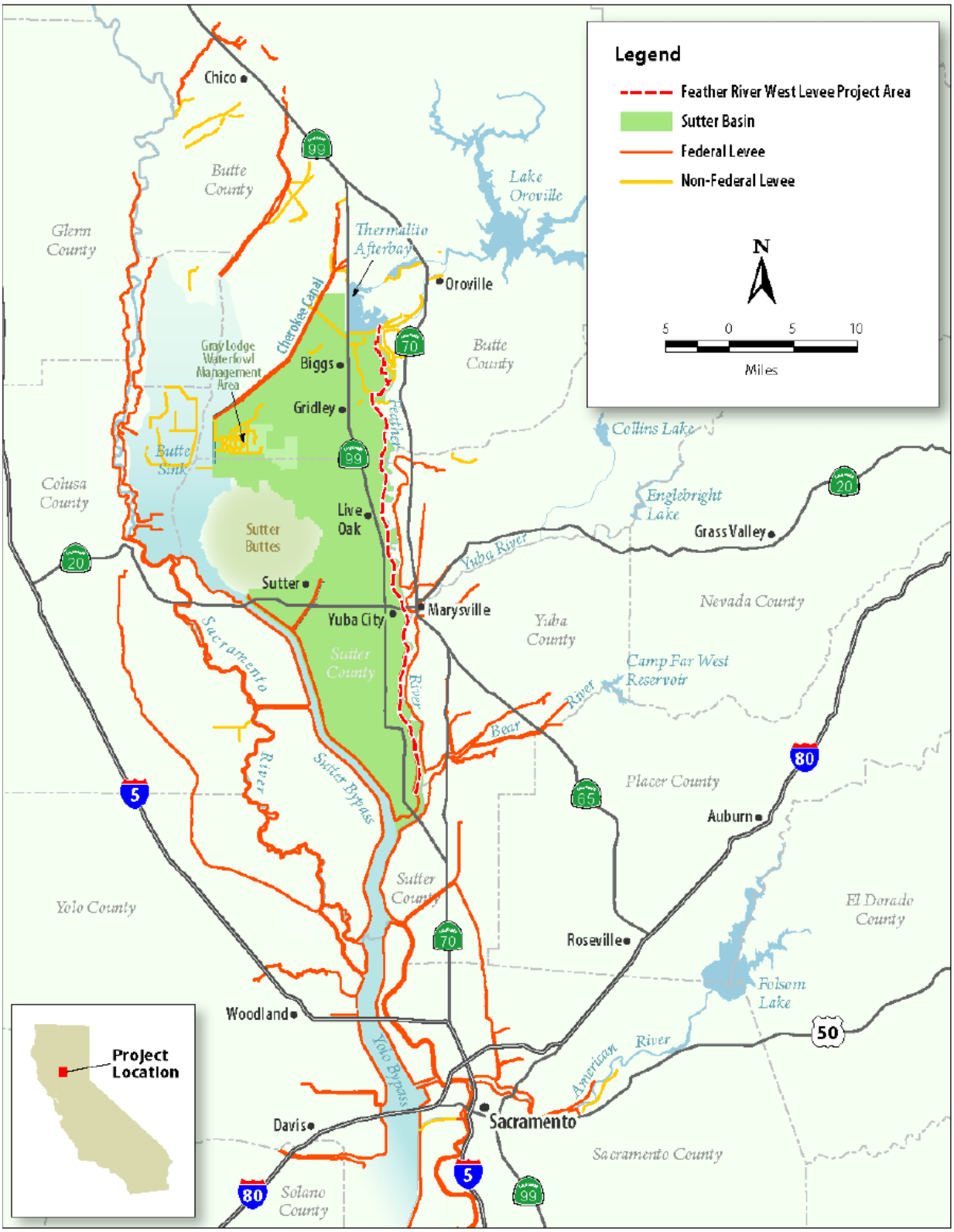
There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the City are not known. Levee locations in and around the City can be seen on Figure A-13. Levee locations in the region can be seen on Figure A-14.

Figure A-13 City of Live Oak – Levee Locations



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure A-14 City of Live Oak – Regional Levee Map



Source: Determination Of 1-In-200-Year Floodplain for the City of Yuba City Urban Level of Flood Protection Determination – MBK Engineers

The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. The HMPC noted that when northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees.

Past Occurrences

The City Planning Team noted no past occurrences of levee failures.

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

Overtopping of the Feather River levees is considered to be a significant local concern due to the general topography of the region. The Feather River, which forms the eastern border of the General Plan Study Area, consists of a large watershed that stretches to the Sierra Crest. The city's location in the lower portions of the watershed exposes the community to substantial risk from riverine flooding. Additionally riverine flooding can overwhelm the integrity of the local or regional levee system. Levee failure can result if water overtops a levee, if high river levels saturate the levee banks, or if the levee itself is structurally defective. Levee failure can occur very rapidly with little warning. Once a levee is breached, floodwaters can inundate large low-lying areas. Levee overtopping or failure could cause catastrophic flooding in the City.

In the analysis on levee failure, the Q3 data showed no levee protected areas in the City of Live Oak. Because of this, no analysis was performed for levee failure in the City. This is not to suggest that no risk exists. Although the Q3 maps show no X Protected by Levee Zones for the City, a Sutter Butte Flood Control Agency/PBI levee break scenario showed that the City would be inundated with two to four feet of water. It is important for these residents, as well as businesses that may fall in these areas, to have evacuation plan.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Future Development

Future development built in the areas protected by levees is subject to being built to the standards in the City of Live Oak Floodplain Ordinance. Whether a levee is certified as providing protection from the 1% or 0.5% annual chance flood will also factor into development requirements. Future development in levee protected areas may be affected by this hazard, thus there will always be some level of concern. The City

noted that with the upgrading on the levees by SBFCA, impacts to the City should be more limited in the future.

Pandemic

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity. It is important to realize that this LHMP Update does not examine pandemic contingency plans, but instead focuses on examining the risk of a normal hazard occurrence.

A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the WHO to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning and preparation. An especially severe a pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the City, County, and surrounding region is at risk, as pandemic is a regional, national, or international event. The speed of onset of pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by number who die from complications from the pandemic.

Past Occurrences

There has been one state and federal disaster declaration due to pandemic, as shown in Table A-30.

Table A-30 Sutter County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

The 20th century saw three outbreaks of a pandemic:

- The 1918-1919 Influenza Pandemic (H1N1)
- The February 1957-1958 Influenza Pandemic (H2N2)

- The 1968 Influenza Pandemic (H3N2)

To date, the 21st century has seen two acknowledged pandemics:

- 2009 Swine Flu (H1N1)
- 2019/2020 COVID 19

Vulnerability to and Impacts from Pandemic

Pandemic has and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public health officials can use to combat pandemic flu. Constant surveillance regarding current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent spread of pandemic flu by staying home, or "self-quarantining," if they suspect they are infected. Pandemic does not affect the buildings, critical facilities, and infrastructure in the City. Pandemic can have varying levels of impact to the citizens of the City and greater County, depending on the nature of the pandemic.

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently) an unemployment rose significantly. Numerous infections and deaths from Covid-19 have and are continuing to occur in the City, County, and all of California. Supply chains for food and essential supplies can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Future Development

Future development is not expected to be significantly impacted by this hazard, though population growth in the City could increase exposure to pandemic flu, and increase the ability of each disease to be transmitted among the population of the City. If the median age of City residents continues to increase, vulnerability to pandemic diseases may increase, due to the fact that these diseases are often more deadly to senior citizens.

Severe Weather: Extreme Heat

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

According to FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and lasts for several weeks. Heat kills by taxing the human body beyond its abilities. In extreme heat and high humidity, evaporation is slowed, and the body must work extra hard to maintain a normal temperature." Most heat disorders occur because the victim has been

overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat.

In addition to the risks faced by citizens of the City, there are risk to the built environment from extreme heat. While extreme heat on its own does not usually affect structures, extreme heat during times of drought can cause wildfire risk to heighten. Extreme heat and high winds can cause Public Safety Power Shutdown (PSPS) events, creating significant issues in the City. However, PSPS events in the City have been declining with PG&E's refined system for shutting power off in high wildfire risk areas.

Location and Extent

Heat is a regional phenomenon and affects the whole of the City. Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly affect vulnerable populations and communities. Heat waves do not generally cause damage or elicit the immediate response of floods, fires, earthquakes, or other more "typical" disaster scenarios.

The NWS has in place a system to initiate alert procedures (advisories or warnings) when extreme heat is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. The NWS HeatRisk forecast provides a quick view of heat risk potential over the upcoming seven days. The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. This can be seen in Section 4.2.2 of the Base Plan.

Past Occurrences

The City Planning Team noted that since extreme heat is a regional phenomenon, events that affected the County also affected the City. Those past occurrences were shown in the Base Plan in Section 4.2.2.

Vulnerability to Extreme Heat

The City experiences temperatures in excess of 100°F during the summer and fall months. The temperature moves to 105-115°F in rather extreme situations. During these times, drought conditions may worsen and the City may see an increase in dry fuels. Also, PSPS events may occur during these times as well. Health issues are the primary concern with this hazard, although economic impacts can also be an issue.

Impacts

The elderly and individuals below the poverty level are the most vulnerable to extreme temperatures. Nursing homes and elder care facilities are especially vulnerable to extreme heat events if power outages occur and air conditioning is not available. In addition, individuals below the poverty level may be at increased risk to extreme heat if use of air conditioning is not affordable. This is especially true of homeless people and the transient population.

Days of extreme heat have been known to result in medical emergencies, and unpredictable human behavior. Periods of extended heat and dryness (droughts) can have major economic, agricultural, and

water resources impacts. Extreme heat can also dry out vegetations, making it more vulnerable to wildfire ignitions.

Future Development

Future development of new buildings in the City will likely not be affected by extreme heat. Extreme heat is more likely to affect vulnerable populations. Vulnerability to extreme heat will increase as the average age of the population in each City shifts. It is encouraged that nursing homes and elder care facilities have emergency plans or backup power to address power failure during times of extreme heat and in the event of a PSPS. Low income residents and homeless populations are also vulnerable. Cooling centers for these populations should be utilized when necessary.

Wildfire

Likelihood of Future Occurrence–Unlikely
Vulnerability–Low

Although considered a low significance hazard by the HMPC, due to the significance of wildfire in the State of California, earthquake vulnerability for the City of Live Oak is detailed here.

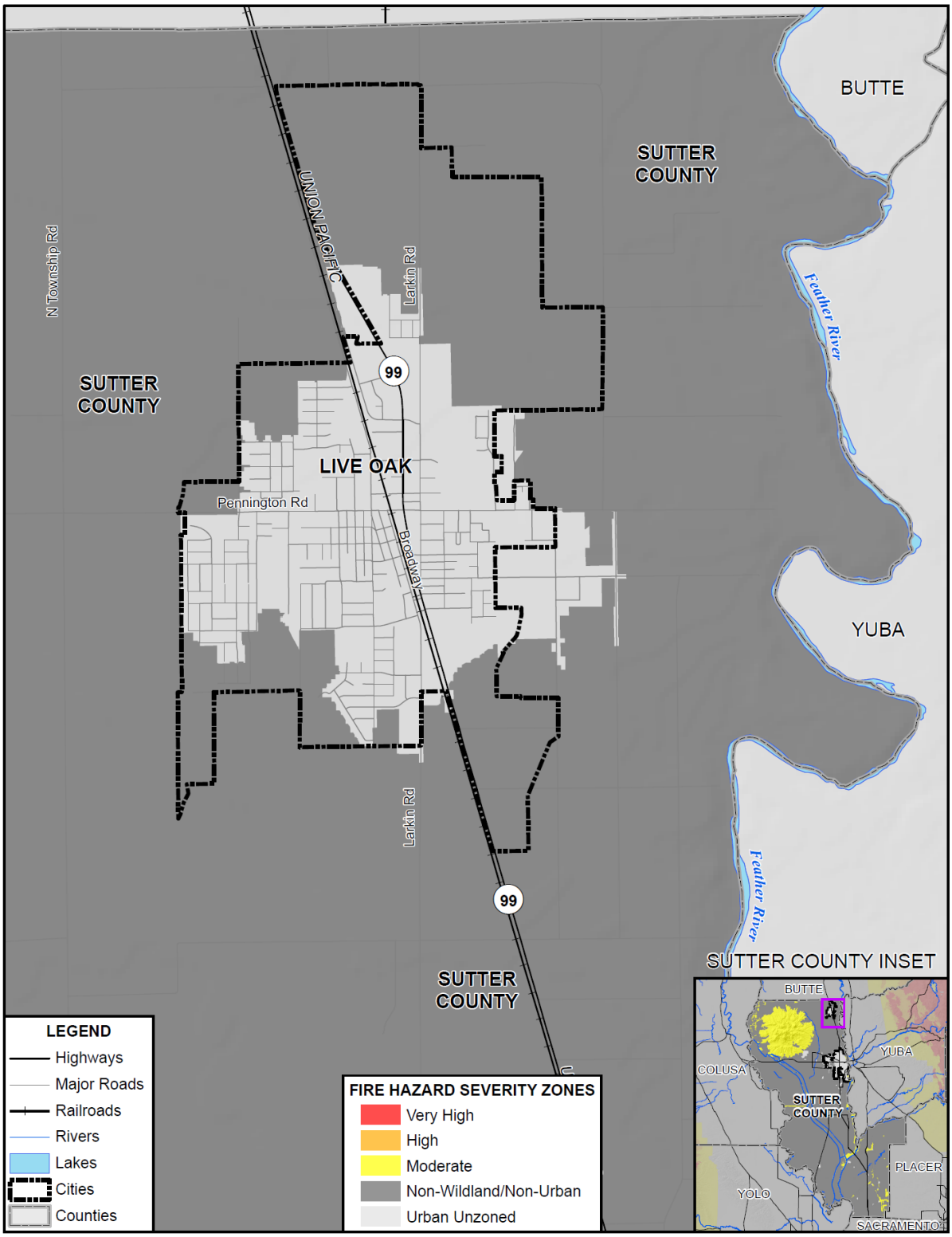
Hazard Profile and Problem Description

Wildland fire and the risk of a conflagration is a minor concern for the City of Live Oak. Throughout California, communities are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire control practices have affected the natural cycle of the ecosystem. Though rare in the City, fire conditions arise from a combination of high temperatures, low moisture content in the air and fuel, accumulation of vegetation, and high winds. These high winds can result in red flag days, and can result in PSPS events in the City.

Location and Extent

Wildfire can affect all areas of the City. CAL FIRE has estimated that the risk varies across the City and has created maps showing risk variance. Following the methodology described in Section 4.3.16 of the Base Plan, wildfire maps for the City of Live Oak were created. Figure A-15 shows the CAL FIRE FHSZ in the City. As shown on the maps, fire hazard severity zones within the City are the Non-Wildland/Non-Urban and Urban Unzoned.

Figure A-15 City of Live Oak – Fire Hazard Severity Zones



Data Source: CAL FIRE (Draft 9/2007 - c51fhszl06_1), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Wildfires tend to be measured in structure damages, injuries, and loss of life as well as on acres burned. Fires can have a quick speed of onset, especially during periods of drought or during hot dry summer months. Fires can burn for a short period of time, or may have durations lasting for a week or more. Geographical FHSZ extent from CAL FIRE is shown in Table A-31.

Table A-31 City of Live Oak – Geographical FHSZ Extents

Fire Hazard Severity Zones	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Very High	0	0.00%	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%	0	0.00%
Moderate	0	0.00%	0	0.00%	0	0.00%
Non-Wildland/Non-Urban	1,006	55.7%	429	40.9%	577	76.3%
Urban Unzoned	799	44.3%	620	59.1%	179	23.7%
Total	**1,805**	**100.0%**	**1,048**	**100.0%**	**757**	**100.0%**

Source: CAL FIRE

Past Occurrences

There have been no federal or state disaster declarations from wildfire.

Vulnerability to and Impacts from Wildfire

Fuel loads in the County and cities, along with geographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. The City is not immune from fire. The dry vegetation and hot and sometimes windy weather results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire. As development continues throughout the County and City, the risk and vulnerability to wildfires will likely increase.

Live Oak is not immune to numerous types of grass and brush fires and any one of them may accelerate into an urban interface wildfire. Such a situation could lead to evacuation of large portions of the population and the potential for significant loss of personal property, structures, and rangeland. The natural fuels available in or near the City vary greatly in the rate and intensity of burning. Fires in heavy brush and stands of trees burn with great intensity but more slowly than in dry grass and leaves.

Potential impacts from wildfire include loss of life and injuries; damage to structures and other improvements, natural and cultural resources, croplands, and timber; and loss of recreational opportunities. Wildfires can cause short-term and long-term disruption to the City. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the City by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading

water quality. Fires can also affect air quality in the City; smoke and air pollution from wildfires can be a severe health hazard.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Schools and businesses can be forced to close for extended periods of time. Recently, the threat of wildfire, combined with the potential for high winds, heat, and low humidity, has caused PG&E to initiate a PSPS which can also significantly impact a community through loss of services, business closures, and other impacts associated with loss of power for an extended period. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides, and erosion during the rainy season.

Based on the vulnerability of the City of Live Oak to the wildfire hazard, the sections that follow describes significant assets at risk in the City.

Assets at Risk

Based on the vulnerability of Live Oak to the wildfire hazard, the sections that follow describes significant assets at risk in the City of Live Oak. This section includes the values at risk, population at risk, and critical facilities at risk.

Values at Risk

GIS was used to determine the possible impacts of wildfire within the City of Live Oak. The methodology described in Section 4.3.18 of the Base Plan was followed in determining structures and values at risk in fire hazard severity zones. Summary analysis results for Live Oak are shown in Table A-32, which summarizes total parcel counts, improved parcel counts and their structure values by fire hazard severity zone.

Table A-32 City of Live Oak – Count and Value of Parcels by Fire Hazard Severity Zone

Fire Hazard Severity Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Non-Wildland/Non-Urban	163	105	$22,118,421	$34,259,855	$18,774,049	$75,152,325
Urban Unzoned	2,673	2,229	$106,938,401	$342,248,100	$206,990,509	$656,177,010
City of Live Oak Total	**2,836**	**2,334**	**$129,056,822**	**$376,507,955**	**$225,764,558**	**$731,329,335**

Source: Sutter County 12/31/2018 Parcel/Assessor's Data, CAL FIRE

Table A-33 breaks out the Table A-32 by adding the property use details by fire hazard severity zone for the City. As shown in both of these tables, the City has no properties in the very high or high fire hazard

severity zones. All of the City falls within the non-wildland/non-urban and urban unzoned fire hazard severity zones.

Table A-33 City of Live Oak – Count and Value of Parcels by Fire Hazard Severity Zone and Property Use

Fire Hazard Severity Zone/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Non-Wildland/Non-Urban						
Agricultural	46	21	$13,413,510	$2,674,243	$2,674,243	$18,761,996
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	9	2	$764,831	$614,000	$614,000	$1,992,831
Miscellaneous	0	0	$0	$0	$0	$0
Residential	90	82	$5,714,941	$30,971,612	$15,485,806	$52,172,359
Vacant	18	0	$2,225,139	$0	$0	$2,225,139
Non-Wildland/Non-Urban Total	**163**	**105**	**$22,118,421**	**$34,259,855**	**$18,774,049**	**$75,152,325**
Urban Unzoned						
Agricultural	27	11	$1,650,556	$900,806	$900,806	$3,452,168
Commercial	88	64	$8,153,949	$23,233,608	$23,233,608	$54,621,165
Industrial	10	9	$2,283,276	$8,301,026	$12,451,539	$23,035,841
Institutional	76	39	$2,251,679	$30,996,452	$30,996,452	$64,244,583
Miscellaneous	81	0	$0	$0	$0	$0
Residential	2,151	2,106	$85,538,358	$278,816,208	$139,408,104	$503,762,670
Vacant	240	0	$7,060,583	$0	$0	$7,060,583
Urban Unzoned Total	**2,673**	**2,229**	**$106,938,401**	**$342,248,100**	**$206,990,509**	**$656,177,010**
City of Live Oak Total	**2,836**	**2,334**	**$129,056,822**	**$376,507,955**	**$225,764,558**	**$731,329,335**

Source: Sutter County 12/31/2018 Parcel/Assessor's Data, CAL FIRE

Population at Risk

The FHSZ dataset was overlayed on the parcel layer. Those residential parcel centroids that intersect the FHSZs were counted and multiplied by the 2010 Census Bureau average household factors for the City of Live Oak – 2.45. According to this analysis, there is a total population of 0 residents of Live Oak at risk to moderate or higher FHSZs. This is shown in Table A-34.

Table A-34 City of Live Oak – Count of Improved Residential Parcels and Population by Fire Hazard Severity Zone

Jurisdiction	Moderate		High		Very High	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Live Oak	0	0	0	0	0	0

Source: Sutter County 12/31/2018 Parcel/Assessor's Data, CAL FIRE

Critical Facilities at Risk

An analysis was performed on the critical facility inventory in Live Oak in identified FHSZs. All critical facilities in the City fall outside of moderate or higher FHSZs; as such, no maps or tabular analysis are displayed here. Details of critical facility definition, type, name and address and jurisdiction by fire hazard severity zone are listed in Appendix F.

Future Development

Additional growth and development within moderate or higher fire hazard severity zones in the City would place additional values at risk to wildfire. City building codes are in effect and should continue to be updated as appropriate to reduce this risk.

GIS Analysis

All future development in the City fall outside of moderate or higher FHSZs; as such, no maps or tabular analysis are displayed here.

A.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

A.6.1. Regulatory Mitigation Capabilities

Table A-35 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Live Oak. FINISH TABLE. TRY TO FILL OUT THE LAST COLUMN AS YOU ARE ABLE. MAKE SURE TO FILL OUT THE LAST CELL.

Table A-35 City of Live Oak Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan	Y 2010	Plan identifies hazards, has a mitigation strategy, and can be used to implement mitigation actions.
Capital Improvements Plan	Y 2020	
Economic Development Plan	Y DATE	
Local Emergency Operations Plan	Y 2015	
Continuity of Operations Plan		
Transportation Plan		
Stormwater Management Plan/Program	N	
Engineering Studies for Streams	Y	Through SBFCA
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)		
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	Y	Version/Year: CBC 2019
Building Code Effectiveness Grading Schedule (BCEGS) Score	Y	Score: INSERT
Fire department ISO rating:	Y	Rating: INSERT
Site plan review requirements	Y	
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	Y	
Subdivision ordinance	Y	
Floodplain ordinance	Y	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)		
Flood insurance rate maps	Y	
Elevation Certificates	Y	
Acquisition of land for open space and public recreation uses		
Erosion or sediment control program	Y	Stormwater management programs has measures for reducing impacts.
Other		
How can these capabilities be expanded and improved to reduce risk?		

PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE CITY

Source: City of Live Oak

City of Live Oak General Plan (2010)

The City of Live Oak General Plan Program serves as the blueprint for future growth and development and provides comprehensive planning for the future. It encompasses what the City is now, and what it intends to be, and provides the overall framework of how to achieve this future condition (see the discussion in Section 4.3.1 Growth and Development Trends).

California Law requires that every City and County in the state have a General Plan. The 2030 City of Live Oak General Plan, adopted in 2010, included an extensive public review process. The General Plan is the most important policy and planning document in the city, and is used by virtually every department. The General Plan is the City's statement of its vision for the future. The General Plan contains policies covering every aspect of the City: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

Goals and policies related to mitigation of natural hazards are as follows:

- Goal: Design buildings to prevent property damage and injury from hazards.
  - ✓ Policy All new buildings in the City shall be built under the seismic requirements of the California Building Code.
  - ✓ Policy The City will encourage the retrofitting of older buildings to current safety standards, as specified in locally applicable fire and building codes.
  - ✓ Policy New development shall ensure adequate water flow for fire suppression as required by City Public Works Improvement Standards.

- Goal: Minimize the loss of life and damage to property caused by flood events.
  - ✓ Policy The City will coordinate with the Sutter Butte Flood Control Agency to ensure that flood control facilities protecting Live Oak's Planning Area from flood risks to the City are well maintained and capable of protecting existing and proposed structures from flooding, in accordance with state law.
  - ✓ Policy The City will regulate development within floodplains according to state and federal requirements to minimize human and environmental risks and maintain the City's eligibility under the National Flood Insurance Program.
  - ✓ Policy The City will require evaluation of potential flood hazards before approving development projects.
  - ✓ Policy The City will require applicants for development to submit drainage studies that adhere to City stormwater design requirements and incorporate measures from the City's master drainage plan to prevent on- or off-site flooding.
  - ✓ Policy New development shall be required to be consistent with regional flood control improvement efforts. New development shall contribute on a fair-share basis to regional solutions to improve flood protection to meet state and federal standards.
  - ✓ Policy The City will use the most current flood hazard and floodplain information from state and federal agencies (such as the State Department of Water Resources, the Federal Emergency

Management Agency, and the Army Corps of Engineers) as a basis for project review and to guide development in accordance with federal and state regulations.

✓ Policy As feasible, new development should incorporate stormwater treatment practices that allow percolation to the underlying aquifer and minimize off-site surface runoff (and therefore flooding).

Master Drainage Study (2011)

Significant development has occurred within the City over the last few years, and additional growth of the City is anticipated in the City's revised General Plan, particularly in/around the southwest, northwest, and northeast quadrants of the City. A critical element in planning for the City's new growth is determining infrastructure needs and funding mechanisms to pay for the required infrastructure. Development of agricultural lands results in constructing buildings and pavement, which greatly increases the runoff rate and total volume of runoff. Consequently, new drainage facilities, including storm drain collection systems, open channels, detention basins, and pump stations, are needed to manage the increased runoff and to prevent flooding. The purposes of the MDS are to:

- Identify the drainage/flood control improvements needed to address existing drainage problems,
- Recommend drainage/flood control facilities needed to allow build out of the City's revised General Plan without causing drainage/flooding impacts within the City or to the existing agricultural areas upstream or downstream of the City, and
- Identify the capital and operations and maintenance (O&M) costs of the recommended drainage/flood control facilities.

A.6.2. Administrative/Technical Mitigation Capabilities

Table A-36 identifies the City department(s) responsible for activities related to mitigation and loss prevention in Live Oak. MAKE SURE TO FILL OUT THE LAST CELL

Table A-36 City of Live Oak's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	Y	
Mitigation Planning Committee	Y	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	
Mutual aid agreements	Y	Agreements with Sutter County Sheriff and Fire Departments???
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Y FT	
Floodplain Administrator	Y FT	

Emergency Manager	Y PT	
Community Planner	Y FT	
Civil Engineer	Y	Contracted
GIS Coordinator	Y	Contracted through Sutter County
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	Y	
Hazard data and information	Y	
Grant writing	Y	
Hazus analysis	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE CITY		

Source: City of Live Oak

A.6.3. Fiscal Mitigation Capabilities

Table A-37 identifies financial tools or resources that the City could potentially use to help fund mitigation activities. MAKE SURE TO FILL OUT THE LAST CELL

Table A-37 City of Live Oak's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	
Authority to levy taxes for specific purposes	Y	
Fees for water, sewer, gas, or electric services	Y	
Impact fees for new development	Y	AB 1600
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	N	
Incur debt through private activities	N	
Community Development Block Grant	Y	
Other federal funding programs	Y	
State funding programs	Y	
Other		

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE CITY		

Source: City of Live Oak

A.6.4. Mitigation Education, Outreach, and Partnerships

Table A-38 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information. MAKE SURE TO FILL LAST CELL.

Table A-38 City of Live Oak's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	AFN Working Group
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	
Natural disaster or safety related school programs	Y	
StormReady certification	Y	Sutter County is a Storm Ready County
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE CITY		

Source: City of Live Oak

A.6.5. Other Mitigation Efforts

The City has many other completed or ongoing mitigation projects/efforts that include the following:

PROVIDE LIST OF OTHER PROJECTS/EFFORTS BY HAZARD

A.7 Mitigation Strategy

A.7.1. Mitigation Goals and Objectives

The City of Live Oak adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

A.7.2. NFIP Mitigation Strategy

The City of Live Oak joined the National Flood Insurance Program (NFIP) on March 23, 1984. As a participant of the NFIP, the City of Live Oak has administered floodplain management regulations that meet the minimum requirements of the NFIP. The management program objective is to protect people and property within the City. The City of Live Oak will continue to comply with the requirements of the NFIP in the future.

In addition, the City of Live Oak actively participates with Sutter County to address local NFIP issues through a regional approach. Many of the program activities are the same for the City of Live Oak as for Sutter County since participation at the County level includes all local jurisdictions.

The City of Live Oak Planning and Engineering Department provides public outreach activities which include map information services, public awareness, public hazard disclosure, and flood protection information. This information is readily available to the public and consists of current and accurate flood mapping. In addition, the Planning and Engineering Department provides information about our stormwater management program and up-to-date information related to the maintenance of our drainage system.

The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS which are to reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood insurance. The City of Live Oak is currently a participating community in the CRS as a Class 10 community, which gives a 15% discount to flood insurance policies in the Special Flood Hazard Area (SFHA), and a 5% discount to those outside of the SFHA.

More information about the floodplain administration in the City of Live Oak can be found in Table A-39.

Table A-39 City of Live Oak Compliance with NFIP

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	1,309 policies $639,405 in premiums $436,514,200 in coverage

NFIP Topic	Comments
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	21 paid losses $15,570.82 in paid losses 0 substantial damage claims
How many structures are exposed to flood risk within the community?	0 in 1% annual chance floodplain (removed with 2014 LOMR) 0 in 0.2% annual chance floodplain
Repetitive Loss (RL) and Severe Repetitive Loss Properties (SRL)	0 RL properties 0 SRL properties
Describe any areas of flood risk with limited NFIP policy coverage	
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	
What are the barriers to running an effective NFIP program in the community, if any?	
Compliance History	
Is the community in good standing with the NFIP?	Y
Are there any outstanding compliance issues (i.e., current violations)?	N
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	5/18/2006 (CAV) 3/7/1990 (CAC)
Is a CAV or CAC scheduled or needed?	
Regulation	
When did the community enter the NFIP?	3/23/1984
Are the FIRMs digital or paper?	Digital
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	
Provide an explanation of the permitting process.	
Community Rating System	
Does the community participate in CRS?	Y
What is the community's CRS Class Ranking?	10
What categories and activities provide CRS points and how can the class be improved?	
Does the plan include CRS planning requirements?	Y

A.7.3. Mitigation Actions

The planning team for the City of Live Oak identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Climate Change
- Dam Failure
- Drought & Water Shortage
- Floods: 1%/0.5%/0.2% annual chance
- Floods: Localized Stormwater
- Levee Failure
- Pandemic
- Severe Weather: Heavy Rain and Storms

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement. NEED ACTIONS

Multi-Hazard Actions

Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan

Hazards Addressed: Multi-hazard (INSERT LIST)

Goals Addressed: 1, 2, 3, 4, 5, 6, 7, 8, 9

Issue/Background: Local jurisdictional reimbursement for mitigation projects and cost recovery after a disaster is guided by Government Code Section 8685.9 (AB 2140). Specifically, this section requires that each jurisdiction adopt a local hazard mitigation plan (LHMP) in accordance with the federal Disaster Mitigation Act of 2000 as part of the Safety Element of its General Plan. Adoption of the LHMP into the Safety Element of the General Plan may be by reference or incorporation.

Other Alternatives: No action

Existing Planning Mechanisms through which Action will be Implemented: Safety Element of General Plan

Responsible Office: City of Live Oak Planning Department

Priority (H, M, L): High

Cost Estimate: Jurisdictional board/staff time

Potential Funding: Local budgets

Benefits (avoided Losses): Incorporation of an adopted LHMP into the Safety Element of the General Plan will help jurisdictions maximize the cost recovery potential following a disaster.

Schedule: As soon as possible

Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness

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Hazards Addressed: Multi-hazard (INSERT LIST)

Goals Addressed: 1, 2, 3, 4, 5, 6, 7, 8, 9

Issue/Background: The City and County play a key role in public outreach/education efforts to communicate the potential risk and vulnerability of their community to the effects of natural hazards. A comprehensive multi-hazard public education program will better inform the community of natural hazards of concern and actions the public can take to be better prepared for the next natural disaster event.

Project Description: A comprehensive multi-hazard outreach program will ascertain both broad and targeted educational needs throughout the community. The City will work with the County and other agencies as appropriate to develop timely and consistent annual outreach messages in order to communicate the risk and vulnerability of natural hazards of concern to the community. This includes measures the public can take to be better prepared and to reduce the damages and other impacts from a hazard event. The public outreach effort will leverage and build upon existing mechanisms, will include elements to meet the objectives of Goal 3 of this LHMP Update, and will consider:

- Using a variety of information outlets, including websites, local radio stations, news media, schools, and local, public sponsored events;
- Creating and distributing (where applicable) brochures, leaflets, water bill inserts, websites, and public service announcements;
- Displaying public outreach information in County office buildings, libraries, and other public places and events;
- Developing public-private partnerships and incentives to support public education activities.

Location of Project: Citywide

Other Alternatives: Continue public information activities currently in place.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Existing County outreach programs will be reviewed for effectiveness and leveraged and expanded upon to reach the broader region.

Responsible Office: City of Live Oak in partnership with the County

Participating Jurisdictions: County and all cities.

Priority (H, M, L): High

Cost Estimate: Annual costs to be determined, and will depend on the scope and frequency of activities and events as well as volunteer participation

Benefits (Losses Avoided): Increase residents' knowledge of potential hazards and activities required to mitigate hazards and be better prepared. Protect lives and reduce damages, relatively low cost to implement.

Potential Funding: Local budgets, grant funds

Timeline: Ongoing/Annual public awareness campaign

New actions

Drought currently working through SIGMA process of working on a groundwater sustainability plan with County and Yuba City assess how vulnerable the entire sub basin is to drought with recommended projects. 5 year update cycle

Wildfire (John Shalowitz)

Annex B City of Yuba City

B.1 Introduction

This Annex details the hazard mitigation planning elements specific to the City of Yuba City, a previously participating jurisdiction to the 2013 Sutter County Local Hazard Mitigation Plan (LHMP) Update. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the City. This Annex provides additional information specific to Yuba City, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

B.2 Planning Process

As described above, Yuba City followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the City formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table B-1. Additional details on Plan participation and City representatives are included in Appendix A.

Table B-1 City of Yuba City – Planning Team

Name	Position/Title	How Participated
Bill Fuller	Fire Department/Administrative Analyst III	Leader in developing and integrating 2013 LHMP measures into City policies and programs. Contributed to plan implementation in areas of emergency services, CRS integration.
Diana Langley	Interim City Manager/Public Works Director	Integrated 2013 LHMP mitigation measures and goals into policies and programs under the Public Works Department. Contributed to plan preparation in areas of community land use, comprehensive planning, CRS integration
Ben Moody	Deputy Public Works Director, Development Services Director	Developed and oversaw projects that supported goals and implementation strategies.
Mike Campos	Chief Building Official, Building Inspector, Plans Examiner	Developed building department policies and enforced building code compliance. Implemented water-efficient landscape ordinance.
Fire Department	Staff	Public outreach and education. Developed flyers and website information for public disaster preparation and recovery.
Development Services	Staff	Contributed to plan preparation in areas of community land use, comprehensive planning, CRS integration
Community Services	Staff	Developed and implemented Feather River habitat restoration projects.

Name	Position/Title	How Participated
Public Works Department	Engineering Staff	Lead in developing projects, obtaining funding, and implementing projects identified as mitigation measures in 2013 LHMP. Key role in construction of Fifth Street Bridge.
Wastewater Treatment Facility	Staff	Developed Capital Improvement Program and other elements of Wastewater System Master Plan
Water Treatment Plant	Staff	Developed Capital Improvement Program and other elements of Water System Master Plan

Coordination with other community planning efforts is paramount to the successful implementation of this LHMP Update. This section provides information on how the City integrated the previously approved 2013 Plan into existing planning mechanisms and programs. Specifically, the City incorporated into or implemented the 2013 LHMP through other plans and programs shown in Table B-2.

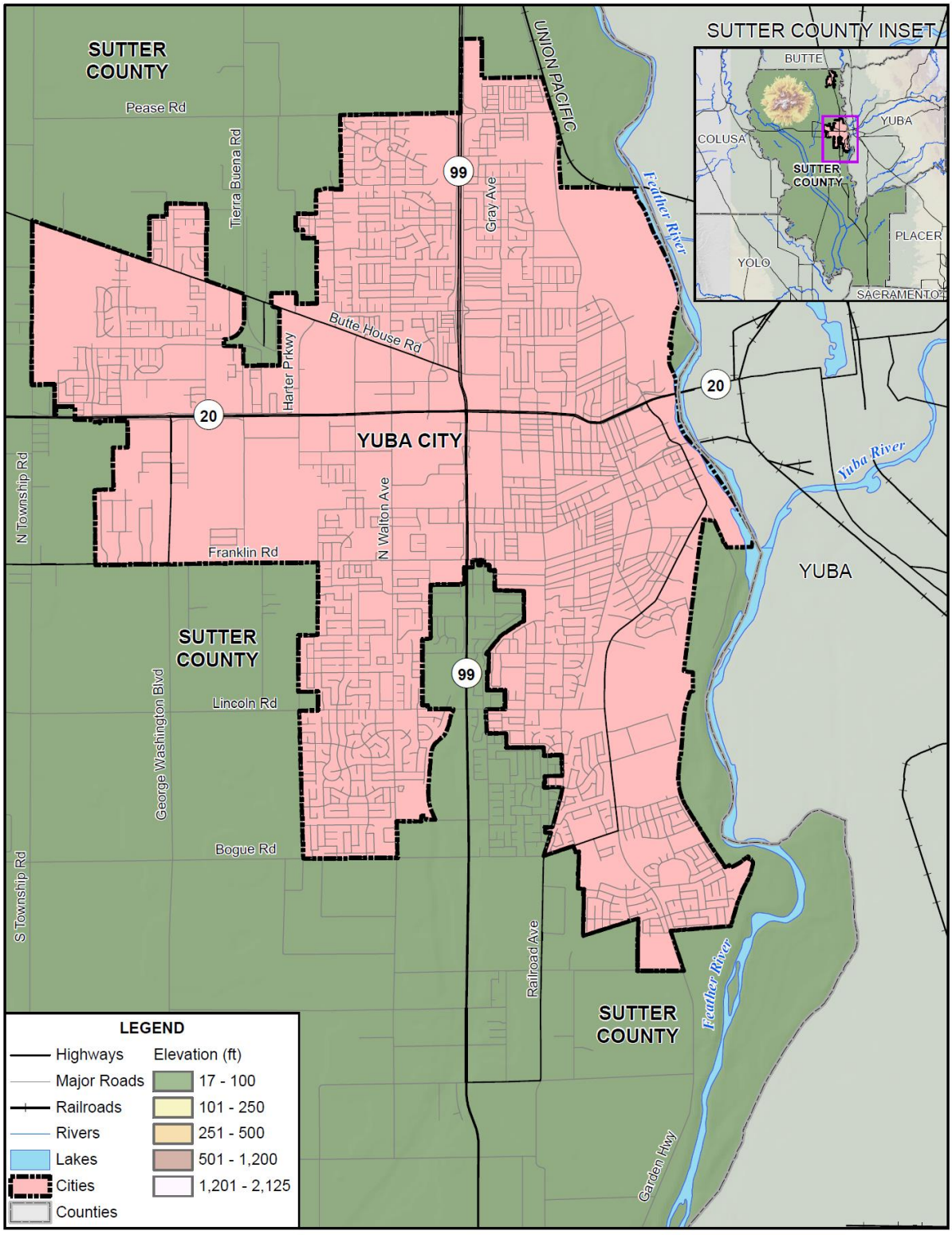
Table B-2 2013 LHMP Incorporation

Planning Mechanism 2013 LHMP Was Incorporated/Implemented In.	Details: How was it incorporated?
WWTF Master Plan 2020	The 2020 Wastewater Treatment Facility and Collection System Master Plan includes projects to improve system resiliency, such as installing backup power generators at sewer lift stations, manhole and pipe restoration to reduce inflow and infiltration, and replacing backup generators at the plant. The capital improvement program provides the mechanism for funding projects needed to improve the dependability of the City's wastewater collection and treatment processes.
Water Master Plan 2019	The 2019 Water Master Plan addresses emergency water supply planning, evaluates the condition of water infrastructure, and addresses resiliency. The capital improvement program provides the mechanism for selecting and funding projects needed to improve the dependability of the City's water supply, treatment, and distribution systems.
Yuba City Basin Storm Water Resource Plan 2018	The 2018 Storm Water Resource Plan includes projects designed to improve stormwater detention basins and therefore reduce erosion and sediment transport to waterways. The plan also calls for trash capture projects in stormwater conveyances, increasing treatment of runoff and protecting the environment.
General Plan, Housing Element Update. 2014	The Housing Element update included consideration of flood management among the environmental constraints requiring appropriate residential design.
Feather River Master Plan	Feather River Habitat Restoration measures were incorporated into Phase 1 and Phase 2 work described in the master plan, as envisioned in the 2013 LHMP.
Resource Efficiency Plan, 2016	This is a climate action plan which outlines programs and policies to use energy resources more efficiently and reduce greenhouse gas emissions as part of the daily management of the community and municipal operations.

B.3 Community Profile

The community profile for the City of Yuba City is detailed in the following sections. Figure B-1 displays a City map and the location of Yuba City within Sutter County.

Figure B-1 City of Yuba City



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

B.3.1. Geography and Climate

Yuba City lies in the northern portion of California's Central Valley, situated in eastern Sutter County on the western bank of the Feather River. Primarily undeveloped agricultural land exists to the north, west, and south of the City. The Sutter Buttes are located to the northwest of the City. The primary transportation corridors are Routes 99 and 20. Route 99 leads due south to Sacramento and north to Oroville and Chico; Route 20 links Yuba City to Colusa County and I-5 to the west and Grass Valley and the Sierra Nevada range to the east. State Routes 70 and 65 lead south from Marysville, connecting the region to Sacramento and to Sacramento's northern suburbs – Roseville and Rocklin. Elevation in the City is roughly 60 ft above mean sea level (msl), with only small variations in topography in the City. Sutter County and Yuba City share the mild climate of their San Joaquin and Sacramento Valley neighbors.

B.3.2. History

Before its founding, the land on which Yuba City is now located was a part of Rancho Nuevo Helvetia (the New Switzerland Ranch), a land grant owned by Swiss emigrant and Mexican citizen John Sutter. Samuel Brannan, Pierson Reading, and Henry Cheever purchased land from Sutter in 1849 to found a town primarily as a distribution center for Gold Rush supplies. Brannan, the Senior Partner, had the town laid out and lots sold. He is honored today as one of the town's founders and has a park named for him.

Yuba City was established as the county seat in 1856. The early town was centered at Second Street and the Garden Highway, near the waterfront. The commercial district ran along Bridge Street, south of the present-day Downtown commercial corridor on Plumas Street. Apart from mining-oriented services, the City's industry also focused on agricultural production, with wheat, grains, and cattle being the dominant goods.

Incorporated on January 23, 1908, the City soon found ethnic diversity taking root. Mexican immigration to the Yuba-Sutter region began in the early Twentieth Century, followed by the arrival of traditionally agrarian Sikh Indian immigrants who have come in a small but steady flow since 1924. More than a quarter of City residents and 30 percent of people in the County now claim either Mexican or Indian heritage.

After World War II, Yuba City's population began to grow more quickly, owing to returning veterans, improved access from highway construction, and the constraints placed on development in its sister city across the river, Marysville. Growth has continued to be strong, with the population nearly doubling every twenty years since 1940. Pressure toward further expansion is most acute in agricultural areas to the west and south of the City, especially along highway corridors.

B.3.3. Economy and Tax Base

US Census estimates show economic characteristics for the City of Yuba City. These are shown in Table B-3 and Table B-4. Mean household income in the City was $83,481. Median household income in the City was $61,773.

Table B-3 City of Yuba City – Civilian Employed Population 16 years and Over

Industry	Estimated Employment	Percent
Agriculture, forestry, fishing and hunting, and mining	2,545	8.5%
Construction	2,556	8.5%
Manufacturing	1,715	5.7%
Wholesale trade	749	2.5%
Retail trade	3,611	12.0%
Transportation and warehousing, and utilities	2,009	6.7%
Information	118	0.4%
Finance and insurance, and real estate and rental and leasing	2,129	7.1%
Professional, scientific, and management, and administrative and waste management services	2,712	9.0%
Educational services, and health care and social assistance	6,745	22.4%
Arts, entertainment, and recreation, and accommodation and food services	2,713	9.0%
Other services, except public administration	1,522	5.1%
Public administration	981	3.3%

Source: US Census Bureau American Community Survey 2019 Estimates

Table B-4 City of Yuba City – Household Income in the Past 12 months

Income Bracket	Percent
<$10,000	3.0%
$10,000 – $14,999	4.2%
$15,000 - $24,9999	9.5%
$25,000 – $34,999	12.0%
$35,000 – $49,999	13.1%
$50,000 – $74,999	17.8%
$75,000 – $99,999	10.3%
$100,000 – $149,999	14.3%
$150,000 – $199,999	10.2%
$200,000 or more	5.5%

Source: US Census Bureau American Community Survey 2019 Estimates

Top ten employers in the City are shown in Table B-5.

Table B-5 Ten Largest Employers in Yuba City

Employer	Number of Employees
Fremont Rideout Medical	2,215
Yuba City Unified School District	1,405
County of Sutter	892

Employer	Number of Employees
Sunsweet Growers	600
Wal-Mart	463
Sutter North Medical	450
City of Yuba City	303
Target	185
Sam's Club	182
Bel Air/Raley's	173

Source: Yuba City Comprehensive Annual Financial Report, 2018

Yuba City has a wide and varied tax base. This can be seen in Table B-6.

Table B-6 Yuba City – Tax Base

Category	Parcels	Net Taxable Value
Residential	17,577	$3,965,832,478 (70.5%)
Commercial	876	$1,034,566,380 (18.4%)
Industrial	289	$226,354,033 (4.0%)
Agricultural	2	$65,908 (0.0%)
Govt. Owned	2	$0 (0.0%)
Institutional	79	$8,031,511 (1.1%)
Irrigated	63	$22,079,748 (0.4%)
Vacant	494	$64,321,208 (1.1%)
Exempt	288	$0.0 (0.0%)
SBE Nonunitary	[22]	$5,428,205 (0.1%)
Cross Reference	[5]	$98,768 (0.0%)
Unsecured	[1890]	$301.052,344 (5.3%)
Totals	**19,670**	**$5,627,830,583**

Source: Sutter County Assessor 2019/20 Combined Tax Rolls

B.3.4. Population

The California Department of Finance estimated the January 1, 2020 total population for the City of Yuba City was 70,458.

B.4 Hazard Identification

Yuba City's identified the hazards that affect the City and summarized their location, extent, likelihood of future occurrence, potential magnitude, and significance specific to Yuba City (see Table B-7).

Table B-7 City of Yuba City —Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Highly Likely	Limited	Medium	Medium
Climate Change	Extensive	Highly Likely	Limited	Medium	–
Dam Failure	Extensive	Unlikely	Catastrophic	High	Medium
Drought & Water shortage	Extensive	Likely	Critical	Medium	High
Earthquake	Extensive	Unlikely	Critical	Medium	Low
Floods: 1%/0.2% annual chance	Extensive	Occasional	Critical	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Limited	Medium	Medium
Levee Failure	Significant	Occasional	Catastrophic	High	Medium
Pandemic	Extensive	Occasional	Critical	High	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Likely	Limited	Medium	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Medium	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Limited	Medium	Medium
Wildfire	Significant	Occasional	Critical	Medium	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

B.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile Yuba City's hazards and assess the City's vulnerability separate from that of the Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the City is included in this Annex. This vulnerability assessment analyzes the property, population, critical facilities, and other assets at risk to hazards ranked of medium or high significance specific to the City (as identified in the Significance column of Table B-7) and also includes a vulnerability assessment to the three primary hazards to the State of California: earthquake, flood, and wildfire. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

B.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section B.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard affects the City and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Planning Area.

B.5.2. Vulnerability Assessment and Assets at Risk

This section identifies Yuba City's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within the community.

Values at Risk

The following data from Sutter County utilizes the 2020 Assessor's data and parcel layer. The methodology used to derive parcel counts and property values is the same as in Section 4.3.1 of the Base Plan. This data should only be used as a guideline to overall values in the County and City, as the information has some limitations. The most significant limitations are created by Proposition 13 and the Williamson Act as detailed in the Base Plan. With respect to Proposition 13, instead of adjusting property values annually, the values are not adjusted or assessed at fair market value until a property transfer occurs. As a result, overall value information is most likely low and does not reflect current market value of properties within the County. It is also important to note, in the event of a disaster, it is generally the value of the infrastructure or improvements to the land that is of concern or at risk. Generally, the land itself is not a loss. However, depending on the type of hazard and impact of any given hazard event, land values may be adversely affected; thus, land values are included as appropriate. Table B-8 shows the 2020 Assessor's values and content replacement values (e.g., the values at risk) broken down by property use for the City.

Table B-8 City of Yuba City – Total Values at Risk by Property Use

Jurisdiction / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	67	49	$17,036,004	$4,315,061	$4,315,061	$25,666,126
Commercial	1,041	900	$369,278,563	$854,172,805	$854,172,805	$2,077,624,173
Industrial	386	301	$70,750,188	$140,581,049	$210,871,574	$422,202,811
Institutional	305	160	$39,800,451	$185,272,932	$185,272,932	$410,346,315
Miscellaneous	507	–	$0	$0	$0	$0
Residential	17,688	17,115	$962,804,074	$3,282,290,821	$1,641,145,411	$5,886,240,306
Vacant	298	15	$21,078,261	$484,735	$0	$21,562,996
City of Yuba City Total	**20,292**	**18,540**	**$1,480,747,541**	**$4,467,117,403**	**$2,895,777,782**	**$8,843,642,726**

Source: Sutter County 2020 Parcel/Assessor's Data

Critical Facilities and Infrastructure

Critical facilities and infrastructure are those buildings and infrastructure that are crucial to a community. Should these be damaged, it makes it more difficult for the community to respond to and recover from a disaster. For purposes of this plan, a critical facility is defined as:

> ***Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.***

Additional information on the three classes of critical facilities are described further in Section 4.3.1 of the Base Plan.

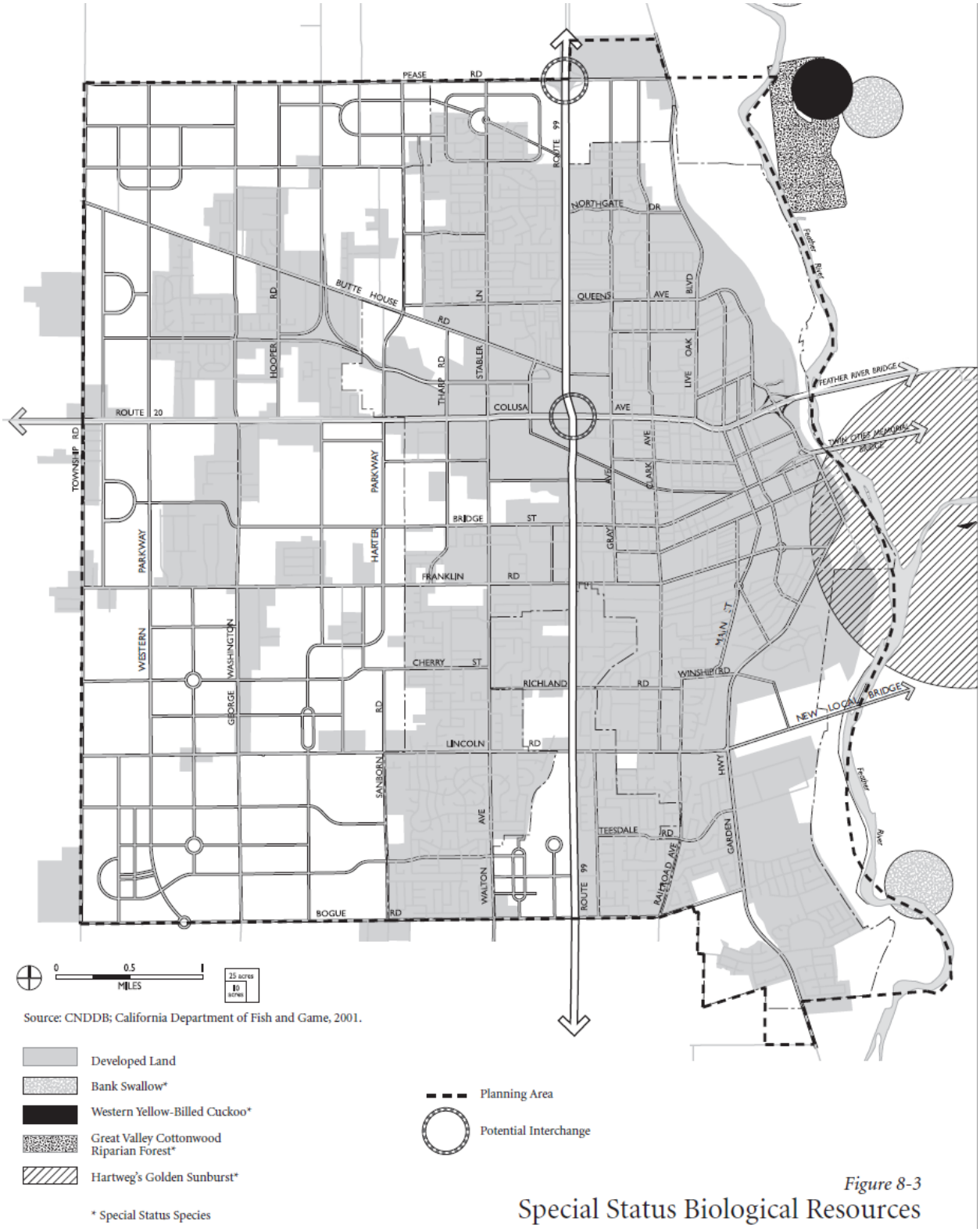
INSERT ANALYSIS

Natural Resources

Natural resources are unique to each area and are difficult to replace. Should a natural disaster occur, a community's natural resources are also at risk. The City of Yuba City and the areas surrounding it include a rich and diverse range of biological resources. Yuba City's setting – within an agricultural county and on the banks of the Feather River—includes natural resources that are important, not only for aesthetic value, but also for environmental quality, habitat protection, recreation, water resources, and agriculture.

A very small portion of the land area in the Planning Area is considered natural, and therefore provides little suitable habitat for special status species. The only designated special-status vegetation species in Yuba City's sphere of influence (SOI) is the Hartweg's Golden Sunburst, a flowering plant that occurs primarily in nonnative grasslands and is threatened mostly by the conversion of habitat to urban uses. The habitat area for this species occurs at the extreme eastern boundary of the Planning Area at the confluence of the Feather and Yuba Rivers (see Figure B-2).

Figure B-2 Yuba City Biological Resources



Source: 2004 Yuba City General Plan

One other special-status habitat exists in the immediate vicinity of the Yuba City Planning Area: Great Valley Cottonwood Riparian Forest. Located just across the Feather River from the northeast corner of the urban growth boundary, this habitat includes such tree species as the Goodding's black willow, box elder, sycamore, walnut, and Fremont's cottonwood. This habitat supports a lush understory of tree saplings, shrubs, and vines, and provides a sheltered area for wildlife with an abundant food and water supply. Although no special status wildlife species exist within the Planning Area, the nearby Cottonwood Riparian Forest provides habitat for the special status Bank swallow and the Western yellow-billed cuckoo. About 90 percent of the Western yellow-billed cuckoo's riparian habitat throughout the west has been modified. Several other special-status wildlife species are known to occur or have the potential to occur in such habitats, including the Cooper's hawk, tricolored blackbird, great blue heron, great egret, bald eagle, double-crested cormorant, among others.

Feather River Riparian Habitat

Although the California Natural Diversity Database does not list any riparian-related special status vegetation species in the Yuba City Planning Area, the Feather River provides important fish and riparian habitat areas. The City worked with the California Department of Fish and Game and Sutter County to develop a multi-year plan for restoring natural habitat and incorporating passive recreational uses along the Feather River. Phase 1 was completed in 2013. The excessive rainfall events of 2017 damaged some of the improvements, which were then repaired with the aid of FEMA funding. The City is now nearly finished with the Phase II improvements.

Not only does such area provide much needed parkland for City residents, but also provides habitat for a variety of wildlife and helps to preserve and enhance the most important natural feature in the City.

Historic and Cultural Resources

Historic and cultural resources are difficult to replace. Should a natural disaster occur, these properties and locations can be at risk.

The City of Yuba City has a stock of historically significant homes, public buildings, and landmarks. To inventory these resources, information was collected from a number of sources. The California Department of Parks and Recreation Office of Historic Preservation (OHP) was the primary source of information. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs. Each program has different eligibility criteria and procedural requirements. These requirements are detailed in Section 4.3.1 of the Base Plan. Table B-9 lists the historical buildings in the City.

Table B-9 City of Yuba City – Historical Resources

Resource Name (Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/ Community
Bill Butler House (P395)				X	3/20/1975	Yuba City
Campbell's House (P390)				X	3/20/1975	Yuba City
E. G. Van Arsdale House (P393)				X	3/20/1975	Yuba City

Resource Name (Plaque Number)	National Register	State Landmark	California Register	Point of Interest	Date Listed	City/ Community
Eugene Boyd House (P396)				X	3/20/1975	Yuba City
G.W. Carpenter House (P391)				X	3/20/1975	Yuba City
H. C. Mclaughlin Law Office (P311)				X	7/13/1973	Yuba City
Hock Farm (Site Of) (346)		X			8/8/1939	Yuba City
Mcgruder House (P389)				X	3/20/1975	Yuba City
S.G. Stabler And Swinson House (P394)				X	3/20/1975	Yuba City
Sanborn Law Office/Winship Hall (P312)				X	7/13/1973	Yuba City
Site Of Propagation Of The Thompson Seedless Grape (929)	X				10/15/1979	Yuba City
Sutter County Canning & Packing Company (P313)				X	7/13/1973	Yuba City
Sutter County Courthouse (P387)				X	3/20/1975	Yuba City
Sutter County Hall Of Records (P388)				X	3/20/1975	Yuba City
Sutter County Masonic Temple (P826)				X	3/3/1997	Yuba City
Thomas D. Boyd House (P392)				X	3/20/1975	Yuba City
William Harkey House (P385)				X	3/20/1975	Yuba City
William O'Banion House (P386)				X	3/20/1975	Yuba City

Source: California Department of Parks and Recreation Office of Historic Preservation, http://ohp.parks.ca.gov/

It should be noted that these lists may not be complete, as they may not include those currently in the nomination process and not yet listed. Additionally, as defined by the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA), any property over 50 years of age is considered a historic resource and is potentially eligible for the National Register. Thus, in the event that the property is to be altered, or has been altered, as the result of a major federal action, the property must be evaluated under the guidelines set forth by CEQA and NEPA. Structural mitigation projects are considered alterations for the purpose of this regulation.

Growth and Development Trends

As part of the LHMP update process, changes in growth and development, both past and future, were evaluated and examined in the context of hazard-prone areas, and how the changes in growth and development affect loss estimates and vulnerability over time. Information from the City of Yuba City General Plan Housing Element, the California Department of Finance, the US Census Bureau form the basis of this discussion.

Population Trends and Special Populations

Population growth can increase the number of people living in hazard prone areas. Yuba City has generally seen steady growth rates as shown in Table B-10. As shown in the table, the City has seen large population growth. Some of this growth has occurred inside the existing City limits, while other growth has occurred as a result of annexation. Growth has slowed in the City somewhat since 2010.

Table B-10 City of Yuba City – Population Changes Since 1950

Year	Population	Change	% Change
1950	7,861	–	–
1960	11,507	3,646	46.4%
1970	13,986	2,479	21.5%
1980	18,736	4,750	34.0%
1990	27,437	8,701	46.4%
2000	36,758	9,321	34.0%
2010[1]	64,925	28,167	76.6%
2020[2]	70,458	5,533	8.5%

Source: [1]US Census Bureau, [2]California Department of Finance

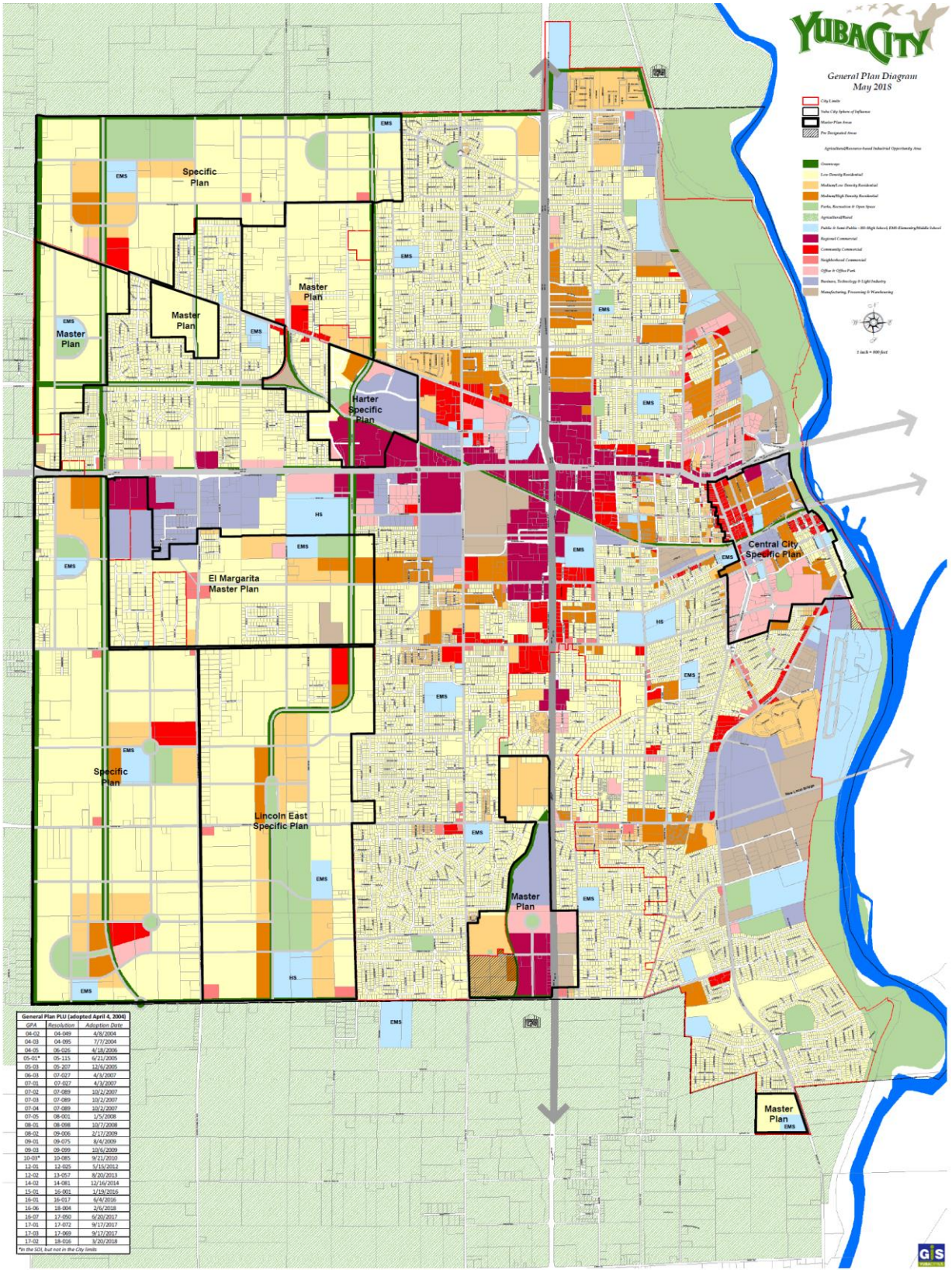
Special Populations and Disadvantaged Communities

As of July 1, 2019 the US Census Bureau estimated that the City of Yuba City has a population of 67,010. Of that population, 14.6% is above the age of 65 and 8.3% are disabled and under the age of 65. Furthermore, 40.3% of persons over the age of 5 speak a language other than English at home and 15.5% of the population was in poverty. Sacramento Area Council of Government (SACOG) produced Disadvantage Community maps for the jurisdictions they oversee (Figure B-2.5). As for demographics, 19.4% are Asian and 29.9% are Hispanic or Latino. Specifically the Punjabi population in the Yuba-Sutter area has grown to be one of the largest in the United States, and one of the largest Sikh populations outside of India.

Land Use

State planning law requires that the land use element of a general plan include a statement of the standard population density, building intensity, and allowed uses for the various land use designations in the plan (Government Code Section 65302(a)). The City's land use designations are generally described below and mapped on the Land Use Diagram (Figure B-3). The Yuba City Municipal Code provides detailed land use and development standards for development. Future land use for the City of Yuba City from the City of Yuba City General Plan Land Use Element is shown on Figure B-3.

Figure B-3 City of Yuba City – Land Use Diagram (2018)



Source: City of Yuba City General Plan Land Use Element

Development since 2013 Plan

As discussed in Section 4.3.1 of the Base Plan, future development has occurred in the County since the last plan. Some of this has occurred in hazard prone areas. The City Building Department tracked total building permits issued since 2013 for the City. These are tracked by total development, property use type, and hazard risk area. These are shown in Table B-11 and Table B-12.

Table B-11 City of Yuba City – Total Development Since 2013

Property Use	2014	2015	2016	2017	2018	2019	2020
Agricultural	0	0	0	0	0	0	0
Commercial	5	5	7	4	4	5	11
Industrial	1	0	3	2	4	4	2
Residential	60	49	47	38	32	49	61
Unknown	0	0	0	0	0	0	0
Total	**66**	**54**	**57**	**44**	**40**	**58**	**74**

Source: City of Yuba City Building Department

Table B-12 City of Yuba City – Development in Hazard Areas since 2013

Property Use	1% Annual Chance Flood	Levee Protected Area	Wildfire Risk Area[1]	Other
Agricultural	0	0	0	0
Commercial	0	41	0	0
Industrial	0	15	0	0
Residential	0	336	0	0
Unknown	0	0	0	0
Total	**0**	**392**	**0**	**0**

Source: City of Yuba City Building Department

[1]Moderate or higher wildfire risk area

Future Development

A discussion of future development is included below. Future development is important to hazard mitigation planning. Ensuring that future development does not place more people and property into known hazard zones is one of the goals of mitigation planning.

Most of the County is of a rural, agricultural nature, so large-scale development projects are rarely outside of the Yuba City city limits. More general information on growth and development in Sutter County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sutter County Vulnerability and Assets at Risk of the Base Plan. However, such projects are anticipated to occur within the cities' spheres of influence in the future. The City of Yuba City has delineated areas inside the City limits that it expects to be developed in the future. These eight locations include:

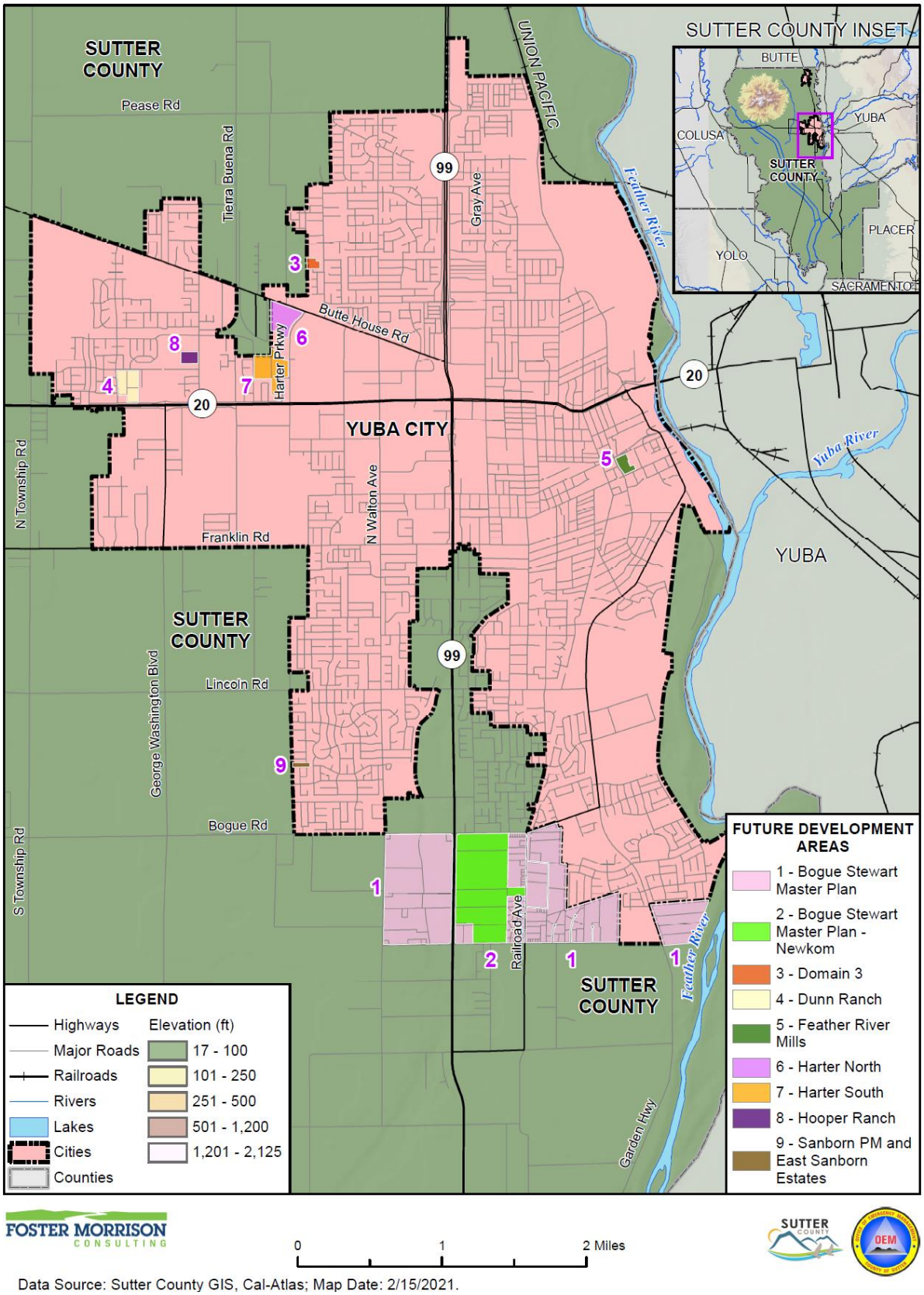
- Dunn Ranch - residential and office park

- Hooper Ranch – residential
- Harter South - residential
- Harter North – single family and multi-family
- Domain 3 – residential
- Feather River Mills – community commercial
- Newkom Ranch - residential, commercial; 25% build-out in 5 years; in newly annexed Sphere of Influence
- Sanborn PM and East Sanborn Estates - residential

GIS Analysis

Using GIS, the following methodology was used in determining parcel counts and acreages with future development projects in the City of Yuba City. Future development areas in the City were provided in mapped format by the City. 8 areas were provided. Using the GIS parcel spatial file for each of these areas, the 8 areas and 125 parcels associated with future development projects for which the analysis was to be performed were identified. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts within each area. Figure B-4 shows the locations of future development areas the City is planning to develop. Table B-13 shows the parcels and acreages of each future development area in the City.

Figure B-4 City of Yuba City – Future Development Areas



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table B-13 City of Yuba City – Future Development Areas with Parcel Counts and Acreages

Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Bogue Stewart Master Plan	109	92	549.9
Bogue Stewart Master Plan - Newkom	6	6	167.8
Domain 3	1	0	3.9
Dunn Ranch	3	1	18.5
Feather River Mills	1	0	6.5
Harter North	1	1	21.8
Harter South	2	0	27.9
Hooper Ranch	1	1	6.4
Sanborn PM and East Sanborn Estates	1	0	2.4
Yuba City Total	**125**	**101**	**805.1**

Source: City of Yuba City GIS

B.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table B-7 as high or medium significance hazards. Impacts of past events and vulnerability of the City to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the City to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, populations at risk, critical facilities and infrastructure, and future development.

Aquatic Invasive Species

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

The introduction of nonnative species into coastal marine and estuarine waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability.

Boats discharge ballast water that has been obtained from waters throughout the state, country, or the world. This water might include non-native organisms, untreated sewage, and other contaminants. Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. Examples include the zebra mussel infestation in the Great Lakes and the propagation of water hyacinth in the California Delta and other California waterways. Both the zebra mussel and the quagga mussel are concerns for California and Sutter County. These mussels have not affected the waters in Sutter County yet, but are still a cause for concern.

Some of California's most serious weed problems occur in waterways, lakes and streams. The aquatic plant hydrilla is considered one of the most serious aquatic weed problems in the world and the California Department of Food and Agriculture (CDFA) maintains an intensive program to survey and eradicate this aquatic weed pest. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, while impeding water flow and delivery. Its rapid growth and ease of spread by boats makes it critical to detect early and eradicate.

The effects of nonnative fish on native fish are generally in the form of predation and competition for food and breeding sites. There are also several non-fish, nonnative invasive species found in aquatic natural communities that can damage such communities. The introduced bullfrog is an important riparian invasive species in the Planning Area. Many varieties of non-native aquatic weeds and species compete for the entire water column and shoreline in Sutter County, crowding out native species and degrading the aquatic and riparian habitat.

Cyanobacteria are photosynthetic bacteria that share some properties with algae and are found naturally in lakes, streams, ponds and other surface water. Similar to other types of algae, when conditions are favorable, cyanobacteria can rapidly multiply in surface water and cause "blooms." Elevated nutrient availability, especially phosphorus and nitrogen, can contribute to cyanobacteria blooms that can cause taste and odor problems or toxicity in drinking water sources.

Location and Extent

All freshwater lakes, streams, and rivers are potentially at risk from aquatic invasive species. There is no established scale for these invasive species. Magnitude is measured by the presence and counts of aquatic invasive species in waterways in Sutter County. Speed of onset of these invasive species is short, as it only takes a careless boater or visitor to the area to accidentally introduce an invasive species. However, the duration is long as once established they can take years to eradicate, if at all.

Past Occurrences

Cyanobacteria blooms occur occasionally in the Feather River at a level that causes taste and odor issues in the City's drinking water. To date, these events have caused nuisance-level concern for the City's drinking water system. When the organisms die, some species release cyanotoxins, which can be harmful to the environment, animals and human health. Further, cyanobacteria consume dissolved oxygen as they decompose, potentially causing unhealthy conditions for aquatic life.

Cyanobacteria blooms occurred in summer and fall during the drought years, and also for shorter time periods during other years when Lake Oroville discharges were lowered. It would be a great concern to the City if cyanobacteria blooms occurred with increasing frequency or toxicity.

The City adds powdered activated carbon as part of its drinking water treatment process when these organisms are present in the river. The cost for this added treatment is approximately $5,600/month in chemical cost alone.

Vulnerability and Impacts to Invasive Aquatics

Aquatic invasive species can jeopardize and damage any part of the entire system ranging from human economy dependent infrastructure to natural aquatic, riparian and wetland habitat. Entire watersheds can be affected when an aggressive invasive species infests the rivers, shorelines, tributaries, drainage, irrigation and domestic delivery systems. Impacts to the City are mostly related to excess flooding that may occur due to the presence of these invasive species.

Assets at Risk

The quality of the City's drinking water, and therefore the health of the community, is at risk when cyanobacteria blooms occur in the Feather River. If cyanobacteria blooms become more intense, the City will need to upgrade its powdered activated carbon feed system at the Water Treatment Plant, at a projected cost of $500,000.

Future Development

The City works to remove and prevent against invasive species where possible. The City is implementing regulations and best management practices to minimize contamination of stormwater flows, which should reduce contributions of nutrients to the Feather River.

Climate Change

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

In Sutter County and the City, the HMPC noted that each year it seems to get a bit warmer each year. It was also noted that 2017 was one of the wettest and 2019 one of the hottest years on record.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the City, Sutter County, and State of California. There is no scale to measure the extent of climate change. Climate change exacerbates other hazards, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Climate change has never been directly linked to any declared disasters. The City and HMPC members noted that the strength of storms does seem to be increasing, annual precipitation is decreasing, and the summer temperatures are getting hotter.

Vulnerability to and Impacts from Climate Change

The California Adaptation Planning Guide (APG) prepared by Cal OES and California Natural Resource Agency was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change. California's APG: Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Sutter County and Yuba City fall within the North Sierra Region characterized as a sparsely settled mountainous region where the region's economy is primarily tourism-based. The region is rich in natural resources, biodiversity, and is the source for the majority of water used by the state. This information can be used to guide climate adaptation planning in the City and Sutter County Planning Area.

The California APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Sutter County Planning Area is part of:

- Temperature increases
- Decreased precipitation
- Reduced snowpack
- Reduced tourism
- Ecosystem change
- Sensitive species stress
- Increased wildfire

Future Development

The City could see population fluctuations as a result of climate impacts relative to those experienced in other regions, and these fluctuations are expected to impact demand for housing and other development. While there are currently no formal studies of specific migration patterns expected to impact the City and County region, climate-induced migration was recognized within the UNFCCC Conference of Parties Paris Agreement of 2015 and is expected to be the focus of future studies.

The City has adopted a Resource Efficiency Plan which establishes greenhouse gas reduction goals and strategies. Greenhouse gas emissions are to be reduced through building code standards that increase energy efficiency in residential housing and commercial units. The City anticipates the need to implement new state requirements for green building requirements, such as requirements for solar panel installations on residential housing.

Dam Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–Extremely High

Hazard Profile and Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, CA DWR Division of Safety of Dams (DSOD) assigns hazard ratings to dams within the State that provides information on the potential impact should a

dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.3.7 of the Base Plan. High and Extremely High hazard dams can result and loss of life, thus dams with these classifications are the focus of this risk assessment.

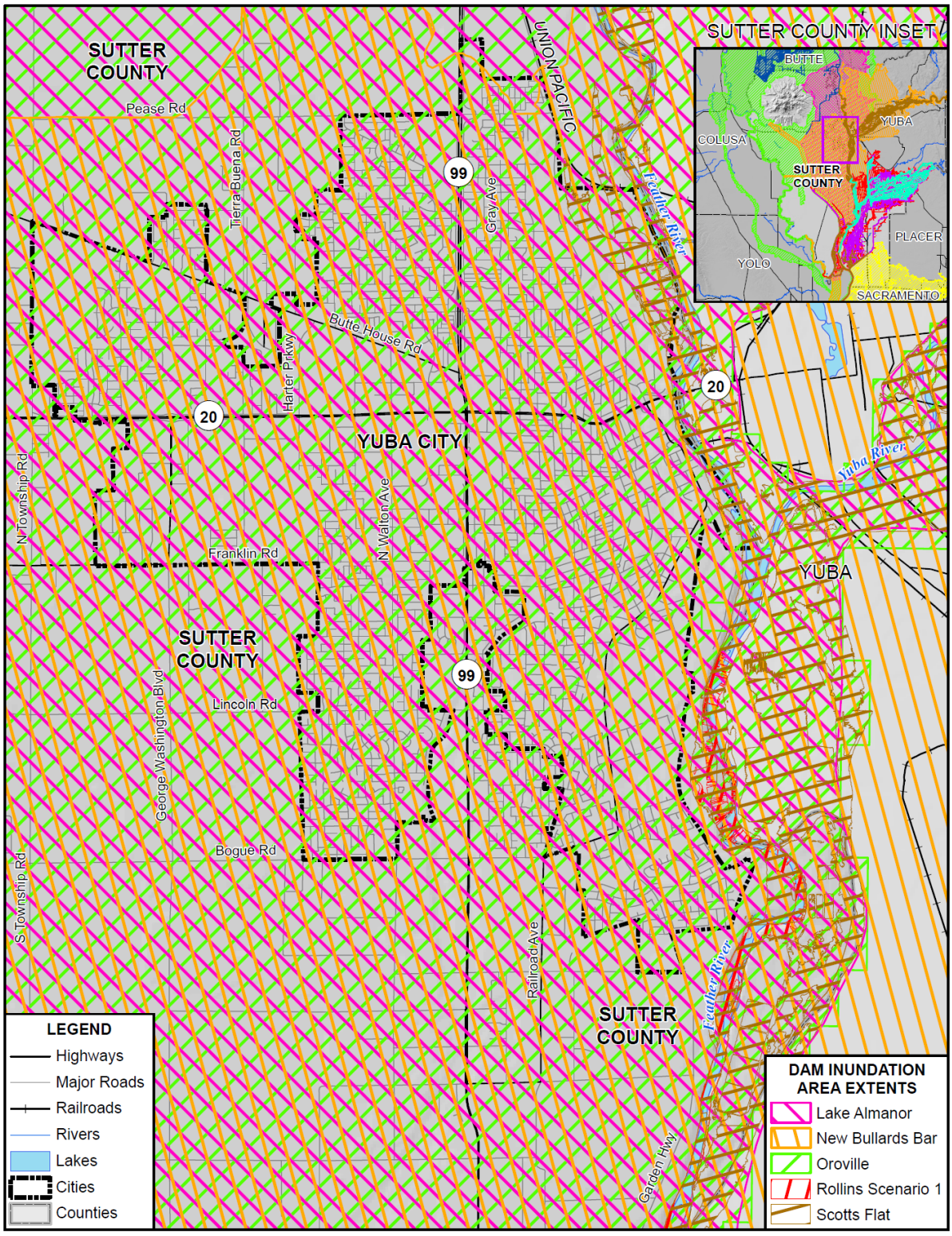
While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The City would be affected for as long as the flood waters from the dam failure took to drain downstream.

Geographic flood extent from the Cal OES dam inundation areas is shown in Table B-14. Based on available data, the City falls within the inundation areas of:

- Extreme High Hazard Dam Inundation Areas
  - ✓ Lake Almanor Dam
  - ✓ New Bullards Bar Dam
  - ✓ Oroville Dam
  - ✓ Scotts Flat Dam
- High Hazard Dam Inundation Areas
  - ✓ Deer Creek Diversion Dam
  - ✓ Thermalito Diversion Dam
  - ✓ Virginia Ranch Dam

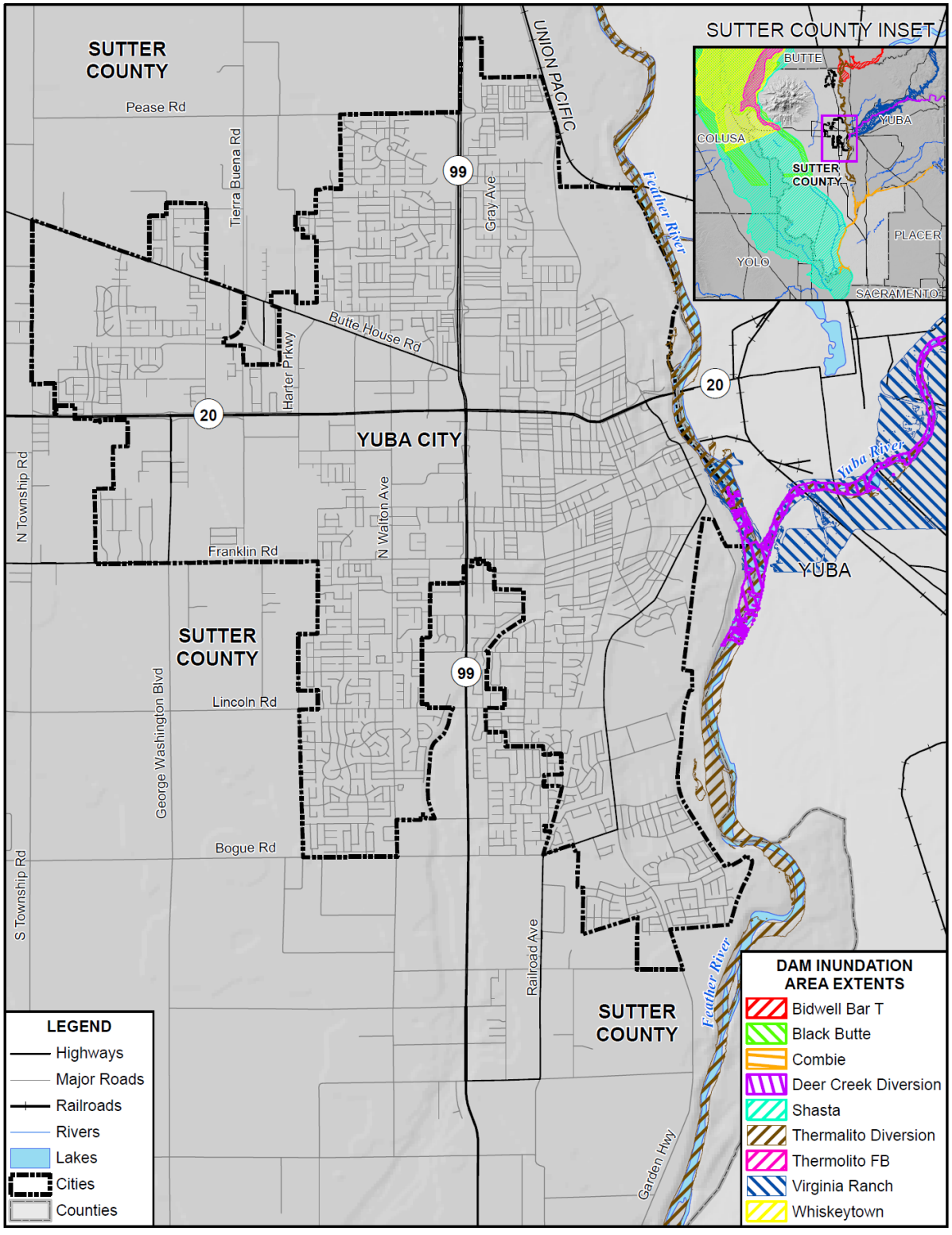
These can be seen on Figure B-5 and Figure B-6.

Figure B-5 Yuba City – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure B-6 Yuba City – High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table B-14 City of Yuba City – Geographical Dam Inundation Extents

Dam Inundation Area	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Extreme High Hazard Dam Inundation Areas						
Lake Almanor	8,043.90	100.0%	6,660.11	100.0%	1,383.79	100.0%
New Bullards Bar	7,995.95	99.4%	6,641.25	99.7%	1,354.70	97.9%
Oroville	8,043.90	100.0%	6,660.11	100.0%	1,383.79	100.0%
Scotts Flat	90.73	1.1%	86.63	1.3%	4.11	0.3%
High Hazard Dam Inundation Areas						
Deer Creek Diversion	0.40	0.02%	0	0.00%	0.40	0.05%
Thermalito Diversion	2.81	0.15%	1.95	0.00%	0.86	0.11%
Virginia Ranch	0.75	0.04%	0	0.00%	0.75	0.09%

Source: Cal OES

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident occurring in nearby Butte County. This can be seen on Table B-15.

Table B-15 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

2017 Oroville Spillway Incident. The 2017 Yuba City Sanitary Survey noted that January and February 2017 were the wettest months recorded in over 100 years for the Feather River Watershed, and the Northern Sierra received 200 percent of its normal snow pack, thus contributing to a surplus of water in Lake Oroville. This combined with numerous storms in early 2017 resulted in damage to the Lake Oroville spillways. On February 7, 2017, the main flood control spillway at Lake Oroville was discovered to have erosion on the lower chute, the concrete weir at the lake was overtopped, and the emergency spillway had to be utilized. Both spillways were damaged, causing significant flooding in the Feather River, erosion, the transport of large debris, damage to infrastructure and areas downstream of the spillway, and increased water turbidity. This increase in turbidity caused minor issues in treating drinking water during the periods of turbidity and high flows. Reportedly, the Water Treatment Plant was able to effectively treat the water to meet Drinking Water Standards and did not cause water quality issues, but high levels of turbidity strained some of the Water Treatment Plant components.

The City noted no other dam failure occurrences that have affected the City.

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Due to the topography surrounding the City, dam failure would result in water of significant depth in Yuba City (should the levees breach). This is due to the "bowl effect" of the southern portions of the County. The City should also have ample warning time to prepare evacuations. Impacts to the City from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant.

Assets at Risk

Based on the vulnerability of Yuba City to the dam failure hazard, the sections that follow describes significant assets at risk in the City of Yuba City. This section includes the values at risk, inundated acres, population at risk, and critical facilities at risk.

Values at Risk

GIS was used to determine the possible impacts of dam failure flooding within the City of Yuba City. The methodology described in Section 4.3.4 of the Base Plan was followed in determining structures and values at risk by property use. Multiple analysis tables were created:

- Table B-16 shows the total parcel counts, improved parcel counts, their improved structure and land values in the Lake Almanor dam inundation area.
- Table B-16 shows the total parcel counts, improved parcel counts, their improved structure and land values in the New Bullards Bar dam inundation area.
- Table B-17 shows the total parcel counts, improved parcel counts, their improved structure and land values in the Oroville dam inundation area.
- Table B-18 shows the total parcel counts, improved parcel counts, their improved structure and land values in the Scotts Flat dam inundation area.
- Table B-19 shows the total parcel counts, improved parcel counts, their improved structure and land values in the Deer Creek dam inundation area.
- Table B-20 shows the total parcel counts, improved parcel counts, their improved structure and land values in the Thermalito Diversion dam inundation area.
- Table B-21 shows the total parcel counts, improved parcel counts, their improved structure and land values in the Virginia Ranch dam inundation area.

Table B-16 City of Yuba City – Count and Value of Parcels in Lake Almanor Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	67	49	$17,036,004	$4,315,061	$4,315,061	$25,666,126
Commercial	1,041	900	$369,278,563	$854,172,805	$854,172,805	$2,077,624,173
Industrial	386	301	$70,750,188	$140,581,049	$210,871,574	$422,202,811

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Institutional	305	160	$39,800,451	$185,272,932	$185,272,932	$410,346,315
Miscellaneous	507	0	$0	$0	$0	$0
Residential	17,688	17,115	$962,804,074	$3,282,290,821	$1,641,145,411	$5,886,240,306
City of Yuba City Total	**19,994**	**18,525**	**$1,459,669,280**	**$4,466,632,668**	**$2,895,777,782**	**$8,822,079,730**

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Table B-17 City of Yuba City – Count and Value of Parcels in New Bullards Bar Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	67	49	$17,036,004	$4,315,061	$4,315,061	$25,666,126
Commercial	1,039	898	$367,602,750	$852,098,460	$852,098,460	$2,071,799,670
Industrial	386	301	$70,750,188	$140,581,049	$210,871,574	$422,202,811
Institutional	305	160	$39,800,451	$185,272,932	$185,272,932	$410,346,315
Miscellaneous	473	0	$0	$0	$0	$0
Residential	17,540	17,113	$962,804,074	$3,282,274,619	$1,641,137,310	$5,886,216,003
City of Yuba City Total	**19,810**	**18,521**	**$1,457,993,467**	**$4,464,542,121**	**$2,893,695,336**	**$8,816,230,924**

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Table B-18 City of Yuba City – Count and Value of Parcels in Oroville Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	67	49	$17,036,004	$4,315,061	$4,315,061	$25,666,126
Commercial	1,041	900	$369,278,563	$854,172,805	$854,172,805	$2,077,624,173
Industrial	386	301	$70,750,188	$140,581,049	$210,871,574	$422,202,811
Institutional	305	160	$39,800,451	$185,272,932	$185,272,932	$410,346,315
Miscellaneous	507	0	$0	$0	$0	$0
Residential	17,688	17,115	$962,804,074	$3,282,290,821	$1,641,145,411	$5,886,240,306
City of Yuba City Total	**19,994**	**18,525**	**$1,459,669,280**	**$4,466,632,668**	**$2,895,777,782**	**$8,822,079,730**

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Table B-19 City of Yuba City – Count and Value of Parcels in Scotts Flat Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	1	0	$18,743	$0	$0	$18,743
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	1	1	$1,194,565	$15,000	$15,000	$1,224,565
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
City of Yuba City Total	**2**	**1**	**$1,213,308**	**$15,000**	**$15,000**	**$1,243,308**

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Table B-20 City of Yuba City – Count and Value of Parcels in Deer Creek Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	0	0	$0	$0	$0	$0
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	1	0	$24,000	$0	$0	$24,000
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
City of Yuba City Total	**1**	**0**	**$24,000**	**$0**	**$0**	**$24,000**

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Table B-21 City of Yuba City – Count and Value of Parcels in Thermalito Diversion Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	0	0	$0	$0	$0	$0
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	0	0	$0	$0	$0	$0
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
City of Yuba City Total	0	0	$0	$0	$0	$0

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Table B-22 City of Yuba City – Count and Value of Parcels in Virginia Ranch Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	0	0	$0	$0	$0	$0
Commercial	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Institutional	1	0	$24,000	$0	$0	$24,000
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
City of Yuba City Total	**1**	**0**	**$24,000**	**$0**	**$0**	**$24,000**

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data

Population at Risk

The Cal OES dam inundation areas were overlayed on the parcel layer. Those residential parcel centroids that intersect the dam inundation areas were counted and multiplied by the 2010 Census Bureau average household factors for Yuba City – 2.99. Results are shown in Table B-37.

Table B-23 City of Yuba City – Count of Improved Residential Parcels and Population by Dam Inundation Area

Dam Inundation Area	Improved Residential Parcels	Population
Extremely High Hazard Dams		
Lake Almanor	17,115	51,174
New Bullards Bar	17,113	51,168
Oroville	17,115	51,174
High Hazard Dams		
Scotts Flat	0	0
Deer Creek Diversion	0	0
Thermalito Diversion	0	0
Virginia Ranch	0	0

Source: Cal OES, DSOD, Sutter County 2020 Parcel/Assessor's Data, US Census Bureau

Critical Facilities at Risk

An analysis was performed on the critical facility inventory in Yuba City in identified dam inundation areas. GIS was used to determine whether the critical facility locations intersect a Cal OES or DSOD dam inundation area. Details of critical facilities in mapped dam inundation areas in the City of Yuba City are shown in Figure B-7 and detailed in Table B-24. Details of critical facility definition, type, name and address and jurisdiction by dam inundation area are listed in Appendix F.

Figure B-7 City of Yuba City – Critical Facilities in Dam Inundation Areas

Table B-24 City of Yuba City – Critical Facilities in Dam Inundation Areas

Critical Facility Category/Dam Inundation Area	Facility Count

Source: Cal OES, Sutter County GIS

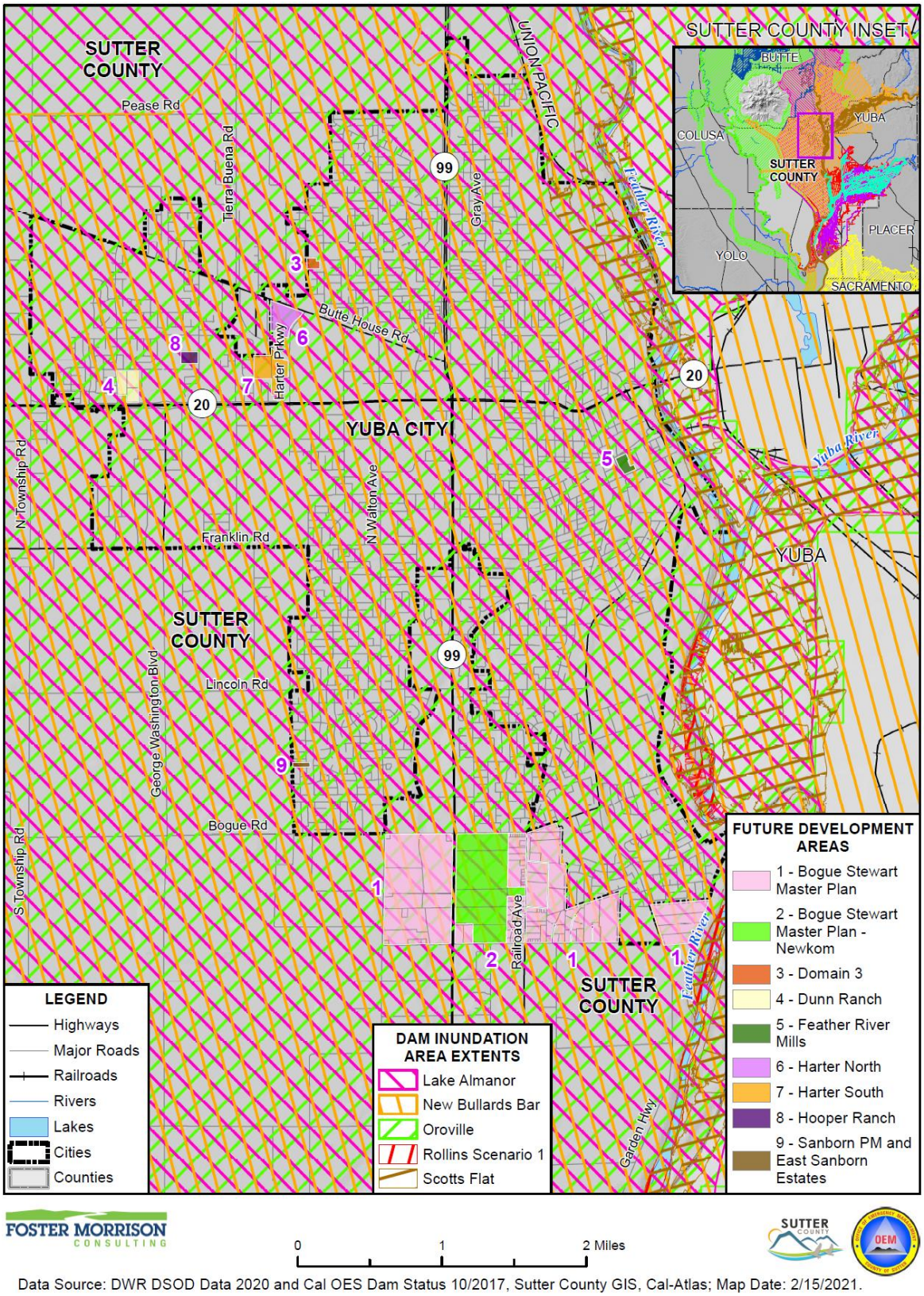
Future Development

Given the high number of potentially affected parcels and the numerous dams of concern to Yuba City, future development in the City could be affected by dam failures and associated flooding. Siting of future development areas should take dam failure flooding into account.

GIS Analysis

The City provided future development areas were used as the basis for the inventory of future development areas for the City. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts within each individual mapped dam inundation area. Figure B-8 shows the locations of future development areas the City is planning to develop and the extremely high hazard dam inundation area that they intersect. Table B-25 shows the parcels and acreages of each future development area in the City by extremely high hazard dam inundation area. It should be noted that there are no future development areas in high hazard dam inundation areas; as such, no map or tabular analysis is shown.

Figure B-8 City of Yuba City –Critical Facilities in Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table B-25 City of Yuba City – Future Development Areas Parcel Counts and Acreages in Extremely High Hazard Dam Inundation Areas

Dam Inundation/Future Development Area	Total Parcel Count	Improved Parcel Count	Total Acres
Lake Almanor Dam			
Bogue Stewart Master Plan	109	92	549.9
Bogue Stewart Master Plan - Newkom	6	6	167.8
Domain 3	1	0	3.9
Dunn Ranch	3	1	18.5
Feather River Mills	1	0	6.5
Harter North	1	1	21.8
Harter South	2	0	27.9
Hooper Ranch	1	1	6.4
Sanborn PM and East Sanborn Estates	1	0	2.4
Lake Almanor Total	**125**	**101**	**805.1**
Oroville Dam			
Bogue Stewart Master Plan	109	92	549.9
Bogue Stewart Master Plan - Newkom	6	6	167.8
Domain 3	1	0	3.9
Dunn Ranch	3	1	18.5
Feather River Mills	1	0	6.5
Harter North	1	1	21.8
Harter South	2	0	27.9
Hooper Ranch	1	1	6.4
Sanborn PM and East Sanborn Estates	1	0	2.4
Oroville Total	**125**	**101**	**805.1**

Source: Cal OES, DSOD, City of Yuba City GIS

Drought & Water Shortage

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects. Drought is different than many of the other natural hazards in that it is not

a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue and is critical for agriculture, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

As noted in the 2017 Yuba City Sanitary Survey, Yuba City receives water from the Lower Feather River Watershed. This watershed encompasses parts of Butte, Sutter, and Yuba Counties, and the Feather River which flows from the Oroville Dam at Lake Oroville to its confluence with the Sacramento River. Subsequently, the majority of Yuba City's drinking water is pumped directly from the Feather River, with a groundwater well at the Water Treatment Plant serving as an additional water source during low flow conditions. An intake structure and low lift pump station are located on the Feather River west of Yuba City that pump water to the Yuba City Water Treatment Plant located on Northgate Drive. The Treatment Plant has the current capacity to treat 36 Million Gallons per Day (MGD) through a combination of conventional and membrane treatment technologies. Conventional treatment includes a series of rapid mixers, flocculation basins, and sedimentation basins that can treat 24 MGD, and the additional 12 MGD is treated through membrane filtration. Following treatment, water is disinfected and sent to on-site storage prior to entering the distribution system. The distribution system encompasses over 260 miles of water mains, nine storage tanks, and seven booster pump stations to deliver water to the City's 18,697 service connections.

Location and Extent

Drought and water shortage are regional phenomenon. The whole of the County, as well as the whole of the City, is at risk. The US Drought Monitor categorizes drought conditions with the following scale:

- None
- D0 – Abnormally dry
- D1 – Moderate Drought
- D2 – Severe Drought
- D3 – Extreme drought
- D4 – Exceptional drought

Drought has a slow speed of onset and a variable duration. Drought can last for a short period of time, which does not usually affect water shortages and for longer periods. Should a drought last for a long period of time, water shortage becomes a larger issue. Current drought conditions in the City and the County are shown in Section 4.3.8 of the Base Plan.

Past Occurrences

There have been 2 state and 1 federal disaster declarations from drought. This can be seen in Table B-26.

Table B-26 Sutter County – State and Federal Drought Disaster Declarations 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Drought	2	1976, 2014	1	1976

Source: Cal OES, FEMA

Since drought is a regional phenomenon, past occurrences of drought for the City are the same as those for the County and includes 5 multi-year droughts over a 85-year period. Details on past drought occurrences can be found in Section 4.3.8 of the Base Plan.

The 2017 Yuba City Sanitary Survey noted past drought events of note. On January 17, 2014, a drought state of emergency was declared in California. This state of emergency was lifted on April 2, 2017. During this time, there was significantly less precipitation and runoff contributing to surface water sources, depletion of groundwater sources, restrictions on water use, and negative impacts on water quality. In Yuba City, the drought caused restrictions on water intake from the Feather River, more reliability on groundwater sources, and effects on water quality due to more stagnant water and algal growth.

That same report noted the following:

> ***Drought conditions spanning from 2011 to 2015 caused restrictions on the intake of water from the Feather River. These restrictions include two curtailed permits and a 10% reduction enforced by the State Water Project. In permit curtailing events, a groundwater well located at the Water Treatment Plant is utilized to supply additional water to the system.***
>
> ***If necessary, options for additional water supply include three groundwater wells in Yuba City and an agreement with Marysville to utilize their water supply as a backup source. The agreement with Marysville is being established via a pipeline connection on the 5th Street bridge. The three additional groundwater wells in Yuba City are not currently attached to a power source, but they can be connected to the system if needed. These wells were previously designated as inactive and would need to be permitted before use. Therefore, these sources have not been included as reliable backup systems at this time.***

The City noted that no City wells went dry, but there were private wells within the City that did go dry.

Vulnerability to and Impacts from Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the City, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users.

The vulnerability of the City to drought is City-wide, but impacts may vary and include reduction in water supply and quality, and an increase in dry fuels. The potential for a reduction in water supply during drought conditions generally leads to both mandated and voluntary conservations measures during extended droughts. During these times, the costs of water can also increase. The increased dry fuels and fuel loads associated with drought conditions can also result in an increased fire danger. In areas of extremely dry fuels, the intensity and speed of fires can be significant. Water supply and flows for fire suppression can also be an issue during extended droughts.

The 2017 Yuba City Sanitary Survey noted drought impacts that affect the City. Lack of flow in the water source due to drought conditions can lead to significant water quality issues. Drought results in shallower, more stagnant water which promotes algae and diatom production that require treatment for removal. This leads to decreased water quality related to taste and odor and the potential production of harmful blooms and cyanotoxins. Additionally, drought conditions typically result in the implementation of flow restrictions at the intake which are enforced through permit amendments and the State Water Project. This increases the reliance on the City's lower quality groundwater to meet the water demands.

Other qualitative impacts associated with drought in the Planning Area are those related to water intensive activities such as, municipal usage, commerce, tourism, recreation and agricultural use. Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding.

With more precipitation likely falling as rain instead of snow in the Sierra's, and warmer temperatures causing decreased snowfall to melt faster and earlier, water supply is likely to become more unreliable. Drought and water shortage is predicted to become more common. This means less water available for use over the long run, and additional challenges for water supply reliability, especially during periods of extended drought.

The City's 2010 Urban Water Management Plan addresses drought conditions and the Municipal Code has a section on emergency water restrictions. These items help the City address drought conditions and mitigate its effects.

Future Development

As the population in the area continues to grow, so will the demand for water. Water shortages in the future may be worsened by drought, as the City relies primarily on surface water for its water source. Ongoing planning will be needed by the City and local water agencies to account for population growth and increased water demands.

In the 2019 Yuba City Water Management Plan, Water demands projections were developed for buildout of the City's water service area and for a near-term scenario, based on anticipated near-term growth areas identified by the City. Water demands were projected for buildout within the City's Sphere of Influence (SOI) plus the Bogue-Stewart Master Plan area using a land use-based approach, which was adjusted using the City's SB x7-7 per capita water use (population-based) target, since that per capita usage reflects the City's currently adopted goal. Because it is currently not known how new regulations will impact future water use targets, demand bracketing was also used to evaluate the sensitivity of WTP and transmission

infrastructure sizing to changes in future demands. Table B-27 summarizes existing and projected demands for the near-term and buildout scenarios developed in the WTP and Distribution System Master Plan. The Plan uses annual growth rates of 1 to 2.4 percent, to evaluate the impact of when facilities would be needed.

Table B-27 Yuba City – Existing and Projected Water Use

Planning Horizon	Projected Water Use			
	Average Annual, MG/yr	Average Day, mgd	Maximum Day, mgd	Peak Hour, mgd
Existing System[a]	5,586	15.3	24.5	35.3
Near-term[b]	5,950	16.3	28.5	41.0
Buildout of General Plan[c]	10,700	29.3	51.3	73.8

(a) Based on actual 2013 water use for average day and maximum day. Peak hour demand estimated from June 22, 2017 operating data when the peak hour demand was 1.44 times the average daily demand.
(b) Near-term development includes portions of the El Margarita Master Plan, portions of the Lincoln East Specific Plan, the Sutter Heritage Master Plan, Walnut Park West and the Bogue Stewart Master Plan area.
(c) General Plan, as amended in 2016, plus Bogue Stewart Master Plan.

Source: 2019 City of Yuba City Water Management Plan

Earthquake

Likelihood of Future Occurrence–Unlikely
Vulnerability–Medium

Hazard Profile and Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction.

Location and Extent

Since earthquakes are regional events, the whole of the City is at risk to earthquake. Yuba City and the surrounding area are relatively free from significant seismic and geologic hazards. There are no known or inferred active faults within the City.

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales, as discussed in Section 4.3.9 of the Base Plan. The faults identified in Sutter County include the Quaternary

Faults, located in the northern section of the County within the Sutter Buttes, and the Pre Quaternary Fault, located in the southeastern corner of the Planning Area, just east of where Highway 70 enters into the County. Both faults are listed as non active faults, but have the potential for seismic activity.

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. The City is located in an area where few earthquakes of significant magnitude occur, so both magnitude and intensity of earthquakes are expected to remain low. Seismic shaking maps for the area show Sutter County and the City fall within a low to moderate shake risk.

Past Occurrences

The City noted no past occurrences of earthquakes or that affected the City in any meaningful way.

Vulnerability to and Impacts from Earthquake

The combination of plate tectonics and associated California coastal mountain range building geology generates earthquake as a result of the periodic release of tectonic stresses. Sutter County's mountainous terrain lies in the center of the North American and Pacific tectonic plate activity. There have been earthquakes as a result of this activity in the historic past, and there will continue to be earthquakes in the future of the California north coastal mountain region.

Fault ruptures itself contributes very little to damage unless the structure or system element crosses the active fault; however, liquefaction can occur further from the source of the earthquake. In general, newer construction is more earthquake resistant than older construction due to enforcement of improved building codes. Manufactured housing is very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Locally generated earthquake motions and associated liquefaction, even from very moderate events, tend to be more damaging to smaller buildings, especially those constructed of unreinforced masonry (URM) and soft story buildings.

The Uniform Building Code (UBC) identifies four seismic zones in the United States. The zones are numbered one through four, with Zone 4 representing the highest level of seismic hazard. The UBC establishes more stringent construction standards for areas within Zones 3 and 4. All of California lies within either Zone 3 or Zone 4. The City of Yuba City is within the less hazardous Zone 3.

Earthquake vulnerability is primarily based on population and the built environment. Urban areas in high seismic hazard zones are the most vulnerable, while uninhabited areas are less vulnerable. No City facilities are of unreinforced masonry. Any unreinforced masonry buildings would be located in the older section of the City, bounded by Highway 20, the Feather River levee, B Street and Clark Road. These were built from the 1920s through the 1950s.

Impacts from earthquake in the City will vary depending on the fault that the earthquake occurs on, the depth of the earthquake strike, and the intensity of shaking. Earthquakes can cause both structural and non-structural damages. Large events could cause damages to infrastructure, critical facilities, residential and commercial properties, and possible injuries or loss of life.

Earthquake Analysis

Due to the regional effects of an earthquake, a probabilistic Hazus earthquake analysis was performed on a countywide basis. This can be found in Section 4.3.9 of the Base Plan. While this Hazus run was not done specific to the City, maps showing damage in the County show greater areas of damage near the cities in the County where the greatest development occurs.

Future Development

Existing structures in the City could be affected by the types of earthquake-induced effects listed above, but to varying degrees based on length, intensity, and distance of the earthquake from a given building. New structures are required to adhere to current California Uniform Building Code (CUBC) standards, providing adequate design, construction and maintenance of structures to prevent exposure of people and structures to major geologic hazards. In particular, any critical facilities such as hospitals, fire and police stations, and emergency communications and operations centers must be adequately designed, constructed and maintained with the goal of remaining functional after a large seismic event. The use of flexible utility connections, building anchors, and adequately reinforced concrete can reduce the loss of life and damage to buildings for human occupancy.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

This hazard analyzes FEMA's 1% and 0.2% annual chance floods, as well as the 0.5% (200-year) annual chance flood. These tend to be the larger floods that can occur in the County and City, and have caused damages in the past. Flooding is a significant problem in Sutter County and the City. Historically, the City has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures, including a vast system of levees. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1%, 0.5%, and 0.2% annual chance floodplains and in other localized areas.

As previously described in Section 4.3.10 of the Base Plan, the Sutter County Planning Area and the City of Yuba City have been subject to historical flooding. The 2018 Yuba City Drainage Study noted that drainage in and around the City flows generally from the northeast to southwest, where the drainage is pumped out of the Yuba City Basin at several locations.

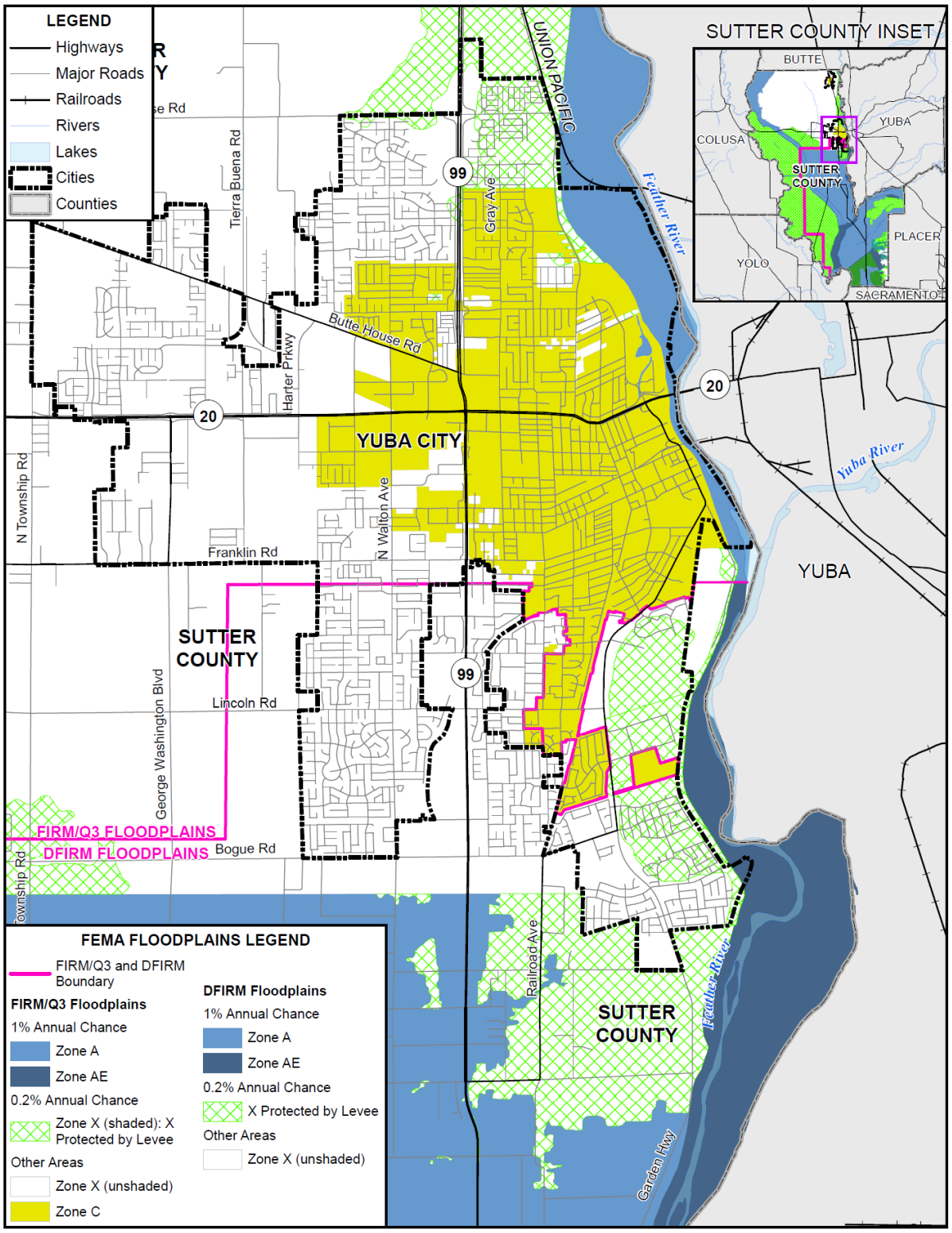
Location and Extent

A small portion of the City of Yuba City is located inside of the 1% annual chance floodzones as defined by the Federal Emergency Management Agency's (FEMA) current Q3 FIRM/DFIRM maps. Most of the City is protected by levees which reduces the area of the City subject to the 1% annual chance flood. This

is seen in Figure B-9. There have been areas not shown on Figure B-9 that have flooded in the past. These areas are discussed in the localized flooding section that follows. Sutter County's Local Flood Study (discussed in detail in Section 4.3.8 of the Base Plan) areas for the City can be seen on Figure B-10. These Local Flood Study Areas are limited within City boundaries, but may become more of an issue as the City's annexes into these areas of the County. As detailed in Section 4.3.12 of the Base Plan, Sutter County conducted multiple local flood studies of areas that should be subject to construction standards governing development in the 1% annual chance floodplains for new construction and substantial improvements. THIS MAP AND ASSOCIATED ANALYSIS SHOULD BE REPLACED BY THE 100-YEAR LOCALIZED AREA ANALYSIS CONDUCTED BY YUBA CITY THAT REPRESENTS POST LEVEE IMPROVEMENT PROJECTS – CAN WE GET THAT IN GIS?

Completion of levee repairs and improvements along the Sutter Bypass east levee would be needed to reduce the area subject to the 1% annual chance flood. Without these improvements, development in these areas is prohibitively expensive.

Figure B-9 City of Yuba City – FEMA Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure B-10 City of Yuba City – Yuba City Local Flood Study Area

INSERT

Table B-28 details the DFIRM and Q3 (FIRM) mapped flood zones located within the City.

Table B-28 City of Yuba City– Q3/DFIRM Flood Hazard Zones

Flood Zone	Description	Present in Yuba City
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	
AE	1% annual chance flood: Base flood elevations provided	
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	X
X (unshaded)	No flood hazard	X
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	X
AE	100-year Flood: Base flood elevations provided	X
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	
X (unshaded)	No flood hazard	X
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	X

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the City vary, depending on the nature and extent of a flood event; specific flood depths vary by location. Flood durations in the City tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the City tends to have a shorter speed of onset, due to the amount of water that flows through the City.

Geographical flood extents from the FEMA Q3/DFIRMs is shown in Table B-29. Geographical flood hazard extents from the Local Flood Study are shown in Table B-30.

Table B-29 City of Yuba City – Geographical Flood Hazard Extents in FEMA Q3/DFIRM Flood Zones

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance Flood Hazard	277	3.44%	254	3.81%	23	1.66%
0.2% Annual Chance Flood Hazard	670	8.33%	428	6.42%	242	17.49%
Other Areas	7,097	88.23%	5,978	89.76%	1,119	80.86%
Total	**8,044**	**100.00%**	**6,660**	**100.00%**	**1,384**	**100.00%**

Source: Sutter County 6/16/2015 DFIRM

Table B-30 City of Yuba City – Geographical Flood Hazard Extents in Local Flood Study Areas

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
SBFCA Post-Project 100-Year	130	1.6%	124	1.9%	6	0.4%
Outside of Flood Hazard Study Area	7,917	98.4%	6,537	98.1%	1,380	99.6%
City of Yuba City Total	**8,046**	**100.0%**	**6,660**	**100.0%**	**1,386**	**100.0%**

Source: Sutter County 6/16/2015 DFIRM

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table B-31. These events also likely affected the City to some degree.

Table B-31 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

The City noted the following past occurrences of flooding:

In 2008, the City received $1,400,000 from the Natural Resources Agency's California River Parkway Grant Program to fund Phase I of the Feather River Parkway Project. Phase I of the project was completed in 2013. Some Phase I park improvements were severely damaged during the 2017 Oroville Spillway Incident. Feather River Parkway damage included damage to gravel roadways, storm-water culverts, walking trails, trees, sand/sediment deposits, and picnic areas, including concrete pads and benches. The City applied for public assistance to FEMA through Cal OES for the repairs and reconstruction of the facilities damaged in the 2017 Oroville Spillway Incident. FEMA inspected the damages and reimbursed the City $789,567.26 to fund both the design and construction of the project.

In **2017**, the Low Lift Station Access Road to the City's drinking water intake facility and intake pumps were severely damaged. The City applied for assistance to FEMA through Cal OES for $1.5 million in damages to the City's water intake pumps and its access road. The pumps have been repaired, but funds have not been reimbursed. The City access road has not been repaired, and remains impassable.

2017 – Heavy rains in the spring of 2017 caused flooding in the City. The Wastewater Treatment Facility's discharge ponds (Ponds) are located in the Feather River floodplain. The Ponds were damaged by the January/February 2017 storm-related high-water events inside the Feather River floodplain. Damages were estimated to be $2.28 million.

Vulnerability to and Impacts from Flood

With its location on the Feather River, floods have been a part of the City's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages.

Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Structures can also be damaged from trees falling as a result of water-saturated soils. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. During a flood, people can also suffer heart attacks or electrocution due to electrical equipment short outs. Floodwaters can transport large objects downstream which can damage or remove stationary structures. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwaters can also break utility lines and interrupt services. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Public schools may also be required to close or be placed on a delayed start schedule. Roads can be damaged and closed, causing safety and evacuation issues. Standing water can cause damage to crops, roads, foundations, and electrical circuits. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, loss of environmental resources, and economic impacts.

Health Hazards from Flooding

Certain health hazards are also common to flood events. While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry anything that was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where cattle and hogs are kept or their wastes are stored can contribute polluted waters to the receiving streams.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as e. coli and other disease-causing agents.

The second type of health problems arise after most of the water has gone. Stagnant pools can become breeding grounds for mosquitoes, and wet areas of a building that have not been properly cleaned breed mold and mildew. A building that is not thoroughly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants. If a city or county water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

Assets at Risk

Based on the vulnerability of Yuba City to the flood hazard, the sections that follow describes assets at risk in the City of Yuba City. This section includes the values at risk, flooded acres, population at risk, and critical facilities at risk. Analysis is presented in three parts:

- The flood hazard based on FEMA DFIRMs.
- The flood hazard based on areas determined to be within 0.5% annual chance flooding
- The Sutter County Local Flood Study Areas.

More information on the differences of these floodplains can be found in Section 4.3.8 of the Base Plan.

Q3/DFIRM Values at Risk

GIS was used to determine the possible impacts of flooding within the City of Yuba City. The methodology described in Section 4.3.10 of the Base Plan was followed in determining structures and values at risk to the 1% (100-year) and 0.2% (500-year) annual chance flood event. Table B-32 is a summary table for the

City of Yuba City. Parcel counts, values, estimated contents, and total values in the City are shown for the 1% and 0.2% annual chance flood zones, as well as for those properties that fall outside of the mapped FEMA Q3/DFIRM flood zones. As previously mentioned, due to the current status of updated DFIRMs for Yuba City, there are limited areas of the City within the 1% annual chance flood. Table B-33 breaks down Table B-32 and shows the property use, improved parcel count, improved values, estimated contents, and total values that fall in FEMA flood zones in the City.

Table B-32 City of Yuba City – Count and Value of Parcels in Summary Q3/DFIRM Flood Zones

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard	9	2	$1,738,053	$27,496	$27,496	$1,793,045
0.2% Annual Chance Flood Hazard	1,643	1,106	$82,822,130	$306,591,375	$186,796,566	$576,210,071
Other Areas	18,640	17,432	$1,396,187,358	$4,160,498,532	$2,708,953,720	$8,265,639,610
City of Yuba City Total	**20,292**	**18,540**	**$1,480,747,541**	**$4,467,117,403**	**$2,895,777,782**	**$8,843,642,726**

Source: FEMA 6/16/2015 DFIRM, FEMA 1998 Q3 data, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

Table B-33 City of Yuba City – Count and Values of Parcels by Detailed Flood Zone and Property Use

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard						
Zone A						
Agricultural	2	1	$452,965	$12,496	$12,496	$477,957
Commercial	1	0	$23,518	$0	$0	$23,518
Industrial	1	0	$42,005	$0	$0	$42,005
Institutional	3	1	$1,219,065	$15,000	$15,000	$1,249,065
Miscellaneous	1	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
Vacant	0	0	$0	$0	$0	$0
Zone A Total	**8**	**2**	**$1,737,553**	**$27,496**	**$27,496**	**$1,792,545**
Zone AE						
Agricultural	0	0	$0	$0	$0	$0
Commercial	0	0	$0	$0	$0	$0

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Industrial	0	0	$0	$0	$0	$0
Institutional	1	0	$500	$0	$0	$500
Miscellaneous	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
Vacant	0	0	$0	$0	$0	$0
Zone AE Total	**1**	**0**	**$500**	**$0**	**$0**	**$500**
1% Annual Chance Flood Hazard Total	**9**	**2**	**$1,738,053**	**$27,496**	**$27,496**	**$1,793,045**
0.2% Annual Chance Flood Hazard						
X Protected by Levee						
Agricultural	4	2	$1,143,815	$62,008	$62,008	$1,267,831
Commercial	9	8	$3,130,249	$6,073,426	$6,073,426	$15,277,101
Industrial	22	11	$3,889,580	$3,555,833	$5,333,750	$12,779,163
Institutional	29	18	$8,517,049	$54,035,157	$54,035,157	$116,587,363
Miscellaneous	151	0	$0	$0	$0	$0
Residential	1,375	1,066	$62,805,145	$242,584,451	$121,292,226	$426,681,822
Vacant	53	1	$3,336,292	$280,500		$3,616,792
X Protected by Levee Total	**1,643**	**1,106**	**$82,822,130**	**$306,591,375**	**$186,796,566**	**$576,210,071**
0.2% Annual Chance Flood Hazard Total	**1,643**	**1,106**	**$82,822,130**	**$306,591,375**	**$186,796,566**	**$576,210,071**
Other Areas						
Zone X (unshaded)						
Agricultural	60	45	$15,433,729	$4,238,359	$4,238,359	$23,910,447
Commercial	230	171	$131,119,251	$223,458,697	$223,458,697	$578,036,645
Industrial	197	168	$36,957,530	$62,443,997	$93,665,996	$193,067,523
Institutional	88	47	$16,006,387	$42,335,859	$42,335,859	$100,678,105
Miscellaneous	152	0	$0	$0	$0	$0
Residential	9,919	9,845	$605,410,096	$2,090,889,416	$1,045,444,708	$3,741,744,220
Vacant	125	6	$12,438,147	$58,981	$0	$12,497,128
Zone X (unshaded) Total	**10,771**	**10,282**	**$817,365,140**	**$2,423,425,309**	**$1,409,143,619**	**$4,649,934,068**
Zone C						
Agricultural	1	1	$5,495	$2,198	$2,198	$9,891
Commercial	801	721	$235,005,545	$624,640,682	$624,640,682	$1,484,286,909
Industrial	166	122	$29,861,073	$74,581,219	$111,871,829	$216,314,121
Institutional	184	94	$14,057,450	$88,886,916	$88,886,916	$191,831,282
Miscellaneous	203	0	$0	$0	$0	$0

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Residential	6,394	6,204	$294,588,833	$948,816,954	$474,408,477	$1,717,814,264
Vacant	120	8	$5,303,822	$145,254	$0	$5,449,076
Zone C Total	**7,869**	**7,150**	**$578,822,218**	**$1,737,073,223**	**$1,299,810,102**	**$3,615,705,543**
Other Areas Total	**18,640**	**17,432**	**$1,396,187,358**	**$4,160,498,532**	**$2,708,953,720**	**$8,265,639,610**
City of Yuba City Total	**20,292**	**18,540**	**$1,480,747,541**	**$4,467,117,403**	**$2,895,777,782**	**$8,843,642,726**

Source: FEMA 6/16/2015 DFIRM, FEMA 1998 Q3 data, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

Table B-34 summarizes Table B-33 above and shows City of Yuba City loss estimates and improved values at risk by FEMA 1% and 0.2% annual chance flood zones.

Table B-34 City of Yuba City – Flood Loss Estimates

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value	Loss Estimate	Loss Ratio
1% Annual Chance	9	2	$1,738,053	$27,496	$27,496	$54,992	$10,998	0.00%
0.2% Annual Chance	1,643	1,106	$82,822,130	$306,591,375	$186,796,566	$493,387,941	$98,677,588	0.96%
Grand Total	**1,652**	**1,108**	**$84,560,183**	**$306,618,871**	**$186,824,062**	**$493,442,933**	**$98,688,586**	**0.96%**

Source: FEMA 6/6/2015 DFIRM, FEMA 1998 Q3 data, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

According to Table B-33 and Table B-34, the City of Yuba City has 2 improved parcels and $54,992 of structure and contents values or values in the 1% annual chance floodplain, and 1,106 improved parcels and $493 million of structure and contents values in the 0.2% annual chance floodplain. These values can be refined a step further. Applying the 20 percent damage factor as previously described in Section 4.3.10 of the Base Plan, there is a 1% chance in any given year of a flood event causing $10,998 in damage and a 0.2% chance in any given year of a flood event causing $98.7 million in damage in the City of Yuba City. The loss ratio of 0.00% and 0.96% indicates that flood losses for 1% and 0.2% annual chance flooding, respectively, would be somewhat significant, but the City would be able to recover.

Q3/DFIRM Flooded Acres

Also of interest is the land area affected by the various flood zones. The following is an analysis of flooded acres in the City in comparison to total area within the City limits. The same methodology, as discussed in Section 4.3.10 of the Base Plan, was used for the City of Yuba City as well as for the County as a whole. Table B-35 represents a summary analysis of total acres for each FEMA Q3/DFIRM flood zone in the City. Detail on flooded acres by property use is shown in Table B-35.

Table B-35 City of Yuba City – Flooded Acres by Flood Zone Summary

Flood Zone	Total Acres	% of Total Acres*	Improved Acres	% of Total Improved Acres*	Unimproved Acres	% of Total Unimproved Acres*
1% Annual Chance Flood Hazard	277	0.07%	254	0.12%	23	0.01%
0.2% Annual Chance Flood Hazard	670	0.17%	428	0.20%	242	0.13%
Other Areas	7,097	1.76%	5,978	2.84%	1,119	0.58%
City of Yuba City Total	**8,044**	**2.00%**	**6,660**	**3.16%**	**1,384**	**0.72%**

Source: FEMA DFIRM 1/20/2016, FEMA 1998 Q3 data

*this is the percentage of the total acreage in the County

Table B-36 City of Yuba City – Flooded Acres by Flood Zone and Property Use

Flood Zone	Total Acres	% of Total Acres*	Improved Acres	% of Total Improved Acres*	Unimproved Acres	% of Total Unimproved Acres*
1% Annual Chance Flood Hazard						
Zone A						
Agricultural	140.3	0.035%	135.9	0.065%	4.3	0.002%
Commercial	0.4	0.000%	0.1	0.000%	0.3	0.000%
Industrial	2.5	0.001%	1.3	0.001%	1.2	0.001%
Institutional	123.5	0.031%	116.7	0.055%	6.8	0.004%
Miscellaneous	1.0	0.000%			1.0	0.001%
Residential	0.0	0.0%	0.0	0.0%	0.0	0.0%
Vacant	0.0	0.0%	0.0	0.0%	0.0	0.0%
Zone A Total	**267.6**	**0.066%**	**254.0**	**0.121%**	**13.6**	**0.007%**
Zone AE						
Agricultural	0.0	0.0%	0.0	0.0%	0.0	0.0%
Commercial	0.0	0.0%	0.0	0.0%	0.0	0.0%
Industrial	0.0	0.0%	0.0	0.0%	0.0	0.0%
Institutional	1.0	0.000%	0.0	0.0%	1.0	0.001%

Flood Zone	Total Acres	% of Total Acres*	Improved Acres	% of Total Improved Acres*	Unimproved Acres	% of Total Unimproved Acres*
Miscellaneous	0.0	0.0%	0.0	0.0%	0.0	0.0%
Residential	0.0	0.0%	0.0	0.0%	0.0	0.0%
Vacant	8.3	0.002%	0.0	0.0%	8.3	0.004%
Zone AE Total	**9.3**	**0.002%**	**0.0**	**0.0%**	**9.3**	**0.005%**
1% Annual Chance Flood Hazard Total	**277.0**	**0.069%**	**254.0**	**0.121%**	**22.9**	**0.012%**
0.2% Annual Chance Flood Hazard						
X Protected by Levee						
Agricultural	89.0	0.022%	71.7	0.034%	17.3	0.009%
Commercial	30.9	0.008%	29.6	0.014%	1.3	0.001%
Industrial	148.8	0.037%	82.4	0.039%	66.4	0.035%
Institutional	133.0	0.033%	53.2	0.025%	79.8	0.042%
Miscellaneous	10.6	0.003%			10.6	0.006%
Residential	221.0	0.055%	190.8	0.091%	30.2	0.016%
Vacant	36.6	0.009%	0.1	0.000%	36.5	0.019%
X Protected by Levee Total	**669.9**	**0.166%**	**427.9**	**0.203%**	**242.0**	**0.126%**
0.2% Annual Chance Flood Hazard Total	**669.9**	**0.166%**	**427.9**	**0.203%**	**242.0**	**0.126%**
Other Areas						
Zone X (unshaded)						
Agricultural	938.3	0.233%	782.6	0.372%	155.7	0.081%
Commercial	353.0	0.088%	255.6	0.121%	97.3	0.051%
Industrial	392.0	0.097%	260.2	0.124%	131.8	0.069%
Institutional	303.7	0.075%	133.2	0.063%	170.4	0.089%
Miscellaneous	21.7	0.005%	0.0	0.0%	21.7	0.011%
Residential	2,318.0	0.576%	2,313.6	1.099%	4.5	0.002%
Vacant	111.3	0.028%	7.5	0.004%	103.8	0.054%
Zone X (unshaded) Total	**4,438.0**	**1.103%**	**3,752.7**	**1.782%**	**685.3**	**0.357%**
Zone C						
Agricultural	0.1	0.000%	0.1	0.000%		
Commercial	665.0	0.165%	601.5	0.286%	63.4	0.033%
Industrial	264.8	0.066%	170.0	0.081%	94.8	0.049%
Institutional	452.0	0.112%	264.8	0.126%	187.1	0.098%

Flood Zone	Total Acres	% of Total Acres*	Improved Acres	% of Total Improved Acres*	Unimproved Acres	% of Total Unimproved Acres*
Miscellaneous	45.3	0.011%			45.3	0.024%
Residential	1,199.3	0.298%	1,184.3	0.562%	15.0	0.008%
Vacant	32.7	0.008%	4.8	0.002%	27.9	0.015%
Zone C Total	**2,659.1**	**0.661%**	**2,225.5**	**1.057%**	**433.6**	**0.226%**
Other Areas Total	**7,097.1**	**1.763%**	**5,978.2**	**2.839%**	**1,118.9**	**0.583%**
City of Yuba City Total	**8,043.9**	**1.999%**	**6,660.1**	**3.163%**	**1,383.8**	**0.721%**

Source: FEMA DFIRM 1/20/2016, FEMA 1998 Q3 data
*this is the percentage of the total acreage in the County

Q3/DFIRM Population at Risk

The Q3/DFIRM flood zones were overlayed on the parcel layer. Those residential parcel centroids that intersect the flood zones were counted and multiplied by the 2010 Census Bureau average household factors for Yuba City – 2.99. According to this analysis, there is a total population of 0 and 3,187 residents of the City at risk to flooding in the 1% and 0.2% annual chance floodplains, respectively. This is shown in Table B-37. It should be noted that the 0.2% annual chance floodplain in the City is the same as the X Protected by Levee area.

Table B-37 City of Yuba City – Count of Improved Residential Parcels and Population by Flood Zone

Jurisdiction	1 % Annual Chance Flooding		0.2% Annual Chance Flooding	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Yuba City	0	0	1,066	3,187

Source: FEMA DFIRM 6/15/2015, FEMA 1998 Q3 data, Sutter County 2020 Parcel/Assessor's Data, US Census Bureau

Q3/DFIRM Critical Facilities at Risk

INSERT

Yuba City 200 -Year Values at Risk

INSERT

Yuba City 200-Year Flooded Acres

INSERT

Yuba City 200-Year Populations at Risk

INSERT

Yuba City 200-Year Critical Facilities at Risk

INSERT

Local Flood Study Area Values at Risk

GIS was used to determine the possible impacts of flooding within the City of Yuba City. The methodology described in Section 4.3.10 of the Base Plan was followed in determining structures and values at risk in the Local Flood Study Areas. Table B-38 is a summary table for the City of Yuba City. Parcel counts, values, estimated contents, and total values in the City are shown for the Local Flood Study Areas. Table B-39 breaks down Table B-38 and shows the property use, improved parcel count, improved values, estimated contents, and total values that fall in Local Flood Study Areas in the City.

Table B-38 City of Yuba City – Count and Value of Parcels in Local Flood Study Area

INSERT

Source: Yuba City Local Flood Study Area, Sutter County 2020 Parcel/Assessor's Data

Table B-39 City of Yuba City – Count and Values of Parcels by Local Flood Study Area and Property Use

INSERT

Source: Yuba City Local Flood Study Area, Sutter County 2020 Parcel/Assessor's Data

Local Flood Study Areas Flooded Acres

Also of interest is the land area affected by the Local Flood Study Area affecting the City of Yuba City. The following is an analysis of flooded acres in the City in comparison to total area within the City limits. The same methodology, as discussed in Section 4.3.10 of the Base Plan, was used for the City of Yuba City as well as for the County as a whole. Table B-40 represents a summary analysis of total acres for each Local Flood Study Area in the City. A detailed analysis by property use for those acres that fall in the Local Flood Study Area is shown in Table B-41.

Table B-40 City of Yuba City – Flooded Acres by Local Flood Hazard Study Area

INSERT

Source: Yuba City Local Flood Study
*this is the percentage of the total acreage in the County

Table B-41 City of Yuba City – Flooded Acres by Local Flood Hazard Study Area

INSERT

Source: Yuba City Local Flood Study

*this is the percentage of the total acreage in the County

Local Flood Study Population at Risk

The Local Flood Study Area was overlayed on the parcel layer. Those residential parcel centroids that intersect the Local Flood StudyArea were counted and multiplied by the 2010 Census Bureau average household factors for Yuba City – 2.99. This is shown in Table B-42.

Table B-42 City of Yuba City – Count of Improved Residential Parcels and Population by Local Flood Study Area

INSERT

Source: Yuba City Local Flood Study, Sutter County 2020 Parcel/Assessor's Data, US Census Bureau

Critical Facilities at Risk

INSERT

Insurance Coverage, Claims Paid, and Repetitive Losses

The City of Yuba City joined the National Flood Insurance Program (NFIP) on March 23, 1984. The City joined the Community Rating System (CRS) program on October 1, of 2007. The City is currently a CRS Class 6 community, which provides for a 20% discount to flood insurance policies in the Special Flood Hazard Area (SFHA), and a 10% discount to those outside of the SFHA. NFIP data indicates that as of March 24, 2020, there were 1,309 flood insurance policies in force in the City with $436,514,200 of coverage. Of the 1,309 policies, 1,138, were residential (single-family homes), 50 were for multi-family, 26 were for other residential, and 95 were for non-residential properties. 0 policies were located in A zones, while 1,309 were in B, C, and X zones. Of these 1,309 policies in the B, C, or X zones, 33 were standard policies, while 1,276 were preferred risk policies. The GIS parcel analysis detailed above identified no improved parcels in the 1% annual chance flood zone. There have been 21 historical claims for flood losses totaling $15,570.82. There have been no substantial damage claims in the City. NFIP data further indicates that there are no repetitive loss (RL) or severe repetitive loss (SRL) buildings in Yuba City.

California Department of Water Resources Best Available Maps (BAM)

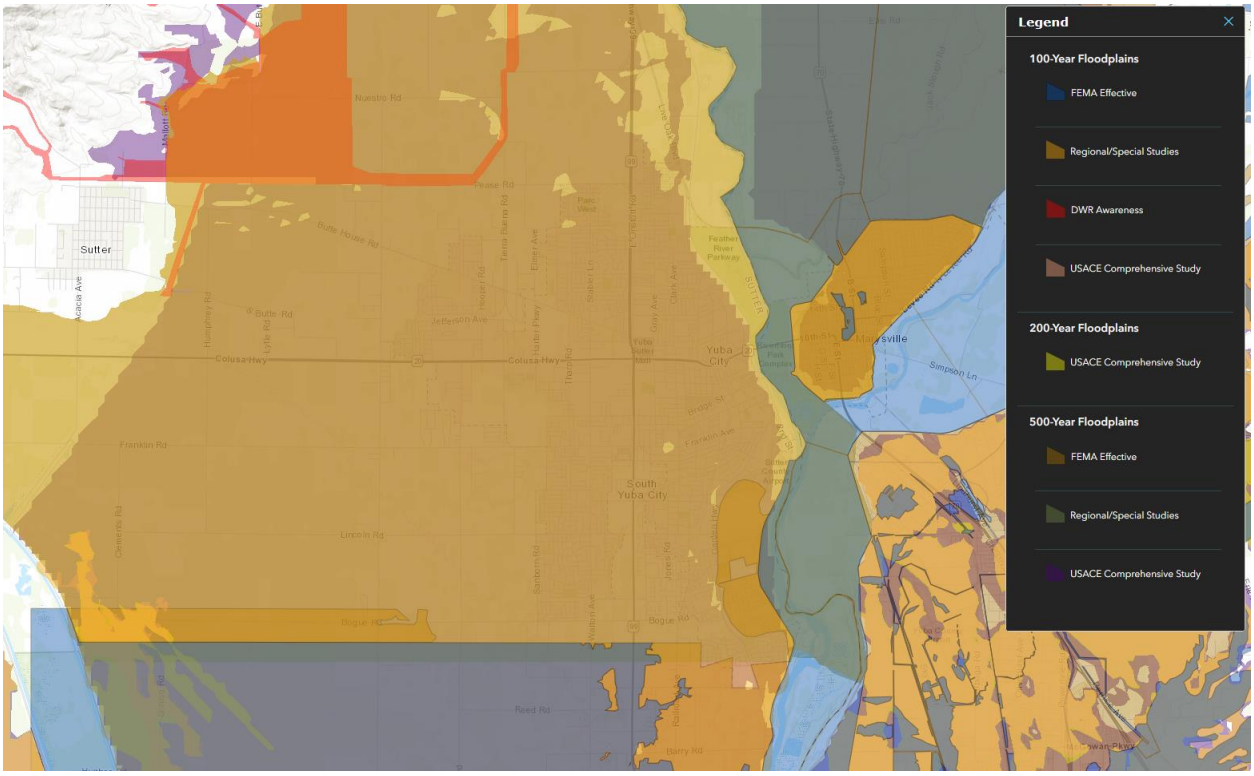
The FEMA regulatory maps provide just one perspective on flood risks in Sutter County. Senate Bill 5 (SB 5), enacted in 2007, authorized the California DWR to develop the Best Available Maps (BAM) displaying 100- and 200-year floodplains for areas located within the Nevada-San Joaquin (SAC-SJ) Valley watershed. This effort was completed by DWR in 2008. DWR has expanded the BAM to cover all counties in the State and to include 500-year floodplains.

Different than the FEMA DFIRMs which have been prepared to support the NFIP and reflect only the 100-year event risk, the BAMs are provided for informational purposes and are intended to reflect current 100-, 200-(as applicable), and 500-year event risks using the best available data. The 100-year floodplain limits on the BAM are a composite of multiple 100-year floodplain mapping sources. It is intended to show all currently identified areas at risk for a 100-year flood event, including FEMA's 100-year floodplains. The

BAM are comprised of different engineering studies performed by FEMA, Corps, and DWR for assessment of potential 100-, 200-, and 500-year floodplain areas. These studies are used for different planning and/or regulatory applications, and for each flood frequency may use varied analytical and quality control criteria depending on the study type requirements.

The value in the BAMs is that they provide a bigger picture view of potential flood risk to the City than that provided in the FEMA DFIRMs. The BAM map for Yuba City is shown in Figure B-11.

Figure B-11 City of Yuba City – Best Available Map



Source: California DWR

Legend explanation: Blue - FEMA 1%, Orange – Local 1% (developed from local agencies), Red – DWR 1%r (Awareness floodplains identify the 1% annual chance flood hazard areas using approximate assessment procedures.), Pink – USACE 1% (2002 Sac and San Joaquin River Basins Comp Study), Yellow – USACE 0.5% (2002 Sac and San Joaquin River Basins Comp Study), Tan – FEMA 0.2%, Grey – Local 0.2% (developed from local agencies), Purple – USACE 0.2%(2002 Sac and San Joaquin River Basins Comp Study).

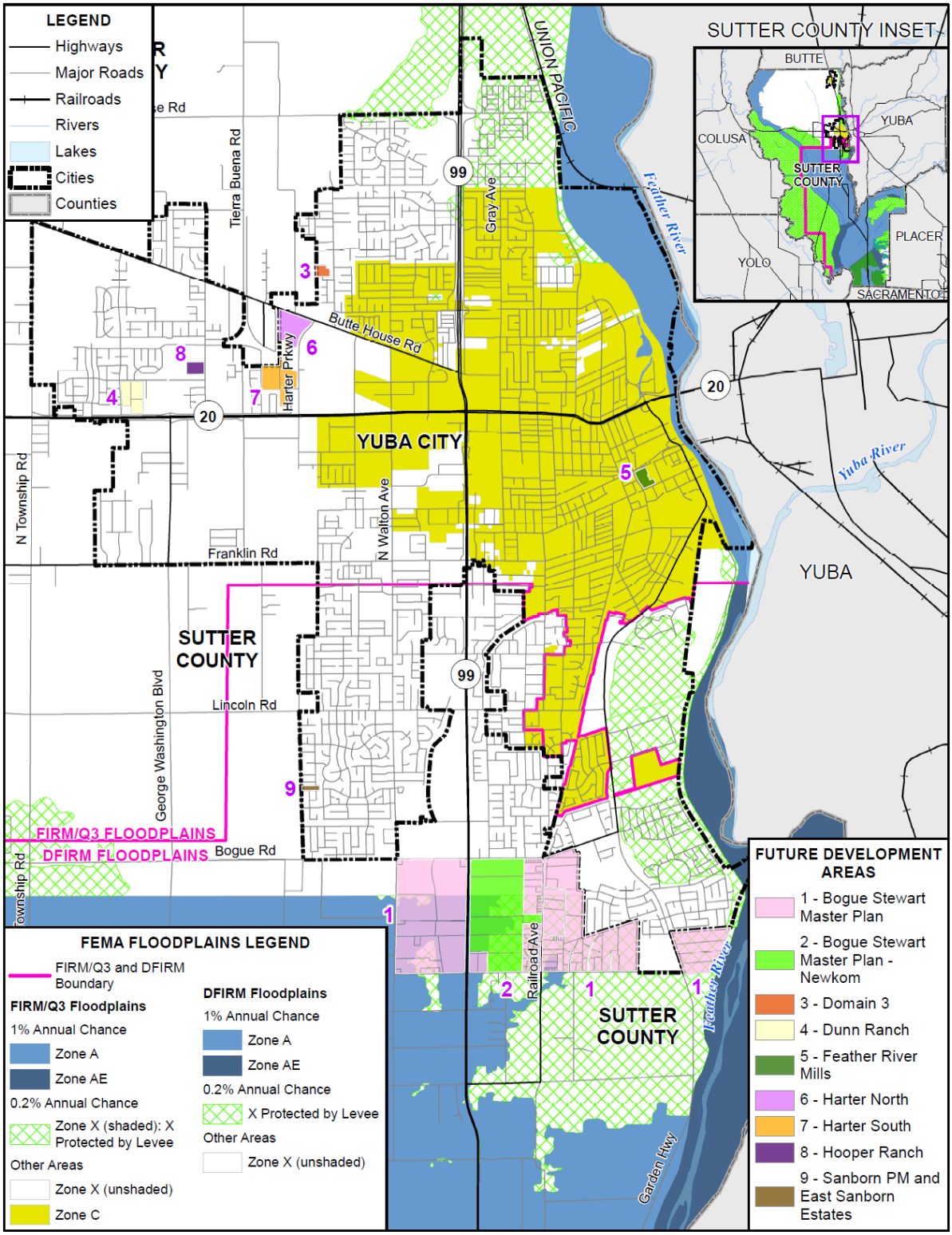
Future Development

The potential for flooding may increase as floodwaters are channeled due to land development. Such changes can exacerbate flooding problems inside and outside of natural floodplains by altering or confining natural drainage channels. Floodplain modeling and master planning should be based on build out property use to ensure that all new development remains safe from future flooding. While local floodplain management, stormwater management, and water quality regulations and policies address these changes on a site-by-site basis, their cumulative effects can have a negative impact on the overall floodplain.

GIS Analysis

The City provided Future Development Areas were used as the basis for the inventory of future development areas for the City. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts within each area. Figure B-12 shows the locations of future development areas the City is planning to develop on the FEMA DFIRM. Table B-43 shows the parcels and acreages of each future development area in the City by DFIRM flood zone. Figure B-13 shows the parcels and acreages of each future development area in the City by Local Flood Hazard Study area. Table B-44 shows the parcels and acreages of each future development area in the City by Local Flood Hazard Study area.

Figure B-12 City of Yuba City – Future Development and DFIRM/Q3 Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table B-43 City of Yuba City – Future Development Parcels and Acres in DFIRM/Q3 Flood Zones

Future Development / Flood Zone	Total Parcel Count	Improved Parcel Count	Total Acres
1% Annual Chance Flood Hazard			
Zone A			
Bogue Stewart Master Plan	18	15	133.0
Bogue Stewart Master Plan - Newkom	2	2	89.2
Zone A Total	**20**	**17**	**222.2**
1% Annual Chance Flood Hazard Total	**20**	**17**	**222.2**
0.2% Annual Chance Flood Hazard			
X Protected by Levee			
Bogue Stewart Master Plan	68	61	265.6
Bogue Stewart Master Plan - Newkom	3	3	51.3
X Protected by Levee Total	**71**	**64**	**316.9**
0.2% Annual Chance Flood Hazard Total	**71**	**64**	**316.9**
Other Areas			
Zone X (unshaded)			
Bogue Stewart Master Plan	23	16	151.2
Bogue Stewart Master Plan - Newkom	1	1	27.4
Domain 3	1	0	3.9
Dunn Ranch	3	1	18.5
Harter North	1	1	21.8
Harter South	2		27.9
Hooper Ranch	1	1	6.4
Sanborn PM and East Sanborn Estates	1	0	2.4
Zone X (unshaded) Total	**33**	**20**	**259.5**
Zone C			
Feather River Mills	1		6.5
Zone C Total	1		6.5
Other Areas Total	**34**	**20**	**266.0**
Yuba City Total	**125**	**101**	**805.1**

Source: FEMA 6/16/2015 DFIRM, City of Yuba City GIS

Figure B-13 City of Yuba City – Future Development and Local Flood Hazard Study Area

INSERT

Table B-44 City of Yuba City – Future Development Parcels and Acres in Local Flood Hazard Study Area

INSERT

Source: Yuba City Local Flood Study, City of Yuba City GIS

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Flooding occurs in areas other than the FEMA mapped 1% and 0.2% annual chance floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate maintenance. Localized, stormwater flooding occurs throughout the County and City during the rainy season from November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration.

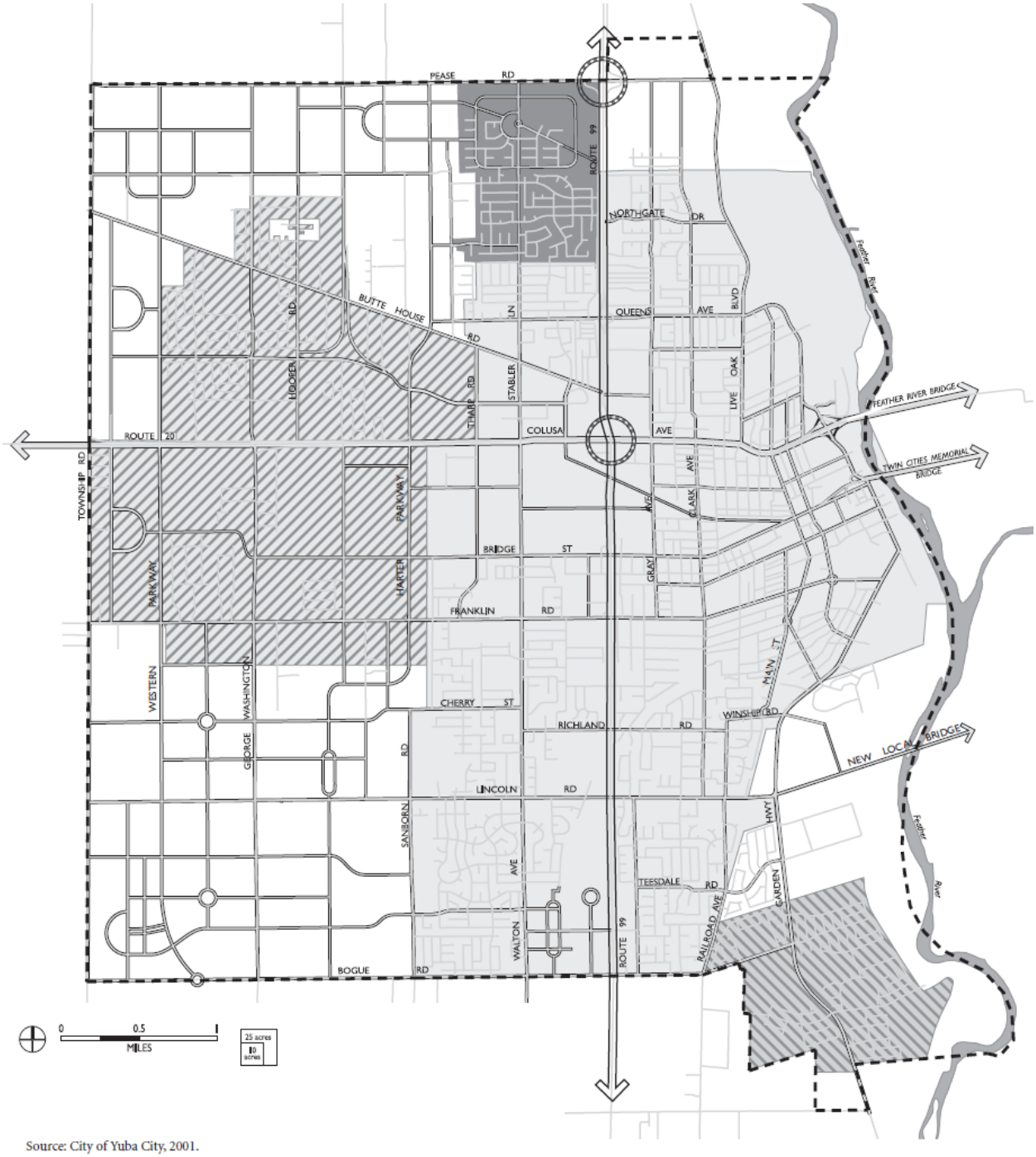
Location and Extent

The City of Yuba City is subject to localized flooding throughout the City. Flood extents are usually measured in areas affected, velocity of flooding, and depths of flooding. Expected flood depths in the City vary by location. Flood durations in the City tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Localized flooding in the City tends to have a shorter speed of onset, especially when antecedent rainfall has soaked the ground and reduced its capacity to absorb additional moisture.

Yuba City is located on an alluvial terrace that generally drains to the southwest. The Sacramento River drains the entire county and the Sacramento Valley with the final outlet being the Delta and San Francisco Bay. Drainage facilities in Yuba City include the Gilsizer Slough, Live Oak Canal, and various City facilities. These facilities are summarized below and illustrated in Figure B-14.

- **Gilsizer Slough**. At one time, this natural drainage channel drained Yuba City and areas to the south of the urban area. The Slough discharges to the State Drain, which flows north to State Pumping Plant No. 2, and then into the Sutter Bypass. Tributaries to the Gilsizer Slough are included in the Gilsizer County Drainage District, except for a small area north of Colusa Highway, which is pumped into the Feather River.
- **Live Oak Canal**. This facility once drained runoff from areas north of Pease Road including an area that is now part of the Tierra Buena County Drainage District. The area north of Pease Road is now drained by the State East Interceptor Canal. This canal drains to the Sutter Bypass through the Wadsworth Canal.
- **City Facilities**. Portions of north and south Yuba City are drained to holding ponds. This water is then pumped over the levee into the Feather River. The Garden Highway/Bogue Road area is also pumped into the Feather River.

Figure B-14 Drainage Facilities in Yuba City



Source: City of Yuba City, 2001.

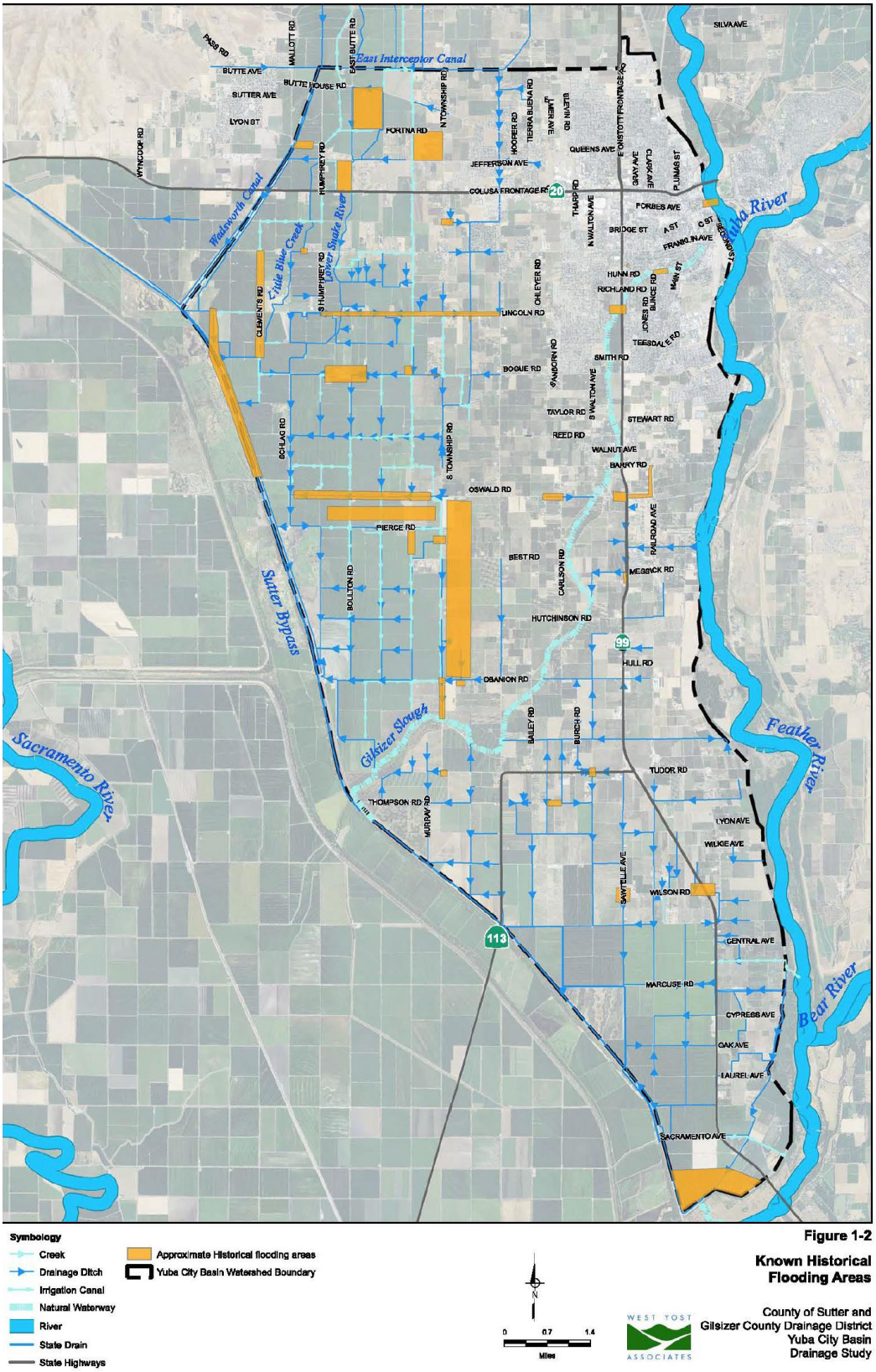
- Gilsizer Drainage Area
- North Yuba Drainage Area
- South Ponds Drainage Area
- County Drainage Area

Figure 9-5
Drainage Facilities

Source; 2004 Yuba City General Plan Update

The City tracks localized flooding areas. Sutter County staff have documented the flooding problems by recording correspondence, complaints, requests for maintenance, photos, and other reports of flooding events. These approximate locations of the historical flooding problems are shown on Figure B-15. These documented flooding problems do not include the many complaints the County has received from citizens regarding flooding on private property. Affected localized flood areas identified by the City of Yuba City are summarized in Table B-45.

Figure B-15 Yuba City – Known Historical Flooding Areas



Source: 2018 Yuba City Drainage Study

Table B-45 City of Yuba City – List of Localized Flooding Problem Areas

Area Name	Flooding	Pavement Deterioration	Washout	High Water	Landslide/ Mudslide	Debris	Downed Trees
Concrete Streets	Yes	No	No	Yes	No	Branches/Leaves	Yes
Palora Ave	Yes	No	No	Yes	No	Branches/Leaves	No
Garden @ Stewart	Yes	No	No	Yes	No	Dirt/Mud	No
B St. (Plumas-Clark)	Yes	No	No	Yes	No	Branches/Leaves	Yes

Source: City of Yuba City
Concrete Streets= Plumas St.- Cooper Ave. / Hwy 20-Reeves Ave
Palora = N. Palora Ave from B St. to Franklin Rd.
Garden Highway at Stewart St.= (2) field DI's north of Stewart St.

Past Occurrences

The City noted the following past occurrences of localized flooding:

Yuba City incurred damage as a result of high water events occurring during the 2005-2006 winter storms from December 17, 2005 through January 3, 2006. Of primary concern to the City was damage associated with two city-owned properties:

- Damage to six effluent percolation ponds on the east side of the Feather River, southeast of the City's Wastewater Treatment Facility. The ponds, composed of graded earthen fill, are an integral part of the wastewater treatment process. Heavy rains and severe storms caused the Feather River to flood its banks, overtopping the adjacent percolation ponds and causing damage to the structure of each of the six ponds. The damages sustained include silt debris deposits, scour along the pond levee slopes and pond bottoms, tearing/displacement of the fabric lining of the ponds, washout of rip rap and fill along the pond slopes, and erosion damage and washout of fill around the concrete spillways of each pond. Similar damages occurred in previous high water events in 1986, 1995, and 1997.
- Damage to the Low Lift Station Access Road which runs along the banks of the Feather River. The roadway, shoulders and embankments are composed of graded and compacted aggregate base and backfill. Severe storms caused the Feather River to flood over its banks and resulted in major roadway flooding that washed out the roadway, roadway shoulders and integral ground of both along sections of the Low Lift Station Access Road.

Vulnerability to and Impacts from Localized Flooding

Historically, much of the growth in the City and County has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff.

Drainage and stormwater runoff are related issues, contributing to potential flooding, which is the most significant risk to life and property in Yuba City. The area of the County with the greatest potential to be impacted by drainage and flooding problems is the Yuba City Urban Area. The greatest potential threat to the Yuba City Urban Area would be flooding resulting from failure of levees along the Feather River. In addition to a damaging flood resulting from a dam or levee failure, the urban area is highly susceptible to flooding from stormwater runoff. As development continues to occur in the urban area, the increase in

impervious surfaces will result in increased overall run-off at an accelerated rate. Ongoing improvements to the drainage infrastructure are being designed and constructed to accommodate this increase in run-off; however, removing run off and flood waters from the urban area does not in itself resolve drainage issues. Lack of downstream channel maintenance and limited flow capacity within the Sutter Bypass can backup flood waters and also contributes to localized flooding issues within the urban area.

Primary concerns associated with stormwater flooding include impacts to infrastructure that provides a means of ingress and egress throughout the community. Ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Objects can also be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt services. Standing water can cause damage to crops, roads, and foundations. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Future Development

Future development in the City will add more impervious surfaces causing an increase in stormwater runoff and the continued need to drain these waters. The City adopted a Stormwater Management and Discharge Control ordinance in 2016 which provides the City with authority to set requirements to minimize the potential increase of stormwater runoff associated with new development and redevelopment projects. The City will need to be proactive to ensure that increased development has proper siting and drainage for stormwaters. The risk of localized flooding to future development can also be minimized by accurate recordkeeping of repetitive localized storm activity. Mitigating the root causes of the localized stormwater flooding will reduce future risks of losses. The City has a track record of addressing localized flooding in the past, and will continue those efforts in the future

Levee Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–Extremely High

Hazard Profile and Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main channel of a stream. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

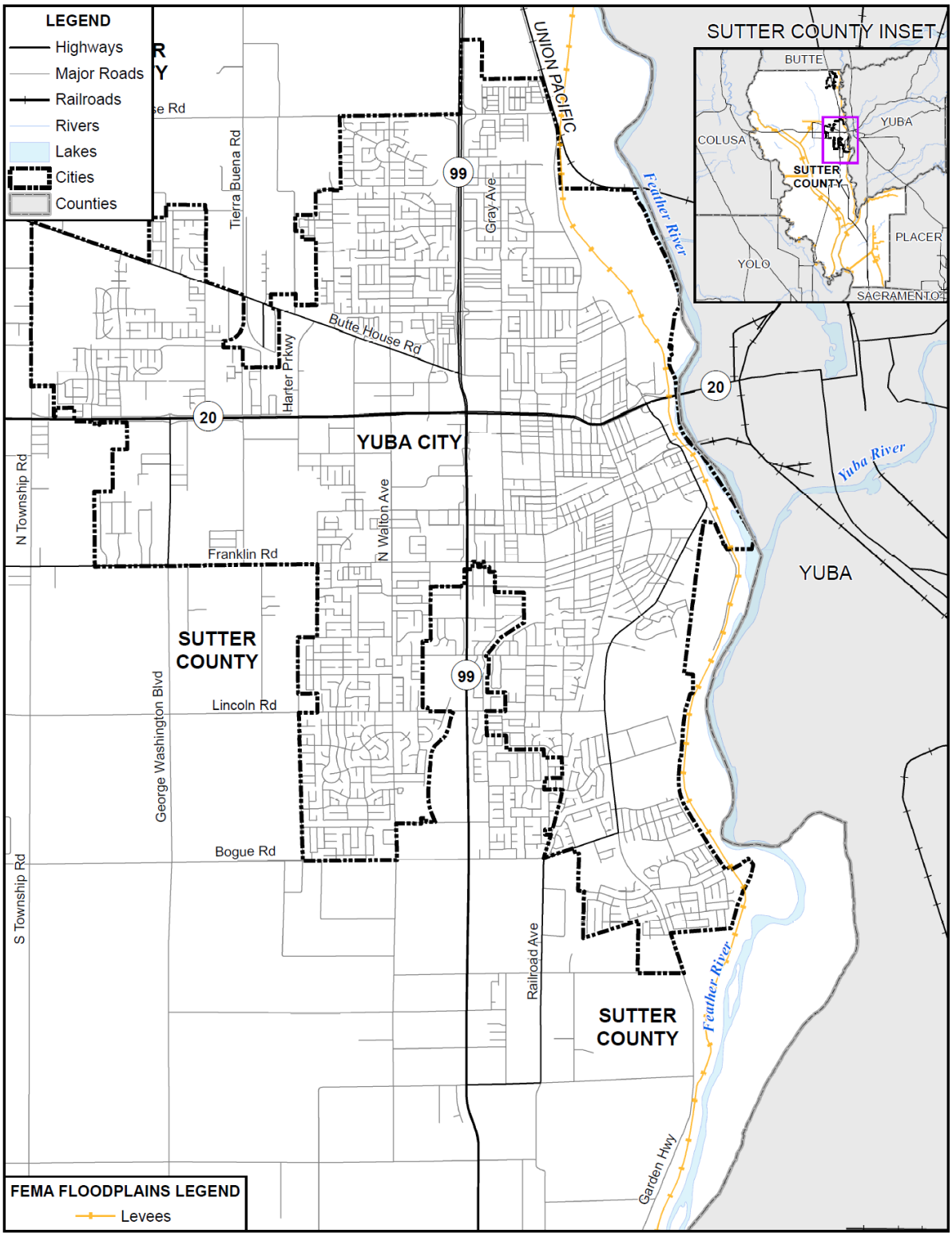
Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% and 0.5% annual chance floods. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection

from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

Yuba City is located in Sutter County, within the Sutter Basin (Basin). The Sutter Basin is bounded by levees on Cherokee Canal, Feather River, Sutter Bypass and Wadsworth Canal. These levees were constructed by the U.S. Army Corps of Engineers (USACE) as part of the Sacramento River Flood Control Project and are currently operated and maintained by local maintaining agencies (LMA). The Sutter Basin covers about 326 square miles and is about 44 miles long north to south and up to 14 miles wide east to west. It is bounded by the Feather River (to the east) and Cherokee Canal, the Sutter Buttes, and Sutter Bypass (to the west, listed from north to south). Floodwaters potentially threatening the Basin originate from the Feather River watershed or the upper Sacramento River watershed, above the Sutter Bypass. The Feather River and Sutter Bypass meet at the southern end of the Basin. Both of these waterways are leveed systems, creating a barrier between the Sutter Basin and the surrounding streams. The Yuba River terminates into the Feather River on the east side of the Basin, near Yuba City. In addition to Yuba City, communities in the Basin include Biggs, Gridley, Live Oak, and Sutter. Levee locations in and around the City can be seen on Figure B-16. Levee locations in the region can be seen on Figure B-17.

Figure B-16 City of Yuba– Levee Locations

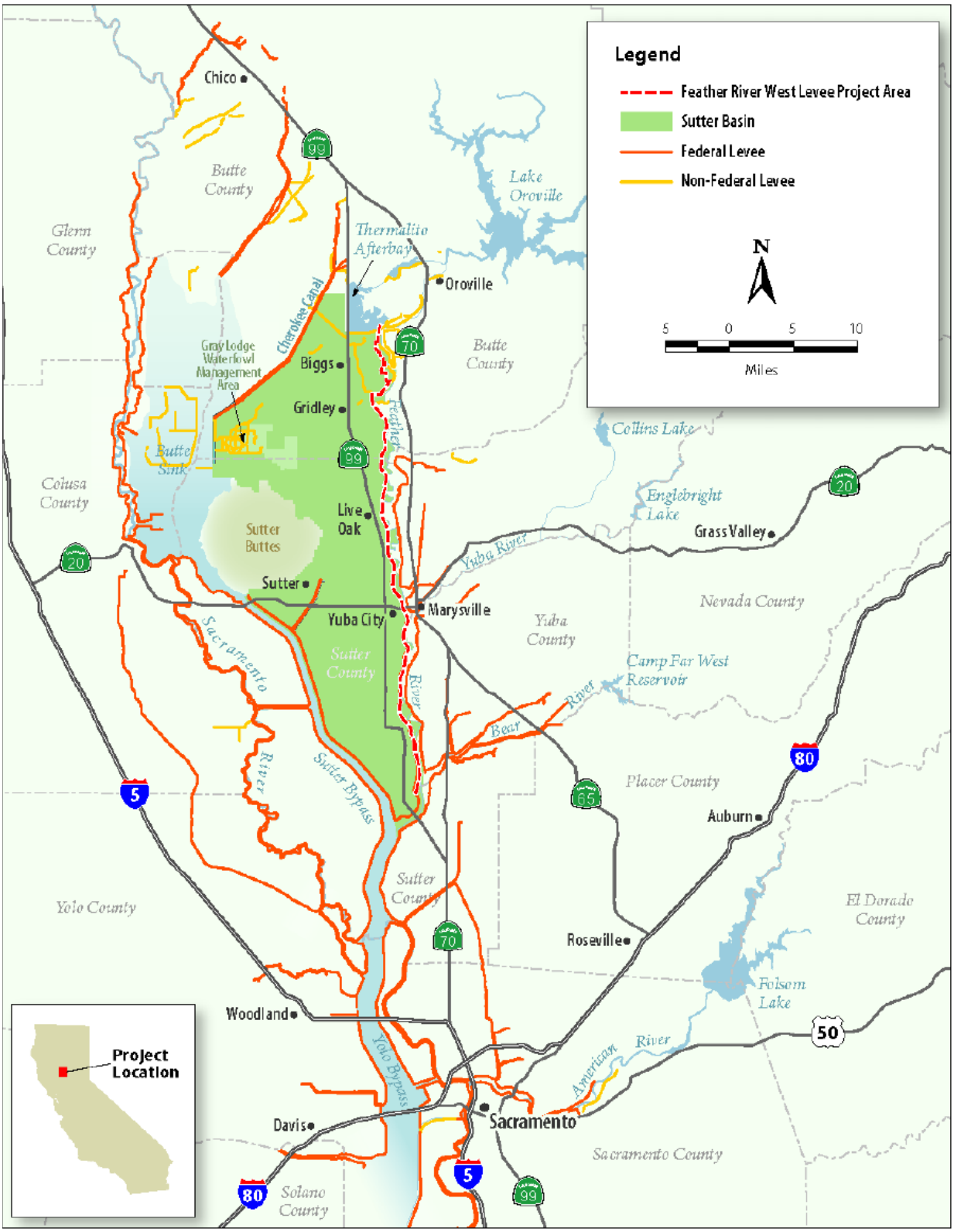


FOSTER MORRISON CONSULTING

0 1 2 Miles

Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure B-17 City of Yuba City – Regional Levee Map



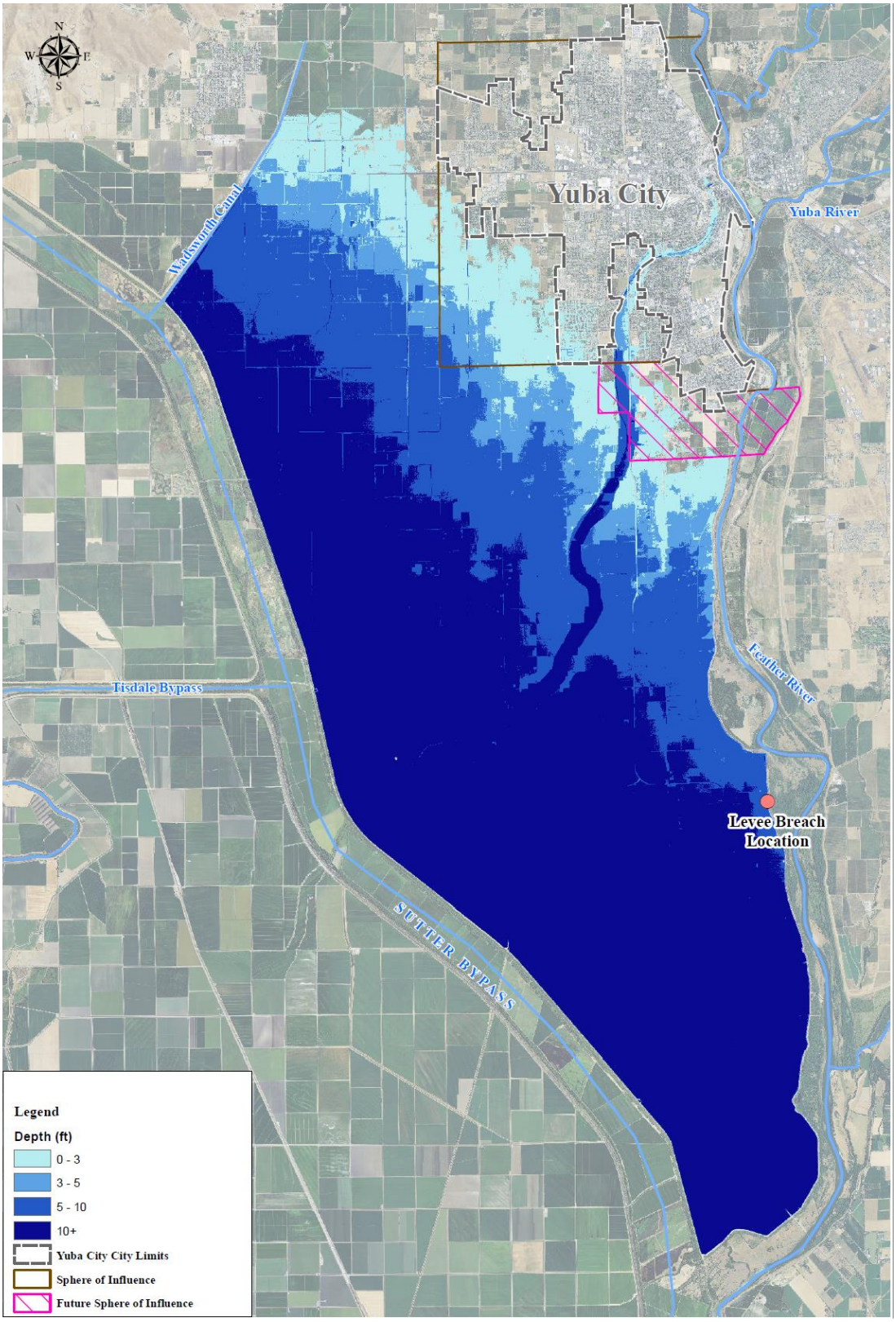
Source: Determination Of 1-In-200-Year Floodplain for the City of Yuba City Urban Level of Flood Protection Determination – MBK Engineers

There is not a scientific scale or measurement system in place for levee failure. In order to measure, levee break scenarios must be performed. Two levee break scenarios were completed in the 2015 Determination Of 1-In-200-Year Floodplain for the City of Yuba City Urban Level of Flood Protection Determination done by MBK Engineers. Two scenarios were put together in this report:

- breach of the Feather River west levee downstream from Star Bend and
- breach of the Sutter Bypass east levee approximately 4 miles downstream of Wadsworth Canal.

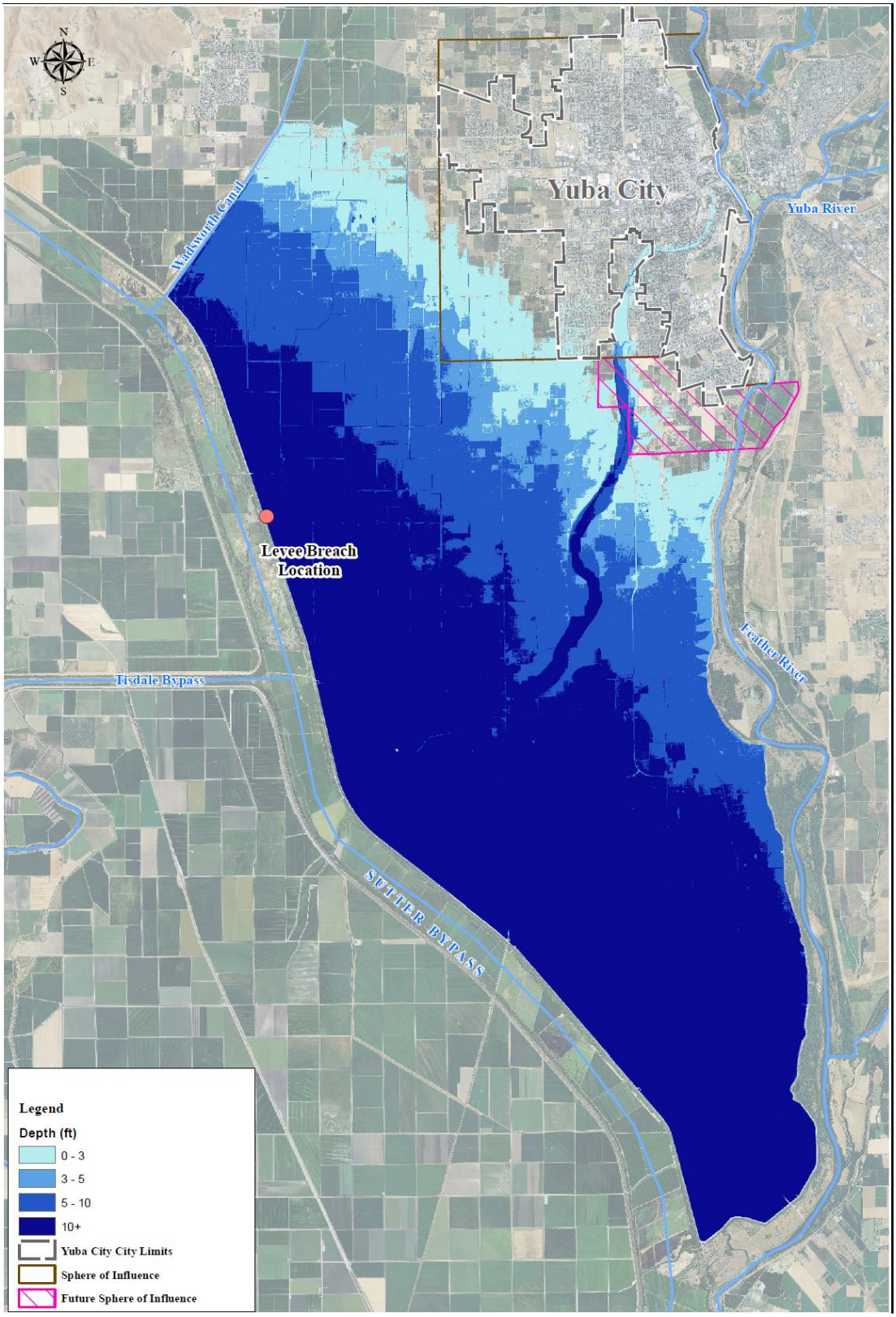
For these two scenarios, all other levees in the system were assumed to not fail and act as weirs if overtopped. Expected flood depths from the two levee failure scenarios are shown below in Figure B-18 and Figure B-19.

Figure B-18 City of Yuba City – Feather River Breach Scenario Flood Depths



Source: Determination Of 1-In-200-Year Floodplain for the City of Yuba City Urban Level of Flood Protection Determination – MBK Engineers

Figure B-19 City of Yuba City – Sutter Bypass Breach Scenario Flood Depths



Source: Determination Of 1-In-200-Year Floodplain for the City of Yuba City Urban Level of Flood Protection Determination – MBK Engineers

The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. The City noted that when northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees.

Past Occurrences

The City Planning Team noted no past occurrences of levee failures.

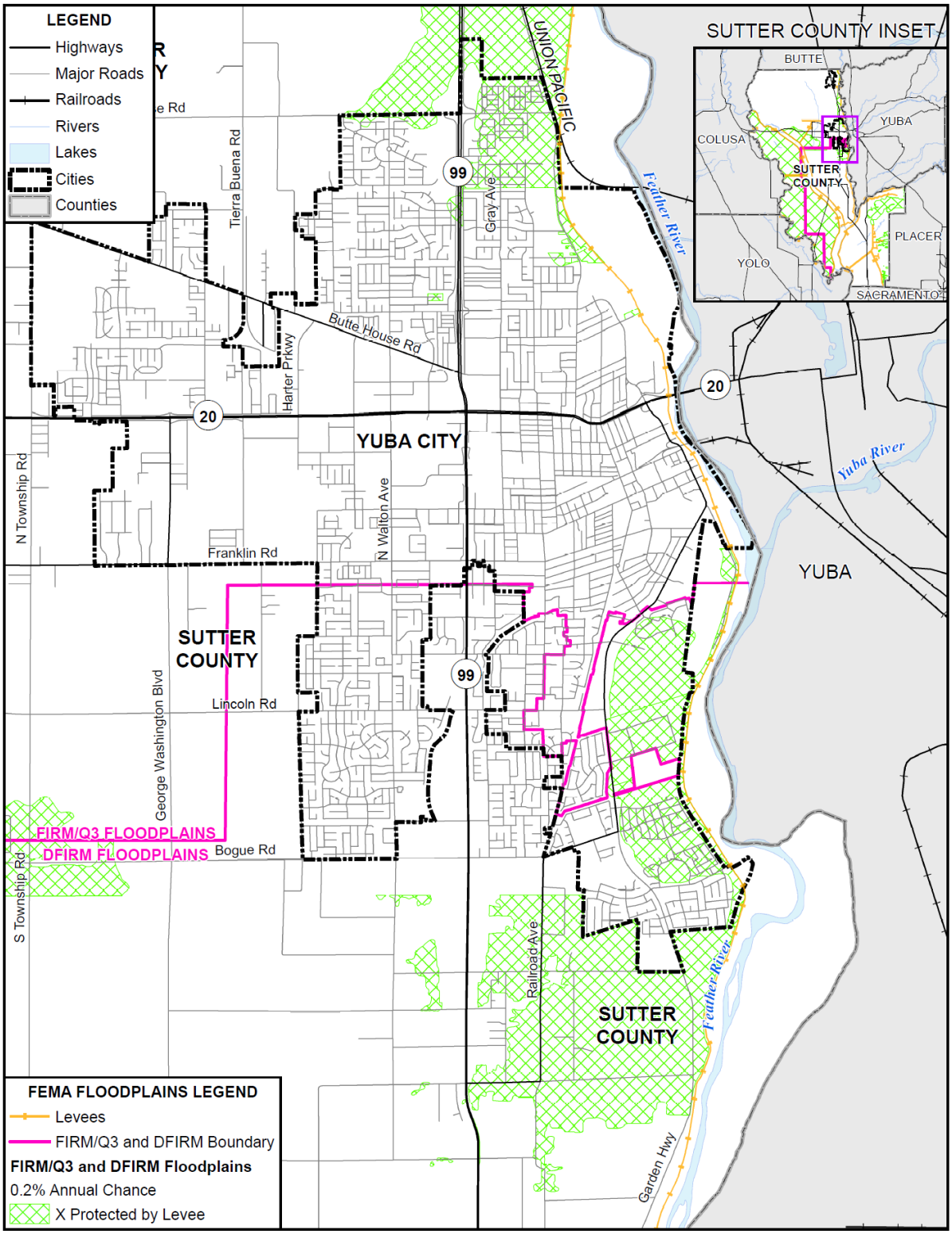
Though not a failure, in early 2017, a 2.9 mile segment of levee adjacent to the City's urban center (from approximately Gilsizer Slough south to Whiteaker Hall) showed signs of severe distress – such as seepage, sink holes and boils, and waterside erosion during winter/spring storm events and in the days following the Oroville spillway failure. Local agencies and the State averted potential disaster by aggressive flood fighting over a period of several weeks. SBFCA had no plans to repair this stretch of levee, because the US Army Corps of Engineers had previously installed a slurry wall within it (2000). However, the poor performance of the slurry wall led SBFCA and the State to plan an emergency repair for completion before the next flood season. The US Army Corps of Engineers and the Central Valley Flood Protection Board expedited the approval of permits required for the project, allowing construction to begin August 2, 2017. Given the scope and scale of the repairs, construction will be completed by December 1, which is one month after the start of flood season. The majority of the $28.5 million project is being paid for by the California Department of Water Resources.

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

The most significant risk from flooding in Yuba City results from the potential for dam or levee failure. Overtopping of the Feather River levees is considered to be a significant local concern due to the general topography of the region. The Feather River, which forms the eastern border of the General Plan Study Area, consists of a large watershed that stretches to the Sierra Crest. The City's location in the lower portions of the watershed exposes the community to substantial risk from riverine flooding. Additionally riverine flooding can overwhelm the integrity of the local or regional levee system. Levee failure can result if water overtops a levee, if high river levels saturate the levee banks, or if the levee itself is structurally defective. Levee failure can occur very rapidly with little warning. Once a levee is breached, floodwaters can inundate large low-lying areas. Levee overtopping or failure could cause catastrophic flooding in the City.

Figure B-20 City of Yuba City – Q3/DFIRM Levee Protected Areas



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and significant life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Values at Risk

GIS was used to determine the possible impacts of levee failure flooding within the City of Yuba City. The methodology described in Section 4.3.10 of the Base Plan was followed in determining structures and values at risk to levee failure flood events. Table B-46 shows the property use, improved parcel count, improved values, estimated contents, and total values that fall in FEMA X Protected by Levee flood zones in the City.

Table B-46 City of Yuba City – Count and Values of Parcels by Detailed Flood Zone by Property Use

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
X Protected by Levee						
Agricultural	4	2	$1,143,815	$62,008	$62,008	$1,267,831
Commercial	9	8	$3,130,249	$6,073,426	$6,073,426	$15,277,101
Industrial	22	11	$3,889,580	$3,555,833	$5,333,750	$12,779,163
Institutional	29	18	$8,517,049	$54,035,157	$54,035,157	$116,587,363
Miscellaneous	151	0	$0	$0	$0	$0
Residential	1,375	1,066	$62,805,145	$242,584,451	$121,292,226	$426,681,822
Vacant	53	1	$3,336,292	$280,500		$3,616,792
X Protected by Levee Total	**1,643**	**1,106**	**$82,822,130**	**$306,591,375**	**$186,796,566**	**$576,210,071**

Source: FEMA 6/16/2015 DFIRM, FEMA 1998 Q3 data, Sutter County 2020 Parcel/Assessor's Data

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

Flooded Acres

Also of interest is the land area affected by the various flood zones. The following is an analysis of levee protected flooded acres in the City in comparison to total area within the City limits. The same methodology, as discussed in Section 4.3.10 of the Base Plan, was used for the City of Yuba City as well as for the County as a whole. Table B-47 represents a summary analysis of total acres for the levee protected areas in the City.

Table B-47 City of Yuba City – Flooded Acres by Flood Zone

Flood Zone	Total Acres	% of Total Acres*	Improved Acres	% of Total Improved Acres*	Unimproved Acres	% of Total Unimproved Acres*
Agricultural	89.0	0.022%	71.7	0.034%	17.3	0.009%
Commercial	30.9	0.008%	29.6	0.014%	1.3	0.001%
Industrial	148.8	0.037%	82.4	0.039%	66.4	0.035%
Institutional	133.0	0.033%	53.2	0.025%	79.8	0.042%
Miscellaneous	10.6	0.003%			10.6	0.006%
Residential	221.0	0.055%	190.8	0.091%	30.2	0.016%
Vacant	36.6	0.009%	0.1	0.000%	36.5	0.019%
X Protected by Levee Total	**669.9**	**0.166%**	**427.9**	**0.203%**	**242.0**	**0.126%**

Source: FEMA DFIRM 1/20/2016 FEMA 1998 Q3 data

*this is the percentage of the total acreage in the County

Populations at Risk

The DFIRM X-protected by levee flood zones were overlayed on the parcel layer. Those residential parcel centroids that intersect the X-protected by levee flood zones were counted and multiplied by the 2010 Census Bureau average household factors for Yuba City – 2.99. According to this analysis, there is a total population of 3,187 residents of the City at risk to levee failure flooding. This is shown in Table B-48.

Table B-48 City of Yuba City – Count of Improved Residential Parcels and Population in Levee Protected Flood Zones

Jurisdiction	X Protected by Levee Areas	
	Improved Residential Parcels	Population
Yuba City	1,066	3,187

Source: FEMA DFIRM 6/15/2015, FEMA 1998 Q3 data. Sutter County 2020 Parcel/Assessor's Data, US Census Bureau

Critical Facilities at Risk

TO BE INSERTED

Future Development

Future development built in the areas protected by levees is subject to being built to the standards in the City of Yuba City Floodplain Ordinance. Whether a levee is certified as providing protection from the 1% or 0.5% annual chance flood will also factor into development requirements. Future development in levee protected areas may be affected by this hazard, thus there will always be some level of concern. The City requires any development proposed near the levee to be reviewed by Levee District 1.

GIS Analysis

TO BE INSERTED

Pandemic

Likelihood of Future Occurrence–Occasional
Vulnerability–High

Hazard Profile and Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity. It is important to realize that this LHMP Update does not examine pandemic contingency plans, but instead focuses on examining the risk of a normal hazard occurrence.

A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the WHO to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning and preparation. An especially severe pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the City, County, and surrounding region is at risk, as pandemic is a regional, national, and international event. The speed of onset of pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by number who die from complications from the pandemic.

Past Occurrences

There has been one state and federal disaster declaration due to pandemic, as shown in Table B-49.

Table B-49 Sutter County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

The 20th century saw three outbreaks of pandemic flu.

- The 1918-1919 Influenza Pandemic (H1N1)
- The February 1957-1958 Influenza Pandemic (H2N2)
- The 1968 Influenza Pandemic (H3N2)

To date, the 21st century has seen two acknowledged pandemics.

- 2009 Swine Flu (H1N1)
- 2019/2020 COVID 19

The City of Yuba City operations were significantly impacted by the COVID-19 pandemic. The City's Parks and Recreation Department discontinued all youth sports and senior center activities starting in March 2019, and these programs remained on hold through the beginning of 2021.

The City adopted a series of policies for its employees and the public. There were periods when only essential employees were allowed to work at City facilities, alternative work schedules, work-from-home arrangements, and quarantines for exposed employees. City offices were closed to the public and/or on limited hours to comply with Yuba-Sutter Public Health guidance.

As of April 10, 2021, there were 9,172 confirmed COVID-19 cases in Sutter County. Of those, 7,600were Yuba City residents.

Vulnerability to and Impacts from Pandemic

Pandemics have and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public health officials can use to combat pandemic. Constant surveillance regarding current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent spread of a pandemic by staying home, or "self-quarantining," if they suspect they are infected. Pandemics do not affect the buildings, critical facilities, and infrastructure in the City. Pandemics can have varying levels of impact to the citizens of the City and greater County, depending on the nature of the pandemic.

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently) an unemployment rose significantly. Numerous infections and deaths from Covid-19 have and are continuing to occur in the City, County, and all of California. Supply chains for food and essential supplies can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Future Development

Future development is not expected to be significantly impacted by this hazard, though population growth in the City could increase exposure to pandemic, and increase the ability of each disease to be transmitted among the population of the City. If the median age of City residents continues to increase, vulnerability to pandemic diseases may increase, due to the fact that these diseases are often more deadly to senior citizens.

Severe Weather: Extreme Cold and Freeze

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

According to the National Weather Service), extreme cold often accompanies a winter storm or is left in its wake. Freezing temperatures can also occur without the accompanying winter storm.

Location and Extent

Extreme cold and freeze are regional issues, meaning the entire City is at risk to cold weather and freeze events. While there is no scale (i.e. Richter, Enhanced Fujita) to measure the effects of extreme cold and freeze, temperature data from the County from the WRCC indicates that there are 18.3 days that fall below 32°F in Sutter County. Freeze has a slow onset and can be generally be predicted in advance for the County. Freeze events can last for hours (in a cold overnight), or for days to weeks at a time.

Past Occurrences

There has been one federal and one state disaster declaration for freeze. This can be seen in Table B-50.

Table B-50 Sutter County – State and Federal Freeze Disaster Declarations 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Freeze	1	1990	1	1990

Source: Cal OES, FEMA

The City noted that extreme cold and freeze is a regional phenomenon; events that affected the County also affected the City. Those past occurrences were shown in the Base Plan in Section 4.3.2.

Vulnerability to and Impacts from Severe Weather: Extreme Cold and Freeze

The City experiences temperatures below 32 degrees during the winter months. The temperature moves to the teens in rather extreme situations. Freeze can cause injury or loss of life to residents of the City. While it is rare for buildings to be affected directly by freeze, damages to pipes that feed building can be damaged during periods of extreme cold.

Extreme cold and freeze can affect critical facilities and infrastructure, down trees, break pipes, and can be a life safety issue. When extreme cold is coupled with high winds or ice storms, power lines may be downed, resulting in an interruption of utilities and critical services. Transportation networks, communications, and utilities infrastructure are the most vulnerable physical assets in the City. The elderly and young population is most vulnerable to temperature extremes. The residents of nursing homes and elder care facilities, as well as transient and homeless populations are especially vulnerable to extreme cold events.

Future Development

Future development built to code should be able to withstand issues associated with extreme cold and freeze events. Pipes at risk of freezing should be buried or insulated from freeze as new facilities are improved or added. Vulnerability to extreme cold will increase as the average age of the population in the County shifts and homelessness becomes more of an issue.

Severe Weather: Extreme Heat

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

According to FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and lasts for several weeks. Heat kills by taxing the human body beyond its abilities. In extreme heat and high humidity, evaporation is slowed, and the body must work extra hard to maintain a normal temperature." Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat.

In addition to the risks faced by citizens of the City, there are risk to the built environment from extreme heat. While extreme heat on its own does not usually affect structures, extreme heat during times of drought can cause wildfire risk to heighten. Extreme heat and high winds can cause Public Safety Power Shutdown (PSPS) events, creating significant issues in the City. However, PSPS events in the City have been declining with PG&E's refined system for shutting power off in high wildfire risk areas.

Location and Extent

Heat is a regional phenomenon and affects the whole of the City. Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly affect vulnerable populations and communities. Heat waves do not generally cause damage or elicit the immediate response of floods, fires, earthquakes, or other more "typical" disaster scenarios.

The NWS has in place a system to initiate alert procedures (advisories or warnings) when extreme heat is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. The NWS HeatRisk forecast provides a quick view of heat risk potential over the upcoming seven days. The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. This can be seen in Section 4.3.3 of the Base Plan.

Past Occurrences

The City Planning Team noted that since extreme heat is a regional phenomenon, events that affected the County also affected the City. Those past occurrences were shown in the Base Plan in Section 4.3.3.

Vulnerability and Impacts to Extreme Heat

The City experiences temperatures in excess of 100°F during the summer and fall months. The temperature moves to 105-115°F in rather extreme situations. During these times, drought conditions may worsen and the City may see an increase in dry fuels. Also, PSPS events may occur during these times as well. Health issues are the primary concern with this hazard, although economic impacts can also be an issue.

The elderly and individuals below the poverty level are the most vulnerable to extreme temperatures. Nursing homes and elder care facilities are especially vulnerable to extreme heat events if power outages occur and air conditioning is not available. In addition, individuals below the poverty level may be at increased risk to extreme heat if use of air conditioning is not affordable. This is especially true of homeless people and the transient population.

Days of extreme heat have been known to result in medical emergencies, and unpredictable human behavior. Periods of extended heat and dryness (droughts) can have major economic, agricultural, and water resources impacts. Extreme heat can also dry out vegetations, making it more vulnerable to wildfire ignitions.

Future Development

Future development of new buildings in the City will likely not be affected by extreme heat. Extreme heat is more likely to affect vulnerable populations. Vulnerability to extreme heat will increase as the average age of the population in each City shifts. It is encouraged that nursing homes and elder care facilities have emergency plans or backup power to address power failure during times of extreme heat and in the event of a PSPS. Low income residents and homeless populations are also vulnerable. Cooling centers for these populations are set up when necessary.

Severe Weather: Heavy Rains and Storms (Hail, Lightning)

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Storms in the City occur annually and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the City falls mainly in the fall, winter, and spring months. Wind often accompanies these storms; hail and lightning are rare in the City.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the City. All portions of the City are at risk to heavy rains. Most of the severe rains occur during the fall, winter, and spring months. There is no scale by which heavy rains and severe storms are measured. Magnitude of

storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Hail and lightning are rare in the City and Sutter County. Duration of severe storms in California, Sutter County, and the City can range from minutes to hours to days. Information on precipitation extremes can be found in Section 4.3.4 of the Base Plan.

Past Occurrences

According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the City. This is the cause of many of the federal disaster declarations related to flooding.

Since 2013, the most significant severe weather event was the Oroville Spillway Incident. This severe weather event resulted in the evacuation of 188,000 people, including the entire City of Yuba City. The heavy rainfall of 2017 led to localized flooding that caused significant damage to the City's Feather River Parkway, cut off access to the City's Water Intake Facility, and damaged the City's wastewater percolation ponds and associated roadways. The high water in the Feather River also caused minor damage to the levee.

Vulnerability to and Impacts from Heavy Rain and Storms

Heavy rain and severe storms are the most frequent type of severe weather occurrences in the City. These events can cause significant and localized flooding. Elongated events, or events that occur during times where the ground is already saturated can cause 1% and 0.2% annual chance flooding. Wind often accompanies these storms and has caused damage in the past. Hail and lightning are rare in the City, but also can cause damage, with lightning occasionally igniting wildfires.

Actual damage associated with the effects of severe weather include impacts to property, critical facilities (such as utilities), and life safety. Heavy rains and storms often result in flooding creating significant issues. Roads can become impassable and ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Floodwaters and downed trees can break utilities and interrupt services.

Future Development

Building codes in the City ensure that new development is built to current building standards, which should reduce the risk to future development in the City from heavy rains and storms. New critical facilities such as communications towers and others should be built to withstand hail damage, lightning, and thunderstorm winds. With adherence to development standards, future losses to new development should be minimal.

Wildfire

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

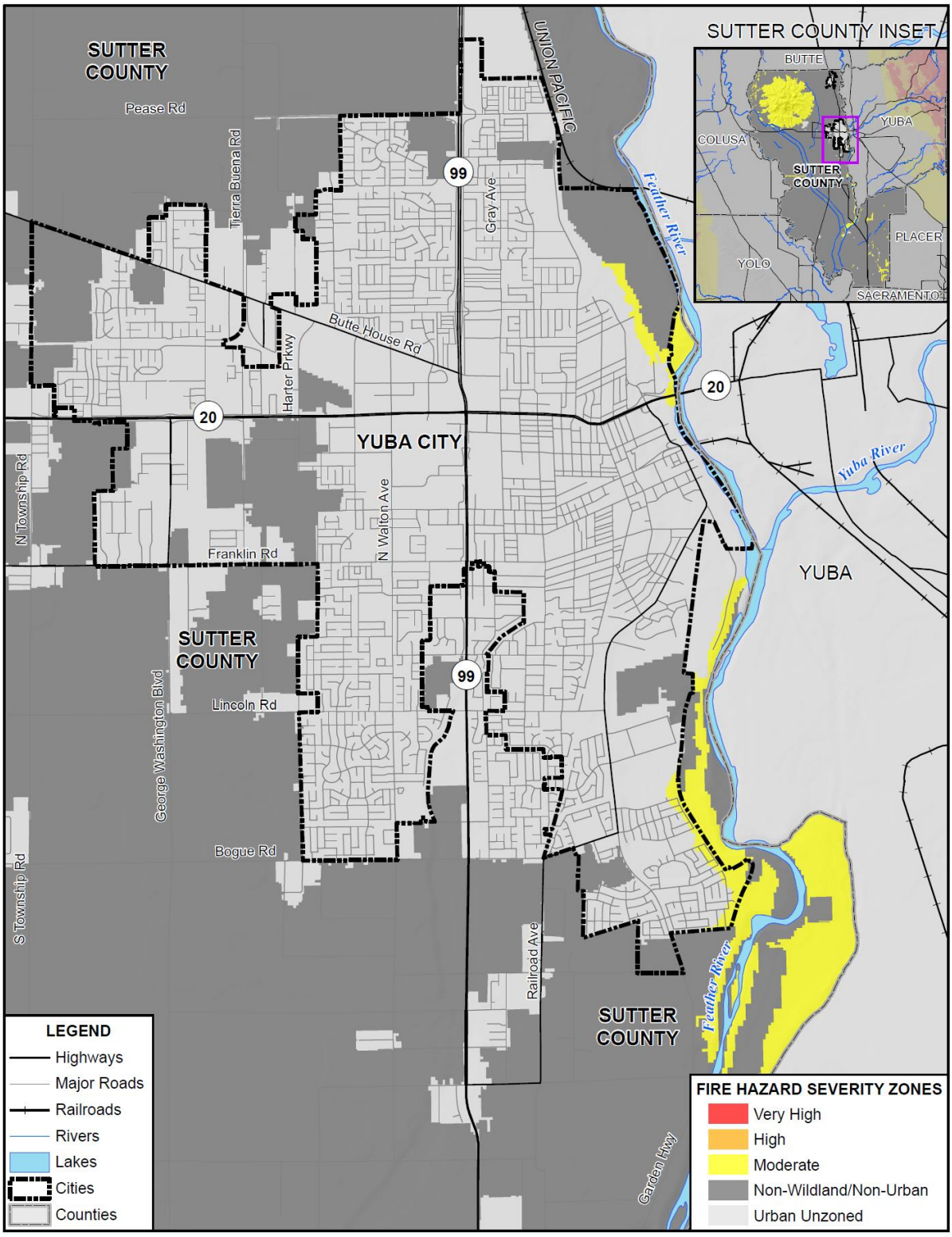
Hazard Profile and Problem Description

Wildland fire and the risk of a conflagration is an ongoing concern for the City of Yuba City. Throughout California, communities are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire control practices have affected the natural cycle of the ecosystem. Wildland fires affect grass, forest, and brushlands, as well as any structures located within them. Where there is human access to wildland areas the risk of fire increases due to a greater chance for human carelessness and historical fire management practices. Historically, the fire season extends from early spring through late fall of each year during the hotter, dryer months; however, in recent years, the risk of wildfire has become a year around concern. Fire conditions arise from a combination of high temperatures, low moisture content in the air and fuel, accumulation of vegetation, and high winds. These high winds can result in red flag days, and can result in PSPS events in the City. While wildfire risk has predominantly been associated with more remote forested areas and wildland urban interface (WUI) areas, significant wildfires can also occur in more populated, urban areas.

Location and Extent

Wildfire can affect all areas of the City. CAL FIRE has estimated that the risk varies across the City and has created maps showing risk variance. Following the methodology described in Section 4.3.16 of the Base Plan, wildfire maps for the City of Yuba City were created. Figure B-21 shows the CAL FIRE FHSZ in the City. As shown on the maps, most of the City is urbanized, with small areas of moderate wildfire risk. Wildfire threat within the City is generally low, with areas of moderate risk in the river bottoms and near waterways in the City.

Figure B-21 City of Yuba City – Fire Hazard Severity Zones



Data Source: CAL FIRE (Draft 9/2007 - c51fhszl06_1), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Wildfires tend to be measured in structure damages, injuries, and loss of life as well as on acres burned. Fires can have a quick speed of onset, especially during periods of drought or during hot dry summer months. Fires can burn for a short period of time, or may have durations lasting for a week or more. Geographical FHSZ extent from CAL FIRE is shown in Table B-51.

Table B-51 City of Yuba City – Geographical FHSZ Extents

Fire Hazard Severity Zones	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Very High	0	0.00%	0	0.00%	0	0.00%
High	0	0.00%	0	0.00%	0	0.00%
Moderate	88	1.1%	31	0.5%	57	4.5%
Non-Wildland/Non-Urban	1,248	16.0%	1,000	15.3%	248	19.8%
Urban Unzoned	6,460	82.9%	5,509	84.2%	951	75.7%
Total	**7,797**	**100.0%**	**6,540**	**100.0%**	**1,257**	**100.0%**

Source: CAL FIRE

Past Occurrences

There have been no federal or state disaster declarations from wildfire. There has been no significant wildland fire in the Wildland Urban Interface (WUI) area within the City resulting in the loss of the residential or commercial structures. However, Yuba City has suffered the impacts of numerous "mega-fires" that resulted in extreme air quality concerns, ash on agricultural products, and evacuees entering the Yuba City Urban Area. These would include:

- Bear Fire - 2020
- Camp Fire – 2018
- Tubbs Fire – 2017
- Cascade Fire – 2017

Vulnerability to and Impacts from Wildfire

Fuel loads in the County and cities, along with geographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. The City is not immune from fire. The dry vegetation and hot and sometimes windy weather results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire. As development continues throughout the County and City, the risk and vulnerability to wildfires will likely increase.

Yuba City is not immune to numerous types of grass and brush fires and any one of them may accelerate into an urban interface wildfire. Such a situation could lead to evacuation of large portions of the population and the potential for significant loss of personal property, structures, and rangeland. The natural fuels

available in or near the City vary greatly in the rate and intensity of burning. Fires in heavy brush and stands of trees burn with great intensity but more slowly than in dry grass and leaves.

The primary area at risk to wildland fires within the Yuba City Urban Area are the river bottoms of the West Feather River. The river bottom area includes two significant infrastructure features that could be at risk from wildfires. These include:

- The water intake pump/lift station structure for the city's water system (the elevated pump structure is located along the west bank of the Feather River.) The pumps pull water from the river and pump it in pipes across the river-bottom area to the City's Water Treatment Plan located on the west side of the adjacent levee.
- A Union Pacific Railroad trestle that spans the width of the west Feather River river bottom area. The subject rail line is Union Pacific's main north-south route between California and the Pacific Northwest. The trestle has caught fire in the past as a result of both grass fires and fires caused by the train operations.

Potential impacts from wildfire include loss of life and injuries; damage to structures and other improvements, natural and cultural resources, agricultural lands; and loss of recreational opportunities. Wildfires can cause short-term and long-term disruption to the City. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the City by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading water quality. Fires can also affect air quality in the City; smoke and air pollution from wildfires can be a severe health hazard.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Schools and businesses can be forced to close for extended periods of time. Recently, the threat of wildfire, combined with the potential for high winds, heat, and low humidity, has caused PG&E to initiate a PSPS which can also significantly impact a community through loss of services, business closures, and other impacts associated with loss of power for an extended period. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides, and erosion during the rainy season.

Based on the vulnerability of the City of Yuba City to the wildfire hazard, the sections that follow describes significant assets at risk in the City.

Assets at Risk

Based on the vulnerability of Yuba City to the wildfire hazard, the sections that follow describes significant assets at risk in the City of Yuba City. This section includes the values at risk, population at risk, and critical facilities at risk.

Values at Risk

GIS was used to determine the possible impacts of wildfire within the City of Yuba City. The methodology described in Section 4.3.18 of the Base Plan was followed in determining structures and values at risk in fire hazard severity zones. Summary analysis results for Yuba City are shown in Table B-52, which summarizes total parcel counts, improved parcel counts and their structure values by fire hazard severity zone.

Table B-52 City of Yuba City – Count and Value of Parcels by Fire Hazard Severity Zone

Fire Hazard Severity Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Moderate	175	166	$11,064,440	$35,712,304	$18,182,470	$64,959,214
Non-Wildland/Non-Urban	144	114	$71,083,991	$109,798,781	$92,048,859	$272,931,631
Urban Unzoned	19,973	18,260	$1,398,599,110	$4,321,606,318	$2,785,546,454	$8,505,751,882
City of Yuba City Total	**20,292**	**18,540**	**$1,480,747,541**	**$4,467,117,403**	**$2,895,777,782**	**$8,843,642,726**

Source: Sutter County 2020 Parcel/Assessor's Data, CAL FIRE

Table B-53 breaks out the Table B-52 by adding the property use details by fire hazard severity zone for the City. As shown in both of these tables, the City has no properties in the very high or high fire hazard severity zones. All of the City falls within the non-wildland/non-urban and urban unzoned fire hazard severity zones.

Table B-53 City of Yuba City – Count and Value of Parcels by Fire Hazard Severity Zone and Property Use

Fire Hazard Severity Zone/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Moderate						
Agricultural	2	0	$18,743	$0	$0	$18,743
Commercial	0	0	$0	$0	$0	$0
Industrial	2	1	$170,480	$326,318	$489,477	$986,275
Institutional	2	0	$109,400	$0	$0	$109,400
Miscellaneous	1	0	$0	$0	$0	$0
Residential	165	165	$10,096,844	$35,385,986	$17,692,993	$63,175,823
Vacant	3	0	$668,973	$0	$0	$668,973
Moderate Total	**175**	**166**	**$11,064,440**	**$35,712,304**	**$18,182,470**	**$64,959,214**
Non-Wildland/Non-Urban						
Agricultural	28	23	$7,285,632	$2,418,470	$2,418,470	$12,122,572
Commercial	35	27	$44,787,128	$65,231,294	$65,231,294	$175,249,716
Industrial	8	3	$7,393,267	$1,901,538	$2,852,307	$12,147,112
Institutional	5	2	$4,064,865	$2,851,700	$2,851,700	$9,768,265

Fire Hazard Severity Zone/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Miscellaneous	0	0	$0	$0	$0	$0
Residential	59	58	$6,783,324	$37,390,175	$18,695,088	$62,868,587
Vacant	9	1	$769,775	$5,604	$0	$775,379
Non-Wildland/Non-Urban Total	**144**	**114**	**$71,083,991**	**$109,798,781**	**$92,048,859**	**$272,931,631**
Urban Unzoned						
Agricultural	37	26	$9,731,629	$1,896,591	$1,896,591	$13,524,811
Commercial	1,006	873	$324,491,435	$788,941,511	$788,941,511	$1,902,374,457
Industrial	376	297	$63,186,441	$138,353,193	$207,529,790	$409,069,424
Institutional	298	158	$35,626,186	$182,421,232	$182,421,232	$400,468,650
Miscellaneous	506	0	$0	$0	$0	$0
Residential	17,464	16,892	$945,923,906	$3,209,514,660	$1,604,757,330	$5,760,195,896
Vacant	286	14	$19,639,513	$479,131	$0	$20,118,644
Urban Unzoned Total	**19,973**	**18,260**	**$1,398,599,110**	**$4,321,606,318**	**$2,785,546,454**	**$8,505,751,882**
City of Yuba City Total	**20,292**	**18,540**	**$1,480,747,541**	**$4,467,117,403**	**$2,895,777,782**	**$8,843,642,726**

Source: Sutter County 2020 Parcel/Assessor's Data, CAL FIRE

Population at Risk

The FHSZ dataset was overlayed on the parcel layer. Those residential parcel centroids that intersect the FHSZs were counted and multiplied by the 2010 Census Bureau average household factors for the City of Yuba City – 2.99. According to this analysis, there is a total population of 493 residents of Yuba City at risk to moderate or higher FHSZs. This is shown in Table B-54.

Table B-54 City of Yuba City – Count of Improved Residential Parcels and Population by Fire Hazard Severity Zone

Jurisdiction	Moderate		High		Very High	
	Improved Residential Parcels	Population	Improved Residential Parcels	Population	Improved Residential Parcels	Population
Yuba City	165	493	0	0	0	0

Source: Sutter County 2020 Parcel/Assessor's Data, CAL FIRE

Critical Facilities at Risk

An analysis was performed on the critical facility inventory in Yuba City in identified FHSZs. Critical facilities in a FHSZ in the City of Yuba City are shown in Figure B-22 and detailed in Table B-55. Details

of critical facility definition, type, name and address and jurisdiction by fire hazard severity zone are listed in Appendix F.

Figure B-22 City of Yuba City – Critical Facilities in Fire Hazard Severity Zones

Table B-55 City of Yuba City – Critical Facilities by Fire Hazard Severity Zone

Source: CAL FIRE, Sutter County

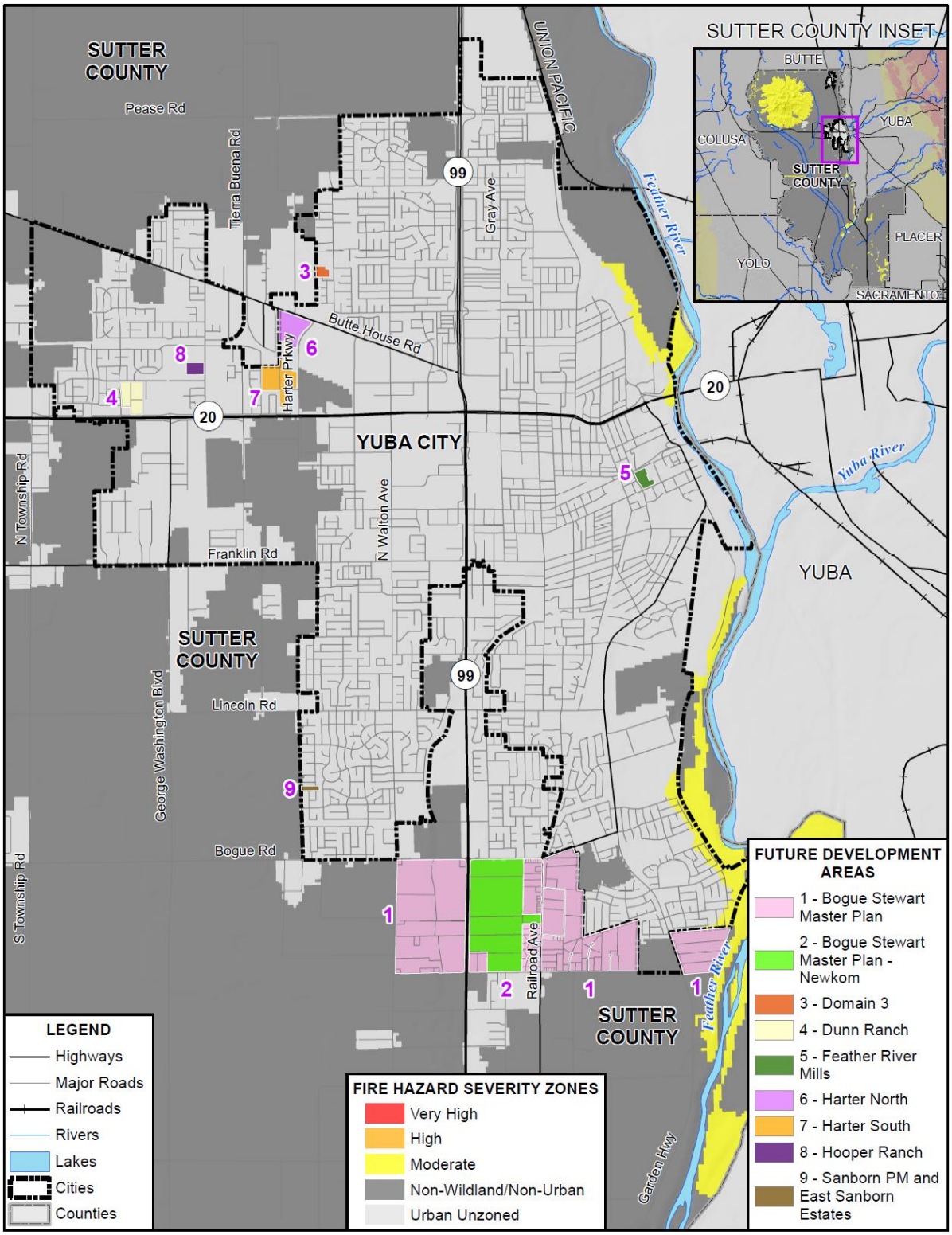
Future Development

Additional growth and development within moderate or higher fire hazard severity zones in the City would place additional values at risk to wildfire. City Building Codes are in place; however, the City does not anticipate growth in areas considered to be moderate or high fire severity zones.

GIS Analysis

The City provided future development areas were used as the basis for the inventory of future development areas for the City. Using the GIS parcel spatial file for each of these areas, the areas and parcels associated with future development projects for which the analysis was to be performed were identified. Utilizing the future development project spatial layer, the parcel centroid data was intersected to determine the parcel counts within each area. Figure B-23 shows the locations of future development areas the City is planning to develop on the FHSZs. Table B-56 shows the parcels and acreages of each future development area in the City in each FHSZ.

Figure B-23 City of Yuba City – Future Development Areas



Data Source: CAL FIRE (Draft 9/2007 - c51fhszl06_1), Sutter County GIS, Cal-Atlas; Map Date: 2/15/2021.

Table B-56 City of Yuba City – Future Development Areas Parcel Counts and Acreages in FHSZs

Fire Hazard Severity Zone/Future Development	Total Parcel Count	Improved Parcel Count	Total Acres
Non-Wildland/Non-Urban			
Bogue Stewart Master Plan	70	53	519.9
Bogue Stewart Master Plan - Newkom	6	6	167.8
Non-Wildland/Non-Urban Total	**76**	**59**	**687.7**
Urban Unzoned			
Bogue Stewart Master Plan	39	39	30.0
Domain 3	1		3.9
Dunn Ranch	3	1	18.5
Feather River Mills	1		6.5
Harter North	1	1	21.8
Harter South	2		27.9
Hooper Ranch	1	1	6.4
Sanborn PM and East Sanborn Estates	1		2.4
Urban Unzoned Total	**49**	**42**	**117.4**
Yuba City Total	**125**	**101**	**805.1**

Source: CAL FIRE, City of Yuba City GIS

B.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

B.6.1. Regulatory Mitigation Capabilities

Table B-57 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the City of Yuba City.

Table B-57 City of Yuba City Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan	Y 2004	Plan identifies hazards, has a mitigation strategy, and can be used to implement mitigation actions.
Capital Improvements Plan	Y 2020	Plan identifies hazards, has a mitigation strategy, and can be used to implement mitigation actions.
Economic Development Plan	Y 2008	
Local Emergency Operations Plan	Y 2006	The City currently does not have an EOP. We have a Slow Rise Flood plan. This plan identifies hazards, and can be used to implement mitigation actions on rising water events. However, it does not encompass hazards other than rising water.
Continuity of Operations Plan	Y 2020	Draft plans for all Departments were developed in 2020.
Transportation Plan	Y	2004 General Plan XXX Specific Plan
Stormwater Management Plan/Program	Y 2018	Storm Water Resource Plan identifies hazards. It identifies projects for implementation through 2030. It can be used to implement mitigation actions.
Engineering Studies for Streams	Y	
Community Wildfire Protection Plan	N	No plan in place.
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y 2016	City of Yuba City Resource Efficiency Plan establishes goals and policies to incorporate environmental responsibility into daily management of community and municipal operations.
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	Y	Version/Year: California Building Code, 2019 Edition
Building Code Effectiveness Grading Schedule (BCEGS) Score	Y	Score: 4
Fire department ISO rating:	Y	Rating: 3/3
Site plan review requirements	Y 2019	Building codes were updated to match state standards.
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	Y	Title 8, Planning and Zoning, went into effect in 1995, and has been updated periodically through the years. The ordinance provides authority to reduce hazard impacts and it is adequately administered and enforced.
Subdivision ordinance	Y	Within zoning ordinance.
Floodplain ordinance	Y 2016	Title 6, Chapter 9, Flood Damage Prevention ordinance went into effect in 2007 and was most recently updated in 2016.

Natural hazard specific ordinance (stormwater)	Y 2016	Storm water ordinance was adopted in 2016. It is implemented through public outreach, construction permits, post-construction inspections, and other enforcement activities.
Flood insurance rate maps	Y	
Elevation Certificates	Y	
Acquisition of land for open space and public recreation uses	Y	The City General Plan requires open space to be provided for as development progresses over time. The Master Plans and Specific Plans call out these components. This is an effective measure for reducing hazard impacts, and it is appropriately administered and enforced.
Erosion or sediment control program	Y	Stormwater management programs has measures for reducing impacts. Grading, Erosion and Sediment Control Ordinance was adopted in 2016
Other		
How can these capabilities be expanded and improved to reduce risk?		
Creating a comprehensive emergency planning process that includes 6 steps: I. Emergency Notification Systems II. Training III. Evacuation Zones IV. D.O.C. and E.O.C. V. Testing the system VI. Developing Emergency Operations Plans		

Source: City of Yuba City

City of Yuba City General Plan (2004)

California Law requires that every City and County in the state have a General Plan. The City of Yuba City General Plan, adopted in 2004, was prepared over a two-year period that included an extensive public review process. The General Plan is the most important policy and planning document in the city, and is used by virtually every department. The General Plan is the City's statement of its vision for the future. The General Plan contains policies covering every aspect of the City: land use (how land can be developed), circulation, noise, air quality, housing, open space and conservation, and health and safety.

Goals and policies related to mitigation of natural hazards are as follows:

Goal	Minimize risks of property damage and personal injury posed by geologic and seismic hazards.
Policy	Review proposed development sites at the earliest stage of the planning process to locate any potential geologic or seismic hazards.
Policy	Prohibit structures intended for human occupancy within 50 feet of an active fault trace.
Policy	Require comprehensive geologic and engineering studies of critical structures regardless of location.
Policy	Require preparation of a soils report as part of the development review and/or building permit process for development proposed in the area depicted with expansive soils.
Policy	Provide information for property owners to rehabilitate existing buildings using construction techniques to protect against seismic hazards.
Policy	Control erosion of graded areas with revegetation or other acceptable methods.

Goal	Minimize risks of property damage and personal injury posed by geologic and seismic hazards.
Policy	Maintain and update, as appropriate, the City's emergency preparedness programs, plans, and procedures to ensure the health and safety of the community in the event of an earthquake or other disaster.
Policy	Encourage the purchase of earthquake insurance.

Goal	Protect the community from risks to lives and property posed by flooding and stormwater runoff. Collect and dispose of storm water in a safe and efficient manner. Ensure that dams and levees are properly maintained for long-term flood protection.
Policy	Implement the drainage improvements identified in the City's Capital Improvement Program.
Policy	Continue to work with the U.S. Army Corps of Engineers to implement levee improvements on the Feather River. Incorporate features in the levee system to ensure flood protection and at the same time improve the connection between the city and the river.
Policy	When necessary, require new development to prepare hydrologic studies to assess storm runoff impacts on the local and subregional storm drainage systems and, if warranted, require new development to provide adequate drainage facilities and to mitigate increases in storm water flows and/or volume to avoid cumulative increases in downstream flows.
Policy	Restrict new development in areas subject to 100 year flooding
Policy	Provide information to property owners about the availability of flood insurance.
Policy	As new development occurs, work with Sutter County to establish drainage areas that serve the entire Planning Area.
Policy	Utilize parks for the secondary purpose of storm water storage

Yuba City Drainage Study (2018)

The Yuba City Basin includes two major area types: the urban and urbanizing areas around Yuba City (City), and the agricultural areas located within Sutter County (County). As the City and County develop, more runoff is delivered to drainage facilities within the Yuba City Basin, which already have flooding issues at multiple locations. The purpose of this study is to evaluate flooding that occurs for existing and buildout land use conditions and to propose improvements that reduce the flooding and are affordable to the City and County. West Yost Associates (West Yost), the County, and the City jointly developed the goals to guide this study, as follows:

- Identify locations and causes of flooding in both agricultural and urban areas by meeting with the irrigation water agencies/districts and drainage districts within the Yuba City Basin.
- Develop a model of the existing drainage system.
- Calibrate the model using historical storms and flooding data.
- Model flooding for existing land use conditions using the calibrated model and a range of design storms.
- Identify drainage improvements within City and County budgets to reduce flooding for existing land use conditions.
- Develop detention basin design criteria to minimize potential increases in downstream water levels caused by new development.
- Size detention basins to reduce impacts from new development.
- Develop a "fair share" basis for distributing the detention basin costs to the development lands and for establishing a drainage development impact fee.
- Investigate various long-term funding mechanisms and identify potential future grant opportunities.

B.6.2. Administrative/Technical Mitigation Capabilities

Table B-58 identifies the City department(s) responsible for activities related to mitigation and loss prevention in Yuba City.

Table B-58 City of Yuba City's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	Y	The Planning Commission holds regular meetings on an established schedule to conduct policy and project review. This is an effective board.
Mitigation Planning Committee	NA	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Parks and Public Works departments work together to maintain trees and landscapes to reduce risk. Parks staff trim trees, Public Works staff maintain and repair drainage systems. These agencies coordinate their efforts effectively.
Mutual aid agreements		
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	Y	Contract Services
Floodplain Administrator	Y	Provided by Sutter Butte Flood Control Agency – Also, City staff administers the CRS program for the City
Emergency Manager	Y	City Manager
Community Planner	Y	Development Services Director
Civil Engineer	Y	Deputy Public Works Director – Engineering and Senior Engineers
GIS Coordinator	Y	IT Analyst
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	Y	Reverse 911, 1500 AM radio frequency, cable override access through Comcast, Rapid Notify
Hazard data and information	Y	The Fire Department web page provides hazard data and information.
Grant writing	Y	Each Department responsible for grant writing – City also contracts for grant writing
Hazus analysis	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
The City's zoning and planning capabilities would be greatly enhanced with access to updated FIRM/Q3 and DFIRM maps.		

Source: City of Yuba City

B.6.3. Fiscal Mitigation Capabilities

Table B-59 identifies financial tools or resources that the City could potentially use to help fund mitigation activities.

Table B-59 City of Yuba City's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Yes, repairs, mitigation & improvements
Authority to levy taxes for specific purposes	Y	Yes, repairs, mitigation & improvements
Fees for water, sewer, gas, or electric services	Y	Yes, operations, infrastructure & improvements
Impact fees for new development	Y	Yes, infrastructure & improvements
Storm water utility fee		No
Incur debt through general obligation bonds and/or special tax bonds	Y	Yes, infrastructure & improvements
Incur debt through private activities	Y	No
Community Development Block Grant	Y	Yes, low/mod housing & services
Other federal funding programs		Unknown
State funding programs	Y	SRF Loans, infrastructure & improvements
Other		
How can these capabilities be expanded and improved to reduce risk?		
The City could try to pass a utility users tax, increase rates, and increase impact fees for new development. Incurring debt would be more difficult without increasing our revenue in some way to keep our debt ratios within range.		

Source: City of Yuba City

B.6.4. Mitigation Education, Outreach, and Partnerships

Table B-60 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table B-60 City of Yuba City's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	N	
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	CRS

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Natural disaster or safety related school programs	Y	
StormReady certification	N	
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
The City will continue to seek ways to improve and expand the CRS program to reduce future risk from floods in the City. The City will continue to seek to expand working relationships with other organizations (Levee District 1, Sutter County, and others) to reduce hazard risks in the City.		

Source: City of Yuba City

B.6.5. Other Mitigation Efforts

The City has many other completed or ongoing mitigation projects/efforts that include the following:

Multi Hazard

The City applied for two Cal OES project grants for generator projects. To combat the issues regarding PSPS in the City, a generator project for the Yuba City Sewer Lift Station was put forth. A grant for $236,000 was sought to provide sewer lift station services in case of power outages. To combat the issues regarding PSPS in the City, a generator project for the City Animal Services Shelter was put forth. A grant for $225,000 was sought to provide backup power to the Yuba City Sutter Animal Services Shelter (a critical facility) in case of power outages.

Dam Failure, Levee Failure, and Flooding

In 2013, the Sutter Butte Flood Control Agency began construction on a levee repair project to fix 44 miles of levees along the west bank of the Feather River from the Thermalito Afterbay to the Sutter Bypass. Repair is necessary due to under-seepage and through-seepage that caused damage to the levees. The project is split into two phases: Project 1 which consists of 34 miles of repairs from the Thermalito Afterbay to Star Bend, which is just south of Yuba City. Project 2 consists of the area south of Star Bend to the confluence of the Feather River and the Sutter Bypass. Project 1 was completed at the end of 2017. Levee repair projects impact Yuba City because the levees provide protection for the City and Water Treatment Plant from potential flooding and contamination.

West Feather River Levee Reaches 14-16 (Yuba City)

In early 2017, a 2.9-mile segment of levee adjacent to Yuba City showed signs of damage including seepage, sink holes and boils, poor performance with the slurry wall in the levee, and erosion caused by failures in the Oroville Spillway. To mitigate issues with this levee segment during the next flood season,

the Sutter Butte Flood Control Agency, Department of Water Resources, U.S. Army Corps of Engineers, and Central Valley Flood Protection Board worked together to expedite emergency repair efforts that began in August 2017 and were completed by the end of 2017.

- The City's 2010 Urban Water Management Plan addresses drought conditions and the Municipal Code has a section on emergency water restrictions. These items help the City address drought conditions and mitigate its effects.

B.7 Mitigation Strategy

B.7.1. Mitigation Goals and Objectives

The City of Yuba City adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

B.7.2. NFIP Mitigation Strategy

The City of Yuba City joined the National Flood Insurance Program (NFIP) on March 23, 1984. As a participant of the NFIP, the City of Yuba City has administered floodplain management regulations that meet the minimum requirements of the NFIP. The management program objective is to protect people and property within the City. The City of Yuba City will continue to comply with the requirements of the NFIP in the future.

In addition, the City of Yuba City actively participates with Sutter County to address local NFIP issues through a regional approach. Many of the program activities are the same for the City of Yuba City as for Sutter County since participation at the County level includes all local jurisdictions.

The City of Yuba City Public Works Department provides public outreach activities which include map information services, public awareness, public hazard disclosure, and flood protection information. This information is readily available to the public and consists of current and accurate flood mapping. In addition, the Public Works Department provides information about our stormwater management program and up-to-date information related to the maintenance of our drainage system.

The NFIP's Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS which are to reduce flood losses, facilitate accurate insurance rating, and promote the awareness of flood insurance. The City of Yuba City is a current participant in the CRS program, and is a Class 6 community.

More information about the floodplain administration in the City of Yuba City can be found in Table B-61.

Table B-61 City of Yuba City Compliance with NFIP

NFIP Topic	Comments
Insurance Summary	
How many NFIP policies are in the community? What is the total premium and coverage?	1,309 policies $639,405 in premiums $436,514,200 in coverage
How many claims have been paid in the community? What is the total amount of paid claims? How many of the claims were for substantial damage?	21 paid claims $15,571 in paid claims 0 substantial damage claims
How many structures are exposed to flood risk within the community?	2 in 1% annual chance floodplain 1,106 in 0.2% annual chance floodplain
Repetitive Loss (RL) and Severe Repetitive Loss Properties (SRL)	32 RL properties 0 SRL properties
Describe any areas of flood risk with limited NFIP policy coverage	City is unaware of any limited NFIP policy coverage since most of the City is classified as Zone C – areas of minimal flooding.
Staff Resources	
Is the Community Floodplain Administrator or NFIP Coordinator certified?	Yes
Provide an explanation of NFIP administration services (e.g., permit review, GIS, education or outreach, inspections, engineering capability)	Permit review, map services, public outreach, public hazard disclosure, flood zone determinations
What are the barriers to running an effective NFIP program in the community, if any?	Limited staff availability
Compliance History	
Is the community in good standing with the NFIP?	Y
Are there any outstanding compliance issues (i.e., current violations)?	N
When was the most recent Community Assistance Visit (CAV) or Community Assistance Contact (CAC)?	CAV 5/18/2006 CAC 3/7/1990
Is a CAV or CAC scheduled or needed?	No
Regulation	
When did the community enter the NFIP?	3/23/1984
Are the FIRMs digital or paper?	Digital
Do floodplain development regulations meet or exceed FEMA or State minimum requirements? If so, in what ways?	The City has an ordinance that requires a development permit for any construction or development that begins within any area of special flood hazard

NFIP Topic	Comments
Provide an explanation of the permitting process.	A development permit shall be obtained before construction or development begins within any area of special flood hazard established in Section 6-9.302. Application for a development permit shall be made on forms furnished by the Public Works Director and may include, but not be limited to: plans in duplicate scale showing the nature, location, dimensions, and elevation of the area in question; existing or proposed structures, fill, storage of materials, drainage facilities; and the location of the foregoing. Specifically, the following information is required:
Community Rating System	
Does the community participate in CRS?	Y
What is the community's CRS Class Ranking?	6
What categories and activities provide CRS points and how can the class be improved?	Adopt current LHMP, increase public outreach
Does the plan include CRS planning requirements?	Y

B.7.3. Mitigation Actions

The planning team for the City of Yuba City identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Aquatic Invasive Species
- Climate Change
- Dam Failure
- Drought & Water shortage
- Earthquake
- Floods: 1%/0.2% annual chance
- Floods: Localized Stormwater
- Levee Failure
- Pandemic
- Severe Weather: Extreme Cold and Freeze
- Severe Weather: Extreme Heat
- Severe Weather: Heavy Rains and Storms
- Wildfire

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts

are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement.

Multi-Hazard Actions

Action 1. Integrate Local Hazard Mitigation Plan into Safety Element of General Plan

Hazards Addressed: Multi-hazard (Aquatic Invasive Species, Climate Change, Dam Failure, Drought & Water shortage, Earthquake, Floods: 1%/0.2% annual chance, Floods: Localized Stormwater, Levee Failure, Pandemic, Severe Weather: Extreme Cold and Freeze, Severe Weather: Extreme Heat, Severe Weather: Heavy Rains and Storms, Wildfire)

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Local jurisdictional reimbursement for mitigation projects and cost recovery after a disaster is guided by Government Code Section 8685.9 (AB 2140). Specifically, this section requires that each jurisdiction adopt a local hazard mitigation plan (LHMP) in accordance with the federal Disaster Mitigation Act of 2000 as part of the Safety Element of its General Plan. Adoption of the LHMP into the Safety Element of the General Plan may be by reference or incorporation.

Other Alternatives: No action

Existing Planning Mechanisms through which Action will be Implemented: Safety Element of General Plan

Responsible Office: City of Yuba City Yuba City Development Services Department

Cost Estimate: Jurisdictional board/staff time

Potential Funding: Local budgets

Benefits (avoided Losses): Incorporation of an adopted LHMP into the Safety Element of the General Plan will help jurisdictions maximize the cost recovery potential following a disaster.

Schedule: As soon as possible

Priority (H, M, L): High

Action 2. Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness

Hazards Addressed: Multi-hazard (Aquatic Invasive Species, Climate Change, Dam Failure, Drought & Water shortage, Earthquake, Floods: 1%/0.2% annual chance, Floods: Localized Stormwater, Levee Failure, Pandemic, Severe Weather: Extreme Cold and Freeze, Severe Weather: Extreme Heat, Severe Weather: Heavy Rains and Storms, Wildfire)

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The City and County play a key role in public outreach/education efforts to communicate the potential risk and vulnerability of their community to the effects of natural hazards. A comprehensive multi-hazard public education program will better inform the community of natural hazards of concern and actions the public can take to be better prepared for the next natural disaster event.

Project Description: A comprehensive multi-hazard outreach program will ascertain both broad and targeted educational needs throughout the community. The City will work with the County and other agencies as appropriate to develop timely and consistent annual outreach messages in order to communicate the risk and vulnerability of natural hazards of concern to the community. This includes measures the public can take to be better prepared and to reduce the damages and other impacts from a hazard event. The public outreach effort will leverage and build upon existing mechanisms, will include elements to meet the objectives of Goal 3 of this LHMP Update, and will consider:

- Using a variety of information outlets, including websites, local radio stations, news media, schools, and local, public sponsored events;
- Creating and distributing (where applicable) brochures, leaflets, water bill inserts, websites, and public service announcements;
- Displaying public outreach information in County office buildings, libraries, and other public places and events;
- Developing public-private partnerships and incentives to support public education activities.

Location of Project: Citywide

Other Alternatives: Continue public information activities currently in place.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Existing County outreach programs will be reviewed for effectiveness and leveraged and expanded upon to reach the broader region.

Responsible Office: City of Yuba City in partnership with the County

Participating Jurisdictions: County and all cities.

Cost Estimate: Annual costs to be determined, and will depend on the scope and frequency of activities and events as well as volunteer participation

Benefits (Losses Avoided): Increase residents' knowledge of potential hazards and activities required to mitigate hazards and be better prepared. Protect lives and reduce damages, relatively low cost to implement.

Potential Funding: Local budgets, grant funds

Timeline: Ongoing/Annual public awareness campaign

Priority (H, M, L): High

Action 3. Hazard Preparedness Public Outreach for Yuba City

Hazards Addressed: Emergency Services/Multi-Hazard

Goals: 1, 2, 3, 4, 5

Issue/Background: It is a challenge for citizens and the business community to understand how to preparer for a hazard or what to do during an emergency situation in the event of a wildfire, earthquake, flood, power outages, extreme heat, extreme cold, and pandemic.

Project Description: Prepare and distribute a Community Hazard Preparedness Guide to the Yuba City Community, allow with Public Outreach to empower citizens and business to educate and prepare for disasters.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: N/A

Responsible Agency/ Department/Partners: City of Yuba City/Yuba City Fire Department

Cost Estimate: $75,000

Benefits (Losses Avoided): A Hazard Preparedness Manual will encourage residents to prepare for and understand what to do during a hazardous situation, which will result in a reduction of property loss and improve life safety.

Potential Funding: State and Federal Grants, Local Funds

Timeline: 24 Months

Project Priority (H, M, L): High

Action 4. Establish Backup Power Sources for Critical Facilities within Yuba City

Hazards Addressed: Emergency Services/Multi-Hazard

Goals Addressed: 1, 2, 4, 5

Issue/Background: Yuba City has numerous critical facilities which do not have adequate backup power. During times of a power outage, staff has to prioritize those facilities that do not have backup power. The Water Treatment Plant has an aging and undersized set of generators, thus staff must determine which systems will be inoperable during power outages. In other parts of the City, staff must determine where portable generators should be placed first, and then moved, as there are not enough generators to power all of the critical facilities at the same time.

Project Description: Establish backup power sources for critical facilities within Yuba City. Among facilities in need of new or replacement backup power systems: Yuba City Water Treatment Plant, Sutter County Animal Services Authority, several sewer lift stations.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works

Cost Estimate: $5+ million

Benefits (Losses Avoided): Reduce the risk of a critical facility losing power thereby making it inoperable, causing property damage, public health hazards and life safety issues.

Potential Funding: State and Federal grants, local funds.

Timeline: Within the next 5 years

Project Priority (H, M, L): High

Action 5. Emergency Operations Plan (EOP) for the City of Yuba City

Hazards Addressed: Fire, High Winds, Floods, Extreme Heat, Earthquakes, and Pandemics

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: According to the State of Californian Emergency Plan, "all local governments with a certified disaster council are required to develop Emergency Operation Plans (EOP) for their jurisdiction that meet state and federal requirements are in accordance with a Cal OES Local Planning Guidance." Yuba City as certified disaster council; however, the City does not have an Emergency Operation Plan.

Project Description: The project consists of hiring a consultant to write a comprehensive Emergency Operations Plan to meet the specific needs of the Yuba City Community in the event of a major disaster could be identified through one of the hbaazards addressed above. This Emergency Operations Plan would be adopted by the City and would be the blueprint for mitigating disasters.

Other Alternatives: Complete the Emergency Operations Plan internally with City Staff.

Existing Planning Mechanism(s) through which Action Will Be Implemented: N/A

Responsible Agency/ Department/Partners: City of Yuba City/Yuba City Fire Department

Cost Estimate: $45,000

Benefits (Losses Avoided): Allow City Emergency Operations to plan and execute successful notifications, evacuations, care/shelter, and respond to these disasters, which will decrease loss of life and property.

Potential Funding: FEMA Hazard Mitigation Grant Program

Timeline: 24 Months

Project Priority (H, M, L): High

Action 6. Enhance Infrastructure to Mitigate Against Climate-Driven Failures

Hazards Addressed: Fire, Floods, Drought, High Winds, Extreme Heat, Extreme Cold

Goals: 1, 2, 3, 4, 5

Issue/Background: Increasing variability in weather conditions and aging infrastructure nationwide have led to an increasing number of catastrophic infrastructure failures. The City's critical infrastructure utilities have been upgraded over time, but some components are clearly insufficient to withstand potential impacts of extreme weather events. The City has prioritized infrastructure improvements through its master planning process. These priorities are to be reexamined with an emphasis on the possibility of extreme events.

Project Description: The City seeks to repair and upgrade critical infrastructure in order to prevent serious damages or catastrophic failure in the face of severe weather events. Projects will be implemented as funding becomes available.

Other Alternatives: No Action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: City of Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works Department

Cost Estimate: $5+ Million

Benefits (Losses Avoided): Maintaining the integrity of critical infrastructure will mitigate damage and enhance the City's ability to respond to climate-driven weather events, and decrease threats to life, human health, and property.

Potential Funding: State and Federal grants, local funding

Timeline: Within 5 years

Project Priority (H, M, L): High

Action 7. Geographic Information Systems (GIS) Update Project

Hazards Addressed: Multi-Hazard

Goals: 1, 2, 3, 4, 5

Issue/Background: The City of Yuba City has a wide range of critical facilities that need to be geo-located and made easily available to disaster workers. Current data is stored on obsolete systems which have reduced availability, make it difficult to use, and increase delay when viewing the data. Current systems do not have the capability for inter-agency data sharing and editing.

Project Description: Update GIS software, hardware, data and appurtenances to meet current standards and best practices. Develop mobile field apps to assign work and resources during disaster. Develop inter-agency data sharing and editing capabilities with neighboring agencies. City staff to attend trainings on the creation, deployment, and use of maps and applications.

Other Alternatives: No Action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Yuba City Public Works, Engineering Division

Responsible Agency/ Department/Partners: Yuba City Public Works Department

Cost Estimate: $400,000

Benefits (Losses Avoided): Updated GIS mapping systems provide critical tools for effectively responding to emergency situations. Current and correct maps of infrastructure increase the ability of critical responders to effectively address emergency situations and minimize potential for loss of life and damage to property.

Potential Funding: Federal and State grants, local funding.

Timeline: Within 5 years.

Project Priority (H, M, L): High

Climate Change Actions

Action 8. Prepare a Study to Evaluate Climate-Driven Impacts on Infrastructure

Hazards Addressed: Climate Change and its effects on Fire, Floods, Drought, High Winds, Extreme Heat, Extreme Cold

Goals: 1, 2, 3, 4, 5

Issue/Background: Increasing variability in weather conditions and aging infrastructure nationwide have led to an increasing number of catastrophic infrastructure failures. The City has prioritized its infrastructure improvements through the master planning process based upon historic weather conditions, and funding of the identified capital improvements is limited by the City's rate structure and the availability of state and federal funding.

Project Description: This study would review the City's critical infrastructure conditions with a view toward its ability to withstand more extreme and more frequent weather events than previously experienced. The study would provide a prioritized list of infrastructure needs and vulnerabilities to guide the City's prioritization of infrastructure maintenance and upgrade processes.

Other Alternatives: No Action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: City of Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works Department

Cost Estimate: $150,000

Benefits (Losses Avoided): A report prioritizing the City's investment in infrastructure maintenance and improvement will enhance the effective allocation of resources to protect life and property.

Potential Funding: State and Federal grants, local funding.

Timeline: Within 5 years

Project Priority (H, M, L): High

Flood, Localized Flood, and Levee Failure Actions

Action 9. Implementation of CRS Activities

Hazards Addressed: Flooding, Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The CRS Program brings several mitigation concepts together to help communities develop solid floodplain management programs by reducing flood losses, protecting properties from flood damage, and helping to strengthen the insurance aspects of the NFIP. The CRS is one of FEMA's premier mitigation programs which also helps to mitigate damage from other natural hazards. Communities who implement CRS activities receive a rating which results in the reduction of flood insurance premiums for policy holders in that community. Sutter County, Yuba City and Live Oak all participate in the CRS Program. This also provides continued compliance with the NFIP.

Project Description: Continue to implement CRS Activities and look for additional CRS credits under the 2013 CRS Coordinator's Manual to better protect residents from flood damage and other natural hazards.

Other Alternatives: None

Existing Planning Mechanism(s) through which Action Will Be Implemented: Yuba City Public Works Department, public outreach programs

Responsible Agency/ Department/Partners: Sutter County Department of Water Resources, Yuba City Public Works Department, Live Oak Building Department

Cost Estimate: Staff time

Benefits (Losses Avoided): Increased flood protection and reduction in the cost of flood insurance.

Potential Funding: Existing budget.

Timeline: Ongoing

Project Priority (H, M, L): High

Action 10. 200-Year Flood Protection for Sphere of Influence Area

Hazards Addressed: Flood and Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The southwest portion of the City's Sphere of Influence is located within the 200-year floodplain.

Project Description: Construct a J-levee around the southwest portion of the City's Sphere of Influence to protect the urban area and allow development to occur per the City's General Plan.

Other Alternatives: Improve the Sutter Bypass Levee to provide 200-year flood protection.

Existing Planning Mechanism(s) through which Action Will Be Implemented: To be determined.

Responsible Agency/ Department/Partners: Yuba City Department of Public Works

Cost Estimate: $70+ Million

Benefits (Losses Avoided): Provide 200-year flood protection to the City's Sphere of Influence area, thereby reducing the risk of flooding.

Potential Funding: Federal and State Grants, Local Funds

Timeline: Within the next 5 years

Project Priority (H, M, L): High

Action 11. Alternative Methods to Dispose of Treated Wastewater

Hazards Addressed: Flood and Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The treated wastewater effluent diffuser line is located in the Feather River near Shanghai Bend. With recent naturally occurring changes to the river, the diffuser line is no longer submerged for much of the year, thus cannot operate as designed. Instead, the City has had to utilize discharge ponds located on the east side of the Feather River in the floodplain, or alternately to allow the wastewater effluent to flow overland in order to reach the river.

Project Description: Develop alternative methods to dispose of treated wastewater effluent through utilizing the effluent for irrigation purposes or relocating the discharge ponds out of the floodplain.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works Department

Cost Estimate: Estimated $10 Million to $20 Million

Benefits (Losses Avoided): Future mitigation and reconstruction costs of rebuilding the ponds after a major storm event.

Potential Funding: State and Federal Grants, Local Funds

Timeline: 10+ years

Project Priority (H, M, L): Low

Action 12. Relocation of Treated Wastewater Effluent Diffuser Line

Hazards Addressed: Flood and Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The treated wastewater effluent diffuser line is located in the Feather River near Shanghai Bend. With recent naturally occurring changes to the river, the diffuser line is no longer submerged for much of the year, thus cannot operate as designed. Instead, the City has had to utilize discharge ponds located on the east side of the Feather River in the floodplain, or alternately to allow the wastewater effluent to flow overland in order to reach the river.

Project Description: Relocate the diffuser line downstream to an area where the river channel is more stable.

Other Alternatives: Find an alternative method to dispose of treated effluent.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works Department

Cost Estimate: $35 million

Benefits (Losses Avoided): The ability to utilize the diffuser line year-round will reduce the City's reliance on discharge ponds located within the floodplain, which have been a repetitive loss in the past.

Potential Funding: Local Funds – CIP Budget

Timeline: Within 3 years

Project Priority (H, M, L): High

Action 13. Water Treatment Plant Intake Access Road and Intake Structure

Hazards Addressed: Flooding, Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: In 2017, high Feather River flows caused severe damage to the Low Lift Station Access Road providing access to the City's drinking water intake facility. Intake pumps also were damaged

and required repair. The City applied for assistance to FEMA through Cal OES for $1.5 million in damages to the City's access road and intake pumps. Given the state of the primary access road, the City has received reluctant approval from Levee District 1 to drive a crane truck on the levee in order to conduct needed maintenance. This is a highly undesirable situation. Further, this route extends along an easement through an orchard over a gravel surface which was also damaged in the 2017 high-water incident.

Project Description: Repair and/or reroute the City's primary access road to restore equipment access to the intake, and upgrade armoring to minimize risk of future flood damage. Restore the gravel surface on the orchard easement access. The pumps have been repaired, but funds have not been reimbursed.

Other Alternatives: No action.

E**xisting Planning Mechanism(s) through which Action Will Be Implemented**: City of Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works Department

Cost Estimate: $1+ Million

Benefits (Losses Avoided): Restore vehicle access to critical infrastructure.

Potential Funding: Federal and State Grants, Local Funds

Timeline: Within the next 2 years

Project Priority (H, M, L): High

Action 14. Project Improvements to Decrease Localized Flooding

Hazards Addressed: Flood.

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Localized flooding throughout the city occurs during storm events due to lack of infrastructure and drainage problems. Due to aging infrastructure, much of the storm water conveyance system needs repair or replacement. As the City has grown and annexed rural areas, drainage problems have arisen that have led to localized flooding of streets and low-lying property. In some cases, the existing infrastructure is undersized for the ultimate buildout. In other cases, there is no storm water conveyance system.

Project Description: Construct drainage improvements to address localized flooding issues. Purchase CCTV truck and camera equipment, and combination Vac truck with jet to be dedicated to stormwater system maintenance. Develop maps of City storm conveyance system pipes, valves, drain inlets, and appurtenances.

Other Alternatives: Continue to allow localized flooding during storm events.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Yuba City Capital Improvement Program.

Responsible Agency/ Department/Partners: Yuba City Public Works

Cost Estimate: $10 Million

Benefits (Losses Avoided): Reduce damage to homeowners and property loss. Reduce the possibility of safety hazards associated with flooded streets, public property, and systems. Reduce infiltration of oils and foreign materials into stormwater conveyance system, thereby reducing contamination of waterways. Reduce labor and associated costs of cleaning up after a localized flooding event.

Potential Funding: State and Federal funds, local funds/

Timeline: Ongoing

Project Priority (H, M, L): High

Action 15. Feather River Habitat Restoration

Hazards Addressed: Flood and levee failure.

Goals Addressed: 1, 3, 5

Issue/Background: The habitat of the Feather River Floodplain on the west bank of the Feather River has changed drastically over the years. Yuba City at one time had wastewater effluent discharge ponds located in the floodplain north of the 10th Street Bridge, and the area had been overtaken by blackberries and non-native species. Significant restoration projects and improvements have been conducted north of the 10th Street Bridge. Phase I, approximately 70 acres, was completed in 2013; Phase II, approximately 80 acres, was nearly complete as of March 2021.

Project Description: Develop and implement a Habitat Restoration Plan. Develop plans for future phases of Feather River Parkway restoration and improvements. Maintain restoration efforts in Feather River Parkway.

Other Alternatives: Do nothing.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Yuba City Capital Improvement Program.

Responsible Agency/ Department/Partners: Yuba City Public Works, Yuba City Parks and Recreation

Cost Estimate: $2+ Million

Benefits (Losses Avoided): Restore native vegetation and recreational opportunities to region valuable as wildlife habitat and parkland.

Potential Funding: Federal and State Grants, Local Funds

Timeline: Within 5 years

Project Priority (H, M, L): M

Action 16. Levee Pipe Crossing Inspection and Reinforcement

Hazards Addressed: Flooding

Goals: 1, 3, 5

Issue/Background: The City relies on several pipelines crossing the levee for critical infrastructure components of the community. These pipelines transport raw drinking water, potable water, wastewater, stormwater, natural gas, communications lines, and high-pressure air in numerous levee crossings to serve the needs of the community.

Project Description: Inspect all pipe crossings of the levees and associated floodplains. Update GIS mapping, document video inspections and pressure test results, develop inter-agency data sharing and editing capabilities with neighboring agencies. Reinforce and/or repair the pipelines and landscape through which these lines travel in and around the floodplain.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: City of Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: City of Yuba City Public Works Department

Cost Estimate: $2 Million

Benefits (Losses Avoided): Maintaining the structural soundness of each pipeline crossing the levee is protective of the both the infrastructure purpose and the levee itself. Any levee structure breach has potential to cause significant damage and potential catastrophic damage.

Potential Funding: Federal and State grants, local funding

Timeline: Within 5 years

Project Priority (H, M, L): H

Project Priority (H, M, L): H

Drought Actions

Action 17. Aquifer Storage and Recovery Well Development

Hazards Addressed: Drought

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The City of Yuba City is over-dependent on outside water agencies and sources to supply potable domestic water to its residence.

Project Description: As a drought mitigation effort, the City intends to develop an aquifer storage recovery (ASR) system, within Yuba City proper, at the City's Water Treatment Plant (WTP) at 701 Northgate Drive, Yuba City. The location is in the Eastern part of Yuba City and adjacent to the Feather River.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: City of Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works Department

Cost Estimate: $6.5 million

Benefits (Losses Avoided): Availability of adequate water supplies during drought conditions.

Potential Funding: Federal and State Grants, Local Funds

Timeline: Within the next 5 years

Project Priority (H, M, L): High

Action 18. Develop additional water supplies

Hazards Addressed: Drought

Goals: 1, 2, 3, 4, 5

Issue/Background: The City of Yuba City is over-dependent on outside water agencies and sources to supply potable domestic water to its residence.

Project Description: As a drought mitigation effort, the City intends to explore options for developing additional water supplies. Among the options under consideration are constructing a new well at the Water Treatment Plant and rehabilitating existing wells to enhance emergency supplies in the Yuba City service area.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: City of Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works Department

Cost Estimate: $7+ Million

Benefits (Losses Avoided): Availability of adequate water supplies during drought conditions.

Potential Funding: Federal and State Grants, Local Funds

Timeline: Within the next 5 years

Project Priority (H, M, L): H

Severe Weather Actions

Action 19. Project to Reduce Localized Vulnerability to Sewer System Overflows

Hazards Addressed: High Winds

Goals: 1, 2, 3, 4, 5

Issue/Background: In January 2021, a wind storm caused a major power outage on the northwest area of the City of Yuba City. Approximately 125 homes in this region are on individual septic tanks, requiring pumps to discharge their sewage into our sewer mains. This neighborhood, the Stonegate area, was without power for approximately 12 hours. The City does not have an effective way to provide power to all those individual Septic Tank Effluent Pumping (STEP) systems, or to pump out all those septic tanks at one time. City employees knocked on every door in the neighborhood to advise residents not to run their water. The power came back on before the City was faced with sewage backing up into homes or overflowing onto the street.

Project Description: The Stonegate area would be less vulnerability to the possibility of widespread Sanitary Sewer Overflows (SSOs) in the event of a power outage if the STEP systems at each individual home were replaced by direct flow into gravity mains.

Alternately, a backup power system to provide power to this neighborhood during larger power outages would alleviate the possibility of widespread SSOs overflows in this community.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Yuba City Capital Improvement Program

Responsible Agency/ Department/Partners: Yuba City Public Works

Cost Estimate: $6 Million

Benefits (Losses Avoided): Ensuring the continued flow of sewage into the sewer system protects public health and avoids incurring state penalties for violating Waste Discharge Requirements.

Potential Funding: State and Federal grants, local funds

Timeline: 1-5 years

Project Priority (H, M, L): Medium

Wildfire Actions

Action 20. Fuels Mitigation for High-Risk Wildland Urban Interface (WUI) Areas

Hazards Addressed: Wildfire-Multi Jurisdictions

Goals Addressed: 1,2, 5

Issue/Background: There are areas in the Sutter County that cross multiple jurisdictions that contain a moderate to high-risk wildland urban interface (WUI) due to unmanaged fuels, which lead to rapid wildfire fire spread. These unmanaged fuels consist of continuous surface, ladder, and aerial of both living and dead matter.

Project Description: Strategically remove living and dead vegetation in high-risk wildland Urban Interface (WUI) area in an effort to decrease the severity and extent of a wildfire to decrease damage and/or risk to life, property, and the environment.

Other Alternatives: No action.

Existing Planning Mechanism(s) through which Action Will Be Implemented: N/A

Responsible Agency/ Department/Partners: City of Yuba City/Sutter County/Levee District/Yuba City Fire/Sutter County Fire

Cost Estimate: $150,000

Benefits (Losses Avoided): A comprehensive fuels mitigation plan and process will decrease the threat to human and animal life, property, and the impact of emergency response agencies.

Potential Funding: State and Federal Grants, Local Funds

Timeline: 24 Months

Project Priority (H, M, L): High

Annex C Levee District 1

C.1 Introduction

This Annex details the hazard mitigation planning elements specific to Levee District 1 (LD 1 or District), a previously participating jurisdiction of the 2013 Sutter County Local Hazard Mitigation Plan (LHMP) Update. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the District. This Annex provides additional information specific to LD 1, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

C.2 Planning Process

As described above, the District followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the District formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table C-1. Additional details on plan participation and District representatives are included in Appendix A.

Table C-1 LD 1 – Planning Team

Name	Position/Title	How Participated
Andrew Stresser	General Manager	Provided input on hazard tables, past occurrences, impacts, and capabilities. Brainstormed ideas for mitigation actions.
George Allen	Superintendent	Provided input on hazard tables, past occurrences, impacts, and capabilities. Brainstormed ideas for mitigation action costs.

Coordination with other community planning efforts is paramount to the successful implementation of this LHMP Update. This section provides information on how the District integrated the previously approved 2013 Plan into existing planning mechanisms and programs. Specifically, the District incorporated into or implemented the 2013 LHMP through other plans and programs shown in Table C-2.

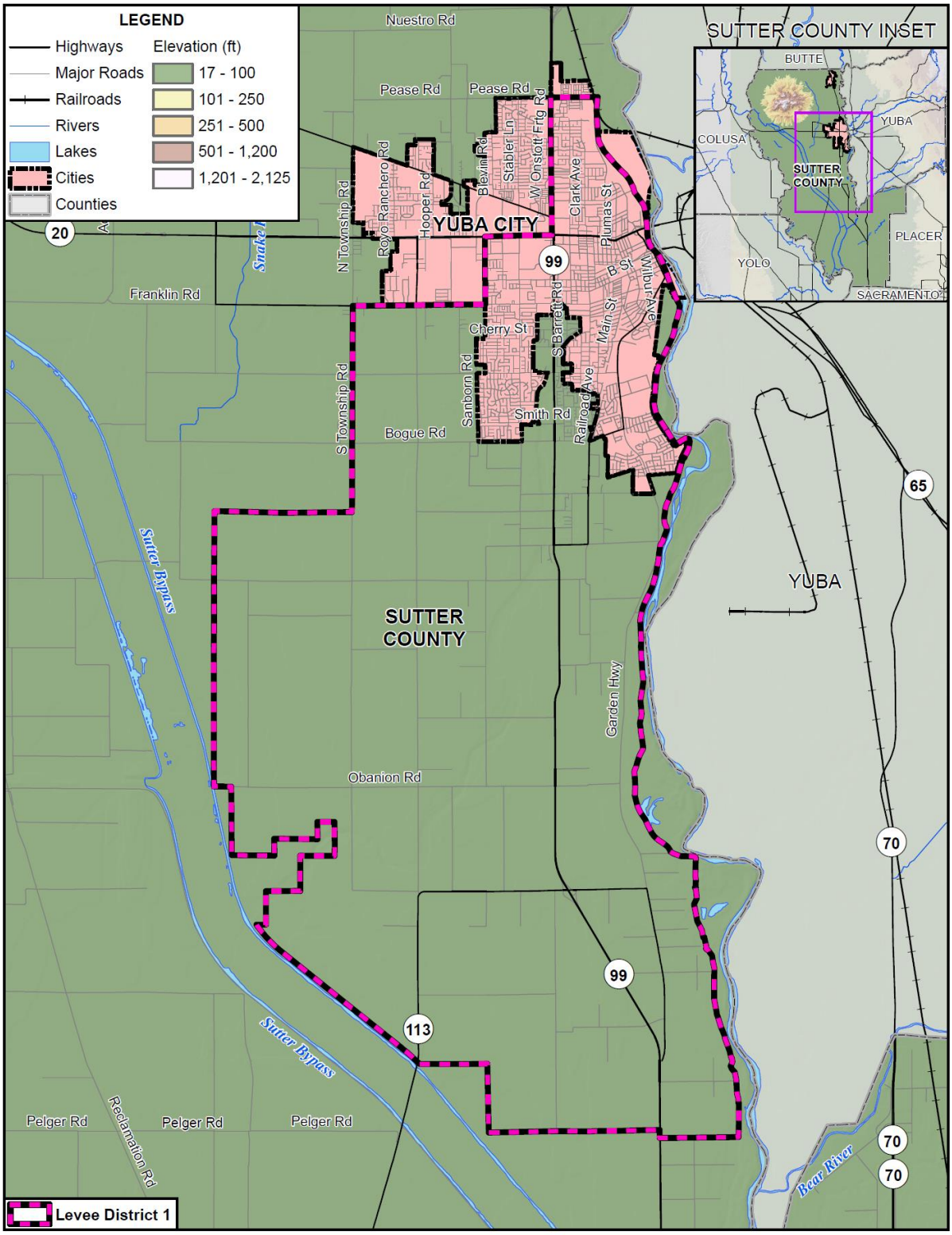
Table C-2 2013 LHMP Incorporation

Planning Mechanism 2013 LHMP Was Incorporated/Implemented In.	Details: How was it incorporated?
N/A	The District completed no planning processes since 2013 related to the LHMP

C.3 District Profile

The District profile for the LD 1 is detailed in the following sections. Figure C-1 displays a map and the location of the District within Sutter County.

Figure C-1 LD 1



C.3.1. Overview and Background

Levee District #1, California's first district, was formed in April 1868 by the State Legislature and has been in continuous operation. Its mission is to protect the residents of Sutter County from flooding by the Feather River and to maintain levees within its jurisdiction. The District is comprised of approximately 41,083 acres of land. District boundaries begin at Pease Road in northern Yuba City and run south downstream along the Feather River for 17 miles. The total footprint of the levees is approximately 270 acres.

The District's levees were first constructed in 1868 and have been raised in height several times since that date. The Department of Water Resources rates California's levee districts, and continues to give Levee District #1 an "excellent" rating. The District underwent major maintenance/repairs in 1999. Current maintenance plans include a setback levee and repair of an erosion site. As part of the FRWLP completed by SBFCA LD1's levee has been completely rehabilitated.

C.4 Hazard Identification

LD 1 identified the hazards that affect the District and summarized their location, extent, frequency of occurrence, potential magnitude, and significance specific to District (see Table C-3).

Table C-3 LD 1—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Highly Likely	Limited	Low	Medium
Climate Change	Extensive	Likely	Limited	Low	–
Dam Failure	Extensive	Occasional	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Limited	Low	High
Earthquake	Extensive	Unlikely	Catastrophic	Low	Low
Floods: 1%/0.2% annual chance	Extensive	Likely	Critical	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Limited	Low	Medium
Levee Failure	Significant	Occasional	Catastrophic	High	Medium
Pandemic	Extensive	Likely	Critical	Low	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Limited	Low	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Low	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Limited	Low	Medium
Wildfire	Significant	Highly Likely	Critical	Low	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

C.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile the District's hazards and assess the District's vulnerability separate from that of the Sutter County Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the District is included in this Annex. This vulnerability assessment analyzes the property and other assets at risk to hazards ranked of medium or high significance specific to the District. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

C.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section C.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table C-3) affects the District and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Sutter County Planning Area.

C.5.2. Vulnerability Assessment and Assets at Risk

This section identifies the District's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the District. This data is not hazard specific, but is representative of total assets at risk within the District.

Assets at Risk and Critical Facilities

This section considers the LD 1's assets at risk, with a focus on key District assets such as critical facilities, infrastructure, and other District assets and their values. With respect to District assets, the majority of these assets are considered critical facilities as defined for this LHMP. Critical facilities are defined for this Plan as:

> ***Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.***

Table C-4 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. LD 1's physical assets, valued at over $100 million, consist of the buildings and infrastructure to support the District's operations.

Table C-4 LD 1 Critical Facilities, Infrastructure, and Other District Assets

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
Levee System	Flood Protection	In excess of $100,000,000	Flood, Levee Failure
Total		**$ 0**	

Source: LD 1

The District noted that the levees in the District have differing levels of certification. From Levee Mile (LM) 0 to approximately 4 there is 100-year (1% annual chance) level of protection. From LM 4 to 16.11 the levee is certified to the 200-year (0.5% annual chance) level of protection.

Natural Resources

LD 1 has a variety of natural resources of value to the District. These natural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Historic and Cultural Resources

LD 1 has a variety of historic and cultural resources of value to the District. These historic and cultural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Growth and Development Trends

Customers are residents and landowners within District boundaries, including almost all of the City of Yuba City. General growth in the District parallels that of Yuba City. Information can be found in Section 4.3.1 of the Base Plan and in the City of Yuba City Annex.

Development since 2013

No new District facilities have been constructed since 2013. SBFCA has completed a number of Project since 2013.

Future Development

The District has no control over future development in areas the District provides levee protection in. The District has the potential to put in a new shop or office in the next 5 years. Future development in the District, in general, parallels that of the Sutter County Planning Area. More general information on growth and development in Sutter County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sutter County Vulnerability and Assets at Risk of the Base Plan.

C.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table C-3 as high or medium significance hazards. Impacts of past events and vulnerability of the District to specific hazards are further discussed below (see Section 4.1 Hazard

Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the District to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, critical facilities and infrastructure, populations at risk, and future development.

Dam Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–Extremely High

Hazard Profile and Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

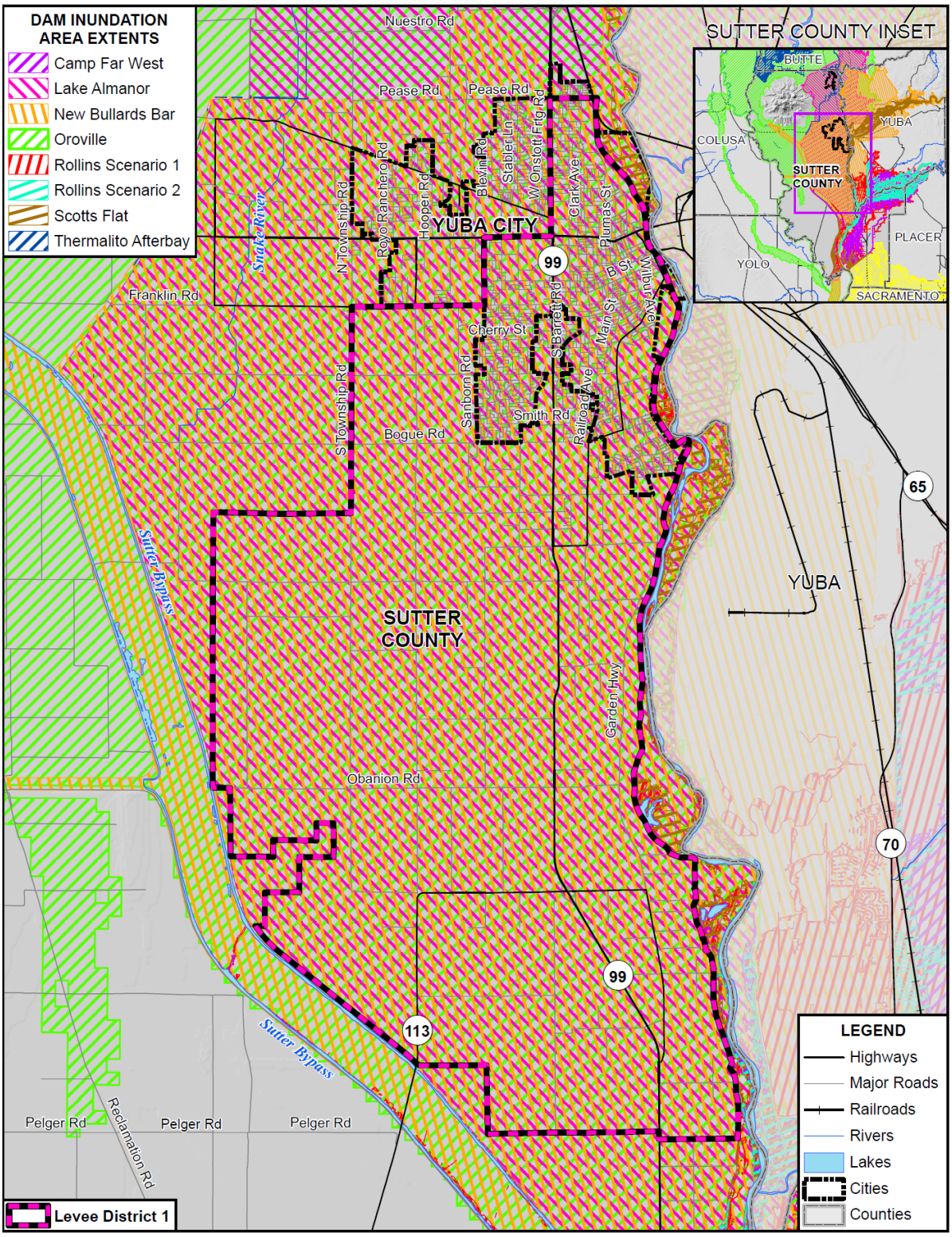
Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, Cal DWR Division of Safety of Dams (DOSD) assigns hazard ratings to dams within the State that provides information on the potential impact should a

dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.2.10 of the Base Plan.

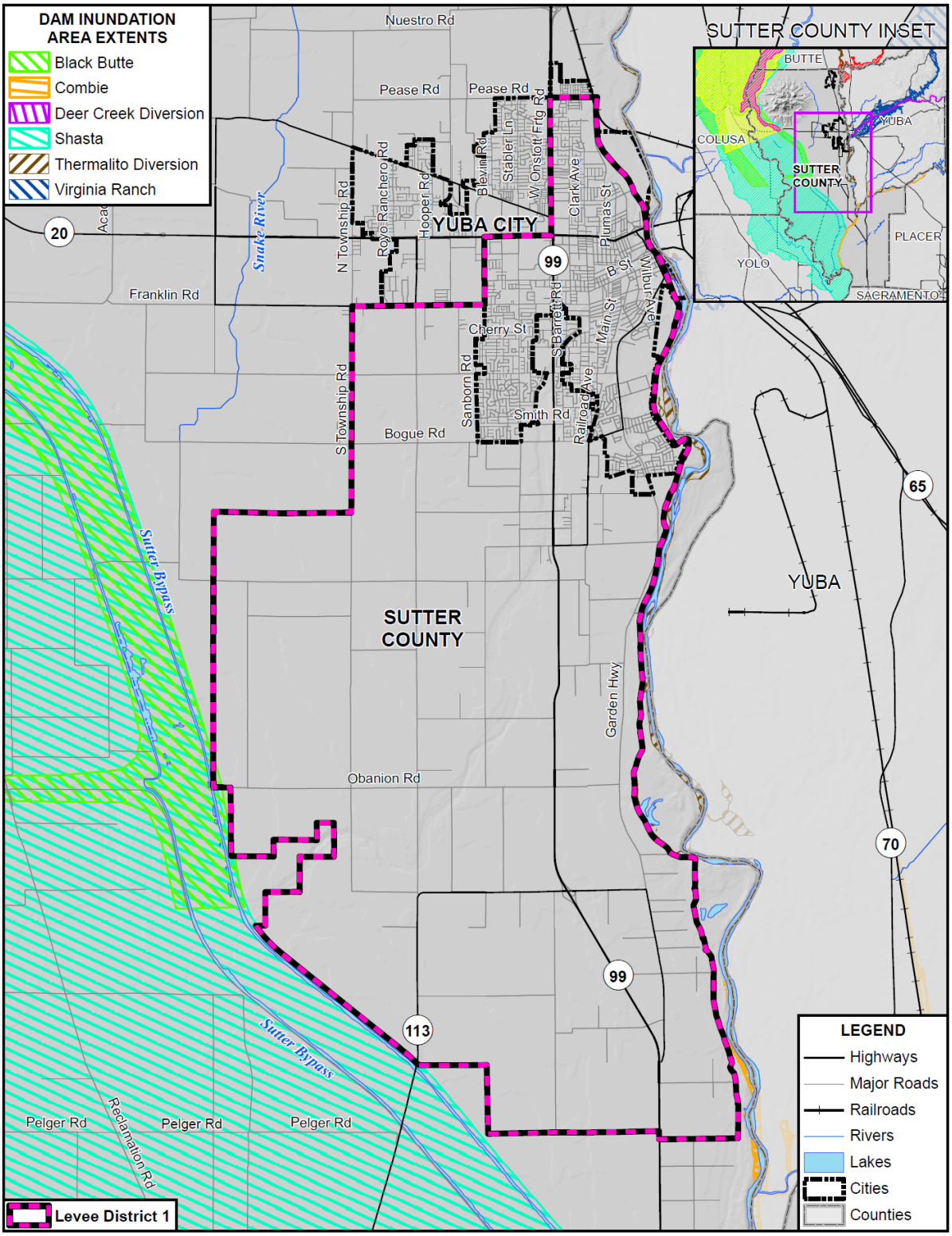
While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The District would be affected for as long as the flood waters from the dam failure took to drain downstream.

Figure C-2 LD 1 – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure C-3 LD 1 – High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident. This can be seen on Table C-5.

Table C-5 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

The District noted the 2017 Oroville Spillway incident did have impacts on the District. The Oroville Dam failure coupled with atmospheric rivers caused impacts throughout flood season. Highest precipitation recorded for flood season in Feather river basin. Feather River West Levee was at risk. Yes, levee was comprised. Repairs were complete and funded by DWR in summer of 2017. Waterside slope between 5th and 10th street bridge. New slurry wall installed from Whitaker Hall to Lynn Way. FEMA/NRCS & Cal OES funding covered approximately $125,000 for Levee District No.1.

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the District from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant. District impacts from dam failure upstream of District levees would be levee breaches, erosion, or potential sluffing.

Assets at Risk

As shown in the figures above, the levees and all District facilities in Table C-4 could be at risk to dam failure, depending on the dam that fails and the nature of its failure.

Future Development

SBFCA would be place in chard of planning future development in the District. General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. LD 1 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD 1 facilities is properly sited and constructed.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

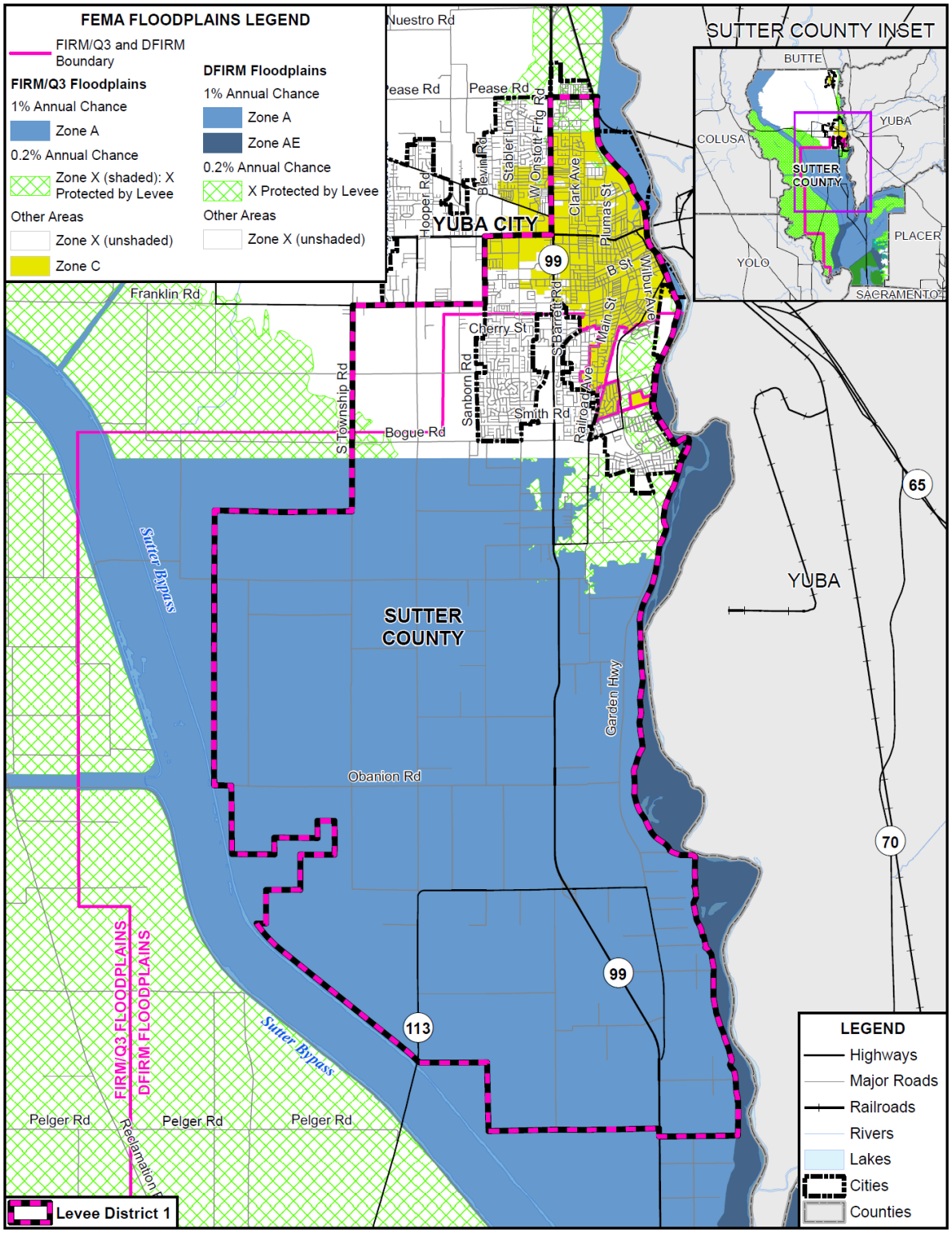
This hazard analyzes the FEMA DFIRM 1%, 0.5%, and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the District, and have caused damages in the past. Flooding is a significant problem in Sutter County and the District. Historically, the District has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1%, 0.5%, and 0.2% annual chance floodplains and in other localized areas.

As previously described in Section 4.2.13 of the Base Plan, the Sutter County Planning Area and the LD 1 have been subject to historical flooding. LD 1 is traversed by several stream systems and is at risk to the 1% and 0.2% flood.

Location and Extent

The LD 1 has areas located in the 1% and 0.2% annual chance floodplain. This is seen in Figure C-4.

Figure C-4 LD 1 – FEMA Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table C-6 details the Q3/DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the District.

Table C-6 LD 1– Q3/DFIRM Flood Hazard Zones

Flood Zone	Description	Present in District
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	X
AE	1% annual chance flood: Base flood elevations provided	X
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	X
X (unshaded)	No flood hazard	X
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	
AE	100-year Flood: Base flood elevations provided	
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	
X (unshaded)	No flood hazard	X
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	X

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the District vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the District tends to have a shorter speed of onset, due to the amount of water that flows through the District.

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table C-7. These events also likely affected the District to some degree.

Table C-7 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

The District facilities consist of two pump back stations to pump relief-wells back into the river; one 50 years old and another that is 14 years old. A new 25 horsepower motor was installed 14 years ago on the oldest pump back station. Pumps only operate when a flood causes the relief wells to run. The last time this occurred was in 1997. Average flow in the west bank is between 8,000 and 12,000 cubic feet per second. The highest recorded capacity was 325,000 cubic feet per second in 1997.

The District noted that there were some damages sustained in the early 2017 high water event. A high-water event in January and February of 2017 were caused due to atmospheric rivers compounded with high reservoir releases from Oroville Dam (failing spillway) impacted systems along the Feather River, Sutter Bypass, and Sacramento River. Water logging of orchards adjacent to the Feather River (e.g. walnut) occurred. There were impacts to the agriculture sector; evacuation closed businesses. Roads in the District were closed due to flooding or evacuation routing; schools were closed during the evacuation. The District had some erosion and seepage issues. Local and federal declarations for eligible applicants for Disasters DR-4301, DR-4308. CA DWR addressed sites they deemed "serious." USACE PL84-99 assisted levee maintaining agencies that were eligible under this program (including eligibility via a Letter of Intent).

Vulnerability to and Impacts from Flood

Floods have been a part of the District's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures and critical facilities in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, loss of environmental resources, and economic impacts.

District specific impacts include the loss of life and property to the tune of 70,000+ residents and approximately $10 billion in property and assets protected by District levees.

Assets at Risk

All District assets (from Table C-4) are at risk from this hazard.

Future Development

SBFCA would be place in chard of planning future development in the District. SBFCA is in the process of certifying the levee for 200 year flood event. General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. LD 1 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD 1 facilities is properly sited and constructed.

Levee Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–High

Hazard Profile and Problem Description

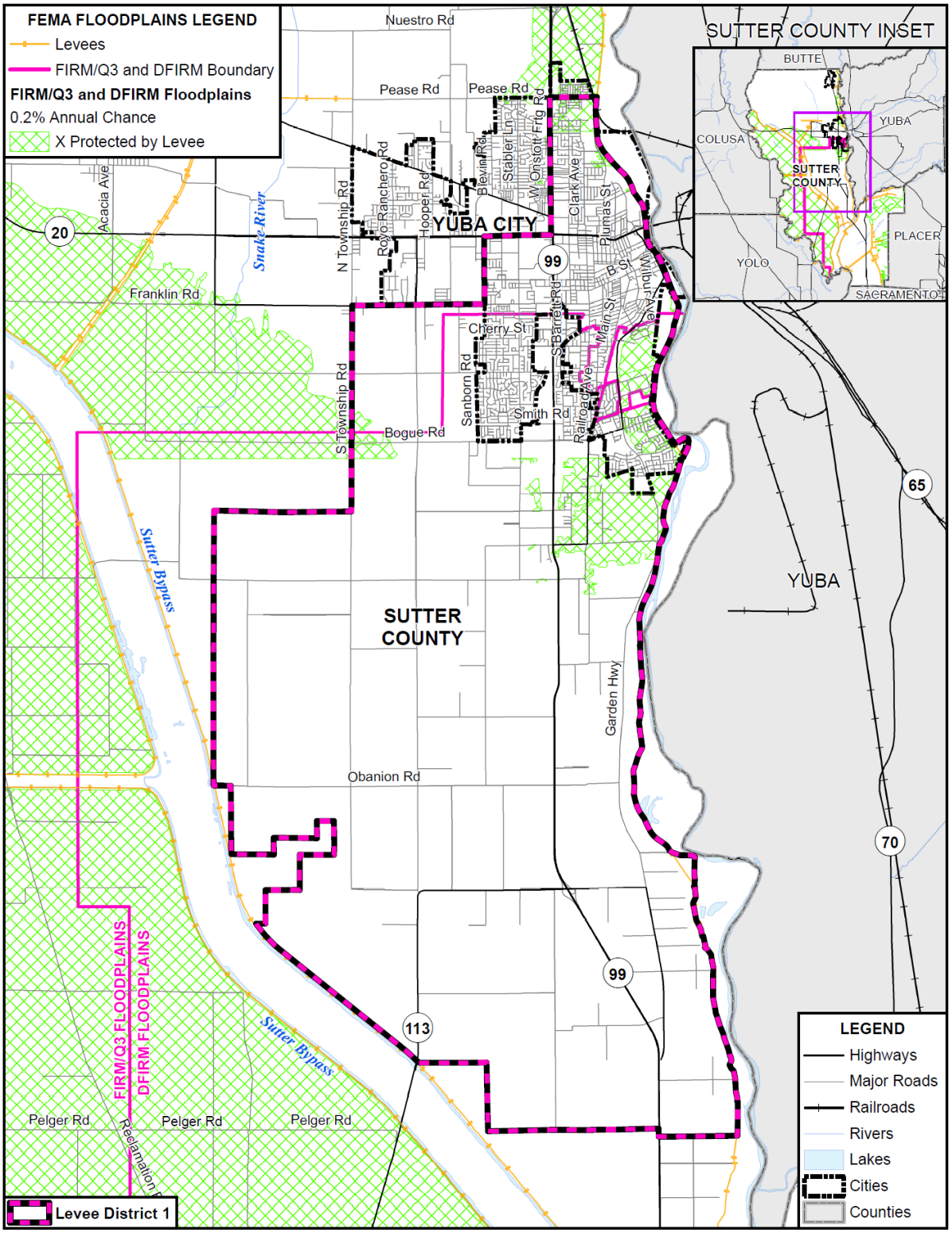
A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the District are not known. The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. When northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees. Levees in the District and DFIRM flood zones are shown on Figure C-5.

Figure C-5 LD 1 – Levees and Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

In December 1955, the levee breached near Shanghai Bend with the loss of many lives and billions of dollars in property losses. Levee failure from either breaching or overtopping would result in the total loss of levee embankment material, as was the case in the 1997 flood event.

Though the levees did not fail in 2017, there was damage. A levee had 100 feet of damage from a waterside erosion. The levee was repaired with rock slope protection.

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

The levees within the District boundaries were built between 1868 and the early 1900s. Over the years, the river has changed courses many times. The straightening of Shanghai Bend and Star Bend levees has relieved much of pressure and helped alleviate a portion of the flooding concerns.

Assets at Risk

All District levees and assets in Table C-4 are considered critical to the operations of the District and in providing adequate flood and drainage control within its boundaries. Should any of these identified assets fail, excessive flooding will occur within the District. Flood water elevations could be anywhere from one to twenty feet in depth for an undetermined amount of time.

Future Development

SBFCA would be place in chard of planning future development in the District. General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. LD 1 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD 1 facilities is properly sited and constructed.

C.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, and mitigation education, outreach, and partnerships.

C.6.1. Regulatory Mitigation Capabilities

Table C-8 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the LD 1.

Table C-8 LD 1 Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan	N	
Capital Improvements Plan	N	
Economic Development Plan	N	
Local Emergency Operations Plan	N	
Continuity of Operations Plan	N	
Transportation Plan	N	
Stormwater Management Plan/Program	N	
Engineering Studies for Streams	N	
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	N	
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	N/A	Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score	N/A	Score:
Fire department ISO rating:	N/A	Rating:
Site plan review requirements	N/A	
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	N/A	
Subdivision ordinance	N/A	
Floodplain ordinance	N/A	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	N/A	
Flood insurance rate maps	N/A	
Elevation Certificates	N/A	
Acquisition of land for open space and public recreation uses	N/A	

Erosion or sediment control program	N/A	
Other		
How can these capabilities be expanded and improved to reduce risk?		
Access Control is the greatest concern to the District at this point.		

Source: LD 1

C.6.2. Administrative/Technical Mitigation Capabilities

Table C-9 identifies the District department(s) responsible for activities related to mitigation and loss prevention in LD 1.

Table C-9 LD 1's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	N	
Mitigation Planning Committee	N	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Continued Maintenance year round
Mutual aid agreements	N	
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	N/A	
Floodplain Administrator	N/A	
Emergency Manager	N/A	
Community Planner	N/A	
Civil Engineer	N/A	
GIS Coordinator	N/A	
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	N	Provided by Sutter County
Hazard data and information	N	
Grant writing	Y	
Hazus analysis	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
Access Control is the greatest concern to the District at this point.		

Source: LD 1

C.6.3. Fiscal Mitigation Capabilities

Table C-10 identifies financial tools or resources that the District could potentially use to help fund mitigation activities.

Table C-10 LD 1's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	
Authority to levy taxes for specific purposes	Y	
Fees for water, sewer, gas, or electric services	N	
Impact fees for new development	N	
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	Y	
Incur debt through private activities	Y	
Community Development Block Grant	N	
Other federal funding programs	N	
State funding programs	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
Access Control is the greatest concern to the District at this point. Securing funds for it is necessary.		

Source: LD 1

C.6.4. Mitigation Education, Outreach, and Partnerships

Table C-11 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table C-11 LD 1's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	Sutter County and City of Yuba City
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	N	
Natural disaster or safety related school programs	N	

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
StormReady certification	N	
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
Providing efficient process for evacuation, in conjunction with Sutter County and Yuba City		

Source: LD 1

C.7 Mitigation Strategy

C.7.1. Mitigation Goals and Objectives

The LD 1 adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

C.7.2. Mitigation Actions

The planning team for the LD 1 identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Dam Failure
- Flood: 1%/0.2% Annual Chance
- Levee Failure

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement.

Multi-Hazard Actions

Action 1. Access Control

Hazards Addressed: Dam Failure, Flood: 1%/0.5%/0.2% Annual Chance, Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The LD1 and LD9 levee segments along the west bank of the Feather River protect a large portion of Sutter County's population, including City of Live Oak and the City of Yuba City, as well as high-value agricultural land.

Unauthorized camping on and near levees, ramps, maintenance roads, channel bank, etc. make it a significant challenge for Levee District personnel to perform critical maintenance activities (as required by the USACE and DWR), levee patrols, emergency flood fight activity, repairs, etc. In addition, unauthorized pedestrian and vehicle access damage the levee slopes that require significant resources for the Districts' to address. This is often compounded with the additional challenge of physically accessing the sites due uncontrolled unauthorized citizen and camping access blocking access to levee sites.

The compounded effects of uncontrolled access could leave the levee and it's system features vulnerable to more damage under highwater conditions, extended dry periods, and (if left unattended) potentially compromise the integrity of the levee.

Project Description: The project proposes to further characterize the best method(s) to control access to, on, and within the levee, ramps, maintenance roads, etc. This could include but is not limited to: additional gates, fencing, signage, partnerships with local enforcement agencies, etc.

Other Alternatives: Fencing place at the toe of the levee

Existing Planning Mechanism(s) through which Action Will Be Implemented: District currently budgets an amount each to address this issue. Current budget only allows for approximately 1 mile per year. Total levee miles are 22.36

Responsible Agency/ Department/Partners: Sutter County, City of Yuba City Levee District No.1 of Sutter County, Levee District No.9

Cost Estimate: $2 million

Benefits (Losses Avoided): Comprising the integrity of the levee which in protects 78,000 people and 10 billion in assets.

Potential Funding: Potential cost share with Levee Districts

Timeline: 2-3 years

Project Priority (H, M, L): High

Action 2. Erosion Mitigation at Levee District 1 – Sutter (LD1S) (Various sites; including those near Morse Road, Sullivan Pump, Singh Ranch Bend, and location where river takes an abrupt turn or bend)

Hazards Addressed: Dam Failure, Flood: 1%/0.5%/0.2% Annual Chance, Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Various locations, not already addressed by recent improvements, impacting the LD1S levee are susceptible to erosion at locations where the river takes an abrupt turn during high water events in the Feather River. In particular, eddies (turning or spinning water at a location) remove channel material and are within the levee prism. Additional sites may be revealed as a result of future high-water events.

Erosion is caused by forces induced by the high flow of water within a river or channel that cause embankment material to shear off. These sites are generally worse at locations where the river makes an abrupt turn or bend. These flows can erode a channel bank and approach the levee, or undermine other flood control structures and cause them to cave into the water. Bank caving or stream bank erosion can be a very serious threat to the stability of the levee. At these specific locations, the river or stream bank erosion has been observed to be moving in the direction of a levee, making fortification of the embankment and levee a need. Because erosion occur underwaters, levee patrols are often unable to see new issue developing or worsening, making it a challenge to respond to erosion during a flood event. Often is not truly seen until after sloughing occurs or waters recede. Therefore, implementing mitigation measures ahead of a flood is critical.

If erosion ultimately causes a levee failure at the project sites (immediately upstream of the City of Yuba City), floodwaters would flow southwest and impact the City of Yuba City, then impound against the levee along the Sutter Bypass or south end of the Feather River, and could produce flood depths exceeding 15-ft.

Project Description: The project seeks to reduce the threat of levee damage and potential failure induced by erosive forces. Fortification of the embankment and LD1S levees along the Feather River serves to protect critical evacuation and emergency transport routes, life, and property in Sutter County, Yuba City, and the City of Live Oak.

The project proposes to further characterize the erosion issue and implement the best erosion mitigation strategy. This includes fortifying the levees by scarifying the material and backfilling with higher quality, compacted, levee material. Since erosion is typically a reoccurring issue, the project should also include reseeding the levee slopes, and installing rock slope protection along the channel embankment. In extreme cases, where erosion persists this may also consider a setback levee.

Other Alternatives: None

Existing Planning Mechanism(s) through which Action Will Be Implemented: System Wide Improvement Framework under the USACE's PL 84-99 program (if eligible), ongoing maintenance, and emergency response

Responsible Agency/ Department/Partners: Levee District 1S / Sutter Butter Flood Control Agency

Cost Estimate: $ 30M

Benefits (Losses Avoided): Increased property protection and life safety protection.

Potential Funding: FEMA grant program (HMGP, BRIC, etc.), State DWR programs such as Flood System Repair Program (FSRP)

Timeline: 36 months

Project Priority (H, M, L): High

Annex D Reclamation District 70

D.1 Introduction

This Annex details the hazard mitigation planning elements specific to Reclamation District 70 (RD 70 or District), a previously participating jurisdiction of the 2013 Sutter County Local Hazard Mitigation Plan (LHMP) Update. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the District. This Annex provides additional information specific to RD 70, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

D.2 Planning Process

As described above, the District followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the District formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table D-1. Additional details on plan participation and District representatives are included in Appendix A

Table D-1 RD 70 – Planning Team

Name	Position/Title	How Participated
Andy Duffey	General Manager	Meetings and Phone calls. Informed hazard ID table. Gave past occurrences. Gave impacts, capabilities, and mitigation actions.

Coordination with other community planning efforts is paramount to the successful implementation of this LHMP Update. This section provides information on how the District integrated the previously approved 2013 Plan into existing planning mechanisms and programs. Specifically, the District incorporated into or implemented the 2013 LHMP through other plans and programs shown in Table D-2.

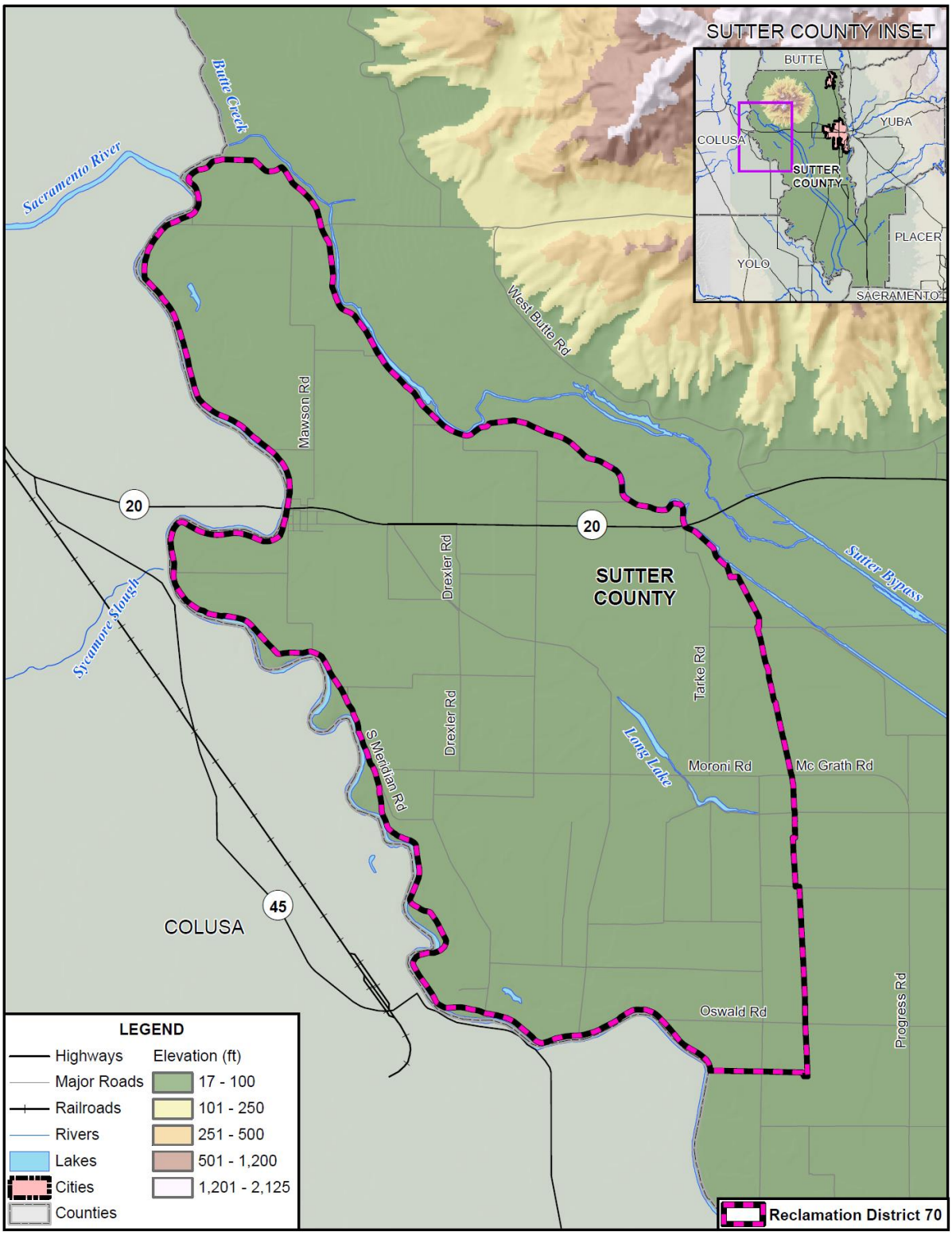
Table D-2 2013 LHMP Incorporation

Planning Mechanism 2013 LHMP Was Incorporated/Implemented In.	Details: How was it incorporated?
N/A	No planning related to the 2013 LHMP was completed.

D.3 District Profile

The District profile for the RD 70 is detailed in the following sections. Figure D-1 displays a map and the location of the District within Sutter County.

Figure D-1 RD 70



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

D.3.1. Overview and Background

Reclamation District 70 (RD 70) was established by voters in 1905 and provides drainage and flood protection to an area surrounding Meridian, CA. The District provides flood protection and drainage by maintaining approximately 23.6 miles of levees, and 100 miles of drainage ditches. The District is bounded by the Sacramento River, Butte Slough and the Sutter By-Pass, and is generally located just inside the western boundary of Sutter County, east of Colusa County. The District is approximately 17 miles west of Yuba City, and serves an area of approximately 20,315.02 gross acres, or 31.74 square miles. The predominant land uses within the District are agricultural.

Reclamation District 70 and Reclamation District 1660 share management, employees, offices and equipment. Daily operations for RD 70 and RD 1660 occur from the RD 70 facility. While the District currently shares resources with Reclamation District 1660, it remains autonomous by holding meetings and determining assessments relevant to RD 70. Therefore there are limited opportunities to share additional facilities and resources.

D.4 Hazard Identification

RD 70 identified the hazards that affect the District and summarized their location, extent, frequency of occurrence, potential magnitude, and significance specific to District (see Table D-3).

Table D-3 RD 70—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Significant	Likely	Limited	Medium	Medium
Climate Change	Extensive	Likely	Critical	High	–
Dam Failure	Extensive	Unlikely	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Critical	High	High
Earthquake	Limited	Unlikely	Limited	Medium	Low
Floods: 1%/0.2% annual chance	Extensive	Occasional	Catastrophic	High	Medium
Floods: Localized Stormwater	Extensive	Occasional	Critical	Low	Medium
Levee Failure	Extensive	Occasional	Catastrophic	High	Medium
Pandemic	Significant	Occasional	Limited	Medium	Medium
Severe Weather: Extreme Cold and Freeze	Limited	Occasional	Negligible	Low	Medium
Severe Weather: Extreme Heat	Limited	Likely	Negligible	Low	High
Severe Weather: Heavy Rains and Storms	Significant	Highly Likely	Critical	High	Medium
Wildfire	Limited	Unlikely	Negligible	Low	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

D.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile the District's hazards and assess the District's vulnerability separate from that of the Sutter County Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Sutter County Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the District is included in this Annex. This vulnerability assessment analyzes the property and other assets at risk to hazards ranked of medium or high significance specific to the District. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

D.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section D.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table D-3) affects the District and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Sutter County Planning Area.

D.5.2. Vulnerability Assessment and Assets at Risk

This section identifies the District's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the District. This data is not hazard specific, but is representative of total assets at risk within the District.

Assets at Risk and Critical Facilities

This section considers the RD 70's assets at risk, with a focus on key District assets such as critical facilities, infrastructure, and other District assets and their values. With respect to District assets, the majority of these assets are considered critical facilities as defined for this LHMP Update. Critical facilities are defined for this Plan as:

> ***Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.***

Table D-4 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. RD 70's physical assets, valued at over $25 million, consist of the buildings and infrastructure to support the District's operations.

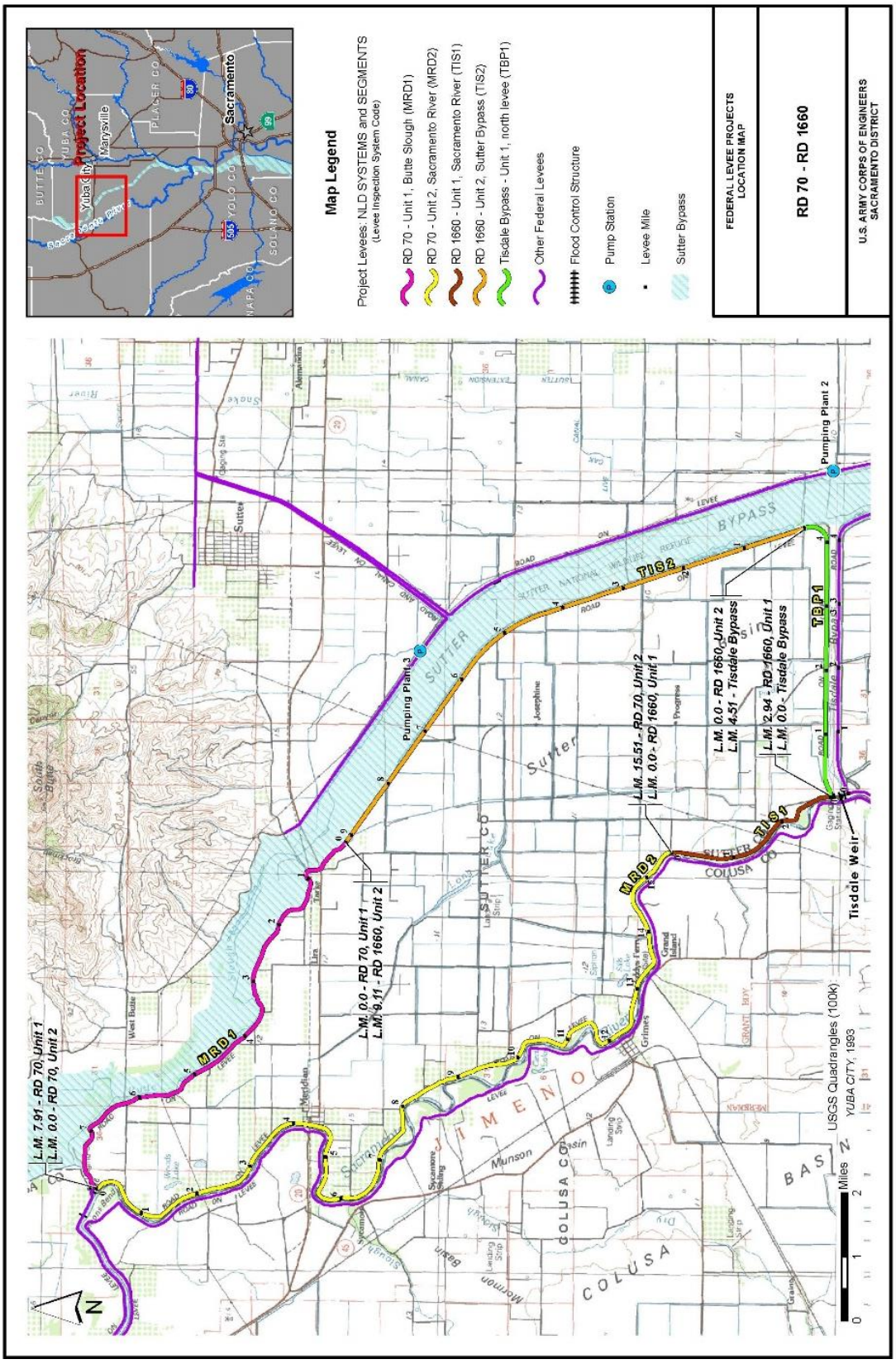
Table D-4 RD 70 Critical Facilities, Infrastructure, and Other District Assets

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
RD 70 Pumping Plant	Pumps	$25,000,000	Flood
RD 70 Mobile Trailer	Dwelling	$500,000	Flood
RD 70 Office	Office	$200,000	Flood
RD 70 Shop	Shop	$100,000	Flood
Total		**$25,800,000**	

Source: RD 70

RD 70 provided a District Levee map, which is shown on Figure D-2.

Figure D-2 RD 70 – Levee Status



Source: RD 70

Natural Resources

RD 70 has a variety of natural resources of value to the District. These natural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Historic and Cultural Resources

RD 70 has a variety of historic and cultural resources of value to the District. These historic and cultural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Growth and Development Trends

Reclamation District 70 will experience minimal rural growth throughout its service area due to County zoning policies that regulate agricultural parcel sizes. Large agricultural parcels limit the ability of rural subdivision development and therefore population growth. Agricultural uses will likely not expand as well given that the majority of land currently exists in agricultural uses.

Development since 2013

No District facilities have been constructed since 2013.

Future Development

The District's Municipal Service Review (MSR) noted that a majority of lands in RD 70 are designated for agricultural purposes. Sutter County's Zoning Ordinance requires that agricultural parcels range in size from a minimum of 20 acres to a maximum of 80 acres. These large lot sizes limit subdivision development, and therefore population growth in the area is minimal. As a result, there has been very little change in the District's population.

The District has no control over future development in areas the District provides levee protection in. Future development in these areas parallels that of Sutter County. More general information on growth and development in Sutter County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sutter County Vulnerability and Assets at Risk of the Base Plan.

D.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table D-3 as high or medium significance hazards. Impacts of past events and vulnerability of the District to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the District to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow.

Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, critical facilities and infrastructure, populations at risk, and future development.

Aquatic Invasive Species

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

The introduction of nonnative species into coastal marine and estuarine waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability.

Boats discharge ballast water that has been obtained from waters throughout the state, country, or the world. This water might include non-native organisms, untreated sewage, and other contaminants. Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. Examples include the zebra mussel infestation in the Great Lakes and the propagation of water hyacinth in the California Delta. Both the zebra mussel and the quagga mussel are concerns for California and Sutter County. These mussels have not affected the waters in Sutter County yet, but are still a cause for concern.

Some of California's most serious weed problems occur in waterways, lakes and streams. The aquatic plant hydrilla is considered one of the most serious aquatic weed problems in the world and the California Department of Food and Agriculture (CDFA) maintains an intensive program to survey and eradicate this aquatic weed pest. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, while impeding water flow and delivery. Its rapid growth and ease of spread by boats makes it critical to detect early and eradicate.

The effects of nonnative fish on native fish are generally in the form of predation and competition for food and breeding sites. There are also several non-fish, nonnative invasive species found in aquatic natural communities that can damage such communities. The introduced bullfrog is an important riparian invasive in the plan area. Many varieties of non-native aquatic weeds compete for the entire water column and shoreline in Sutter County, crowding out native species and degrading the aquatic and riparian habitat. The District's greatest concern is with Water Hyacinth.

Location and Extent

All freshwater lakes, streams, and rivers are potentially at risk from aquatic invasive species. There is no established scale for these invasive species. Magnitude is measured by the presence and counts of aquatic invasive species in waterways in Sutter County. Speed of onset of these invasive species is short, as it only takes a careless boater or visitor to the area to accidentally introduce an invasive species. However, the duration is long as once established they can take years to eradicate, if at all.

Past Occurrences

The District has not seen Water Hyacinth before. This invasive species could cause drainage canals as well as culvert to become clogged causing water to back up into roads and agricultural lands. The currently cost to remove is not available. However yearly the District spends tens of thousands of dollars removing other aquatic weeds.

Vulnerability and Impacts to Invasive Aquatics

The introduction of NAS into rivers and lakes can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability. Ships ballast water obtained from some other foreign location (outside the County) can include non-native organisms, untreated sewage, and other contaminants. Once introduced, NAS are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and economic havoc.

Aquatic invasive species can jeopardize and damage any part of the entire system ranging from human economy dependent infrastructure to natural aquatic, riparian and wetland habitat. Entire watersheds can be affected when an aggressive invasive species infests the rivers, shorelines, tributaries, drainage, irrigation and domestic delivery systems. Impacts to the District are mostly related to water recreation activities that may be hampered by these invasive species.

Assets at Risk

The Drainage Pumping Plant from Table D-4 is at risk from this hazard.

Future Development

The District plans to work with DWR and grant programs to remove and prevent against invasive species where possible. The District purchased a grass rake that attaches to an excavator. Aquatic weeds have been removed from District drains using this grass rake to fork out this floating weed.

Climate Change

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing. In Sutter County and the District, the HMPC the HMPC noted that each year it seems to get a bit warmer each year. It was also noted that 2017 was one of the wettest and 2019 one of the hottest years on record. Higher precipitation directly affects the District's ability to provide adequate drainage from the basin. This results in water overflowing drainage canals. The district has been working to rebuilt pump stations and cleaning drainage canals to handle excess precipitation.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the District, Sutter County, and State of California. There is no scale to measure the extent of climate change. Climate change exacerbates other hazards, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Climate change has never been directly linked to any declared disasters. While the District noted that climate change is of concern, no specific impacts of climate change could be recalled. The District and HMPC members noted that the strength of storms does seem to be increasing and the temperatures seem to be getting hotter.

Vulnerability to and Impacts from Climate Change

The California Adaptation Planning Guide (APG) prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the

unavoidable consequences of climate change. California's APG: Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Sutter County falls within the North Sierra Region characterized as a sparsely settled mountainous region where the region's economy is primarily tourism-based. The region is rich in natural resources, biodiversity, and is the source for the majority of water used by the state. This information can be used to guide climate adaptation planning in the District and Sutter County Planning Area.

The California APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Sutter County Planning Area is part of:

- Temperature increases
- Decreased precipitation
- Reduced snowpack
- Reduced tourism
- Ecosystem change
- Sensitive species stress
- Increased wildfire

Assets at Risk

The District noted that its facilities will most likely not be at risk from climate change.

Future Development

Future development of District facilities is unlikely to be affected by climate change. RD 70 does not control future development in areas protected by levees, that is the purview of the County or cities of Live Oak and Yuba City. RD 70 will continue to work with these entities in the future to ensure that future development is sited in proper areas.

Dam Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–High

Hazard Profile and Problem Description

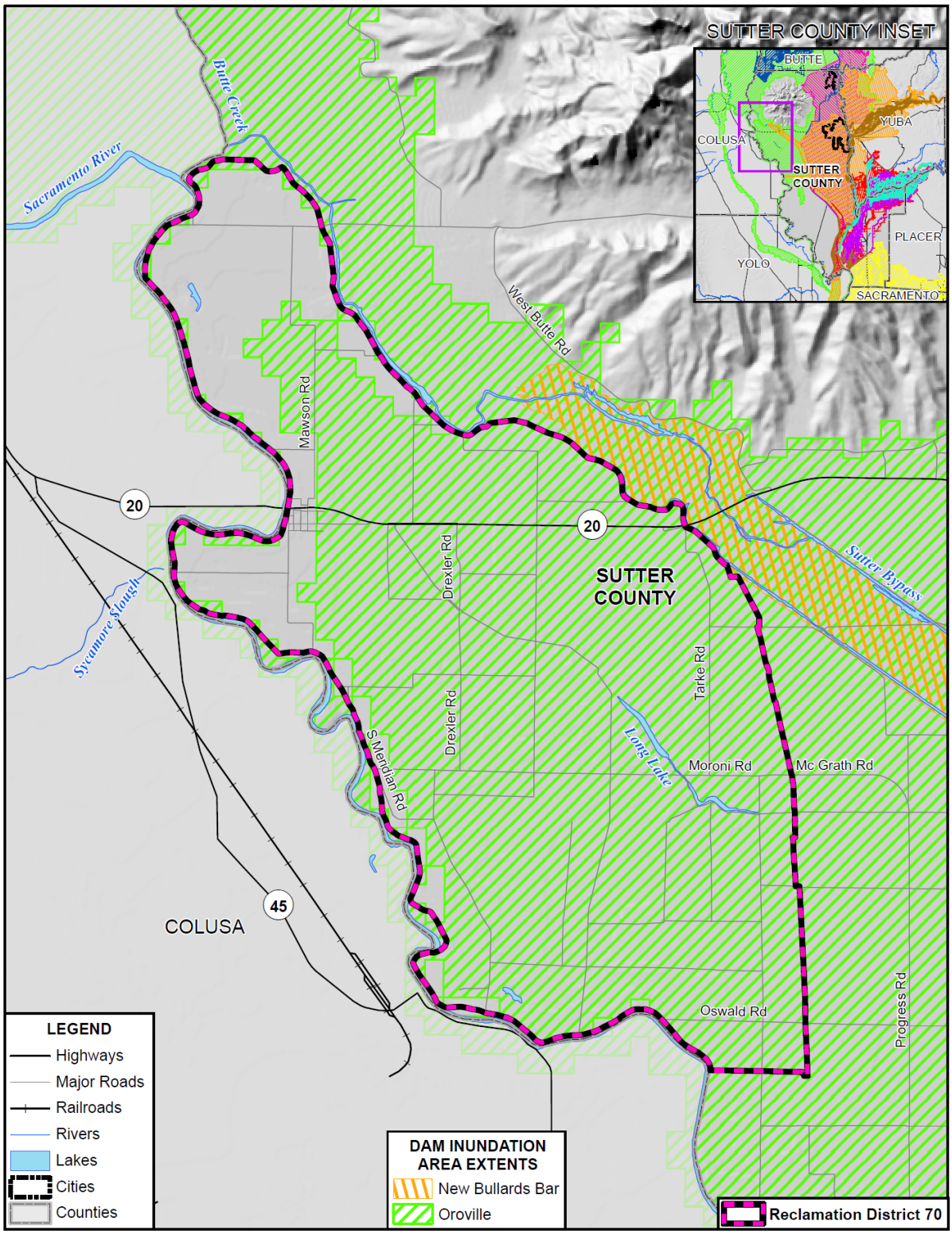
Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, Cal DWR Division of Safety of Dams (DOSD) assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.2.10 of the Base Plan.

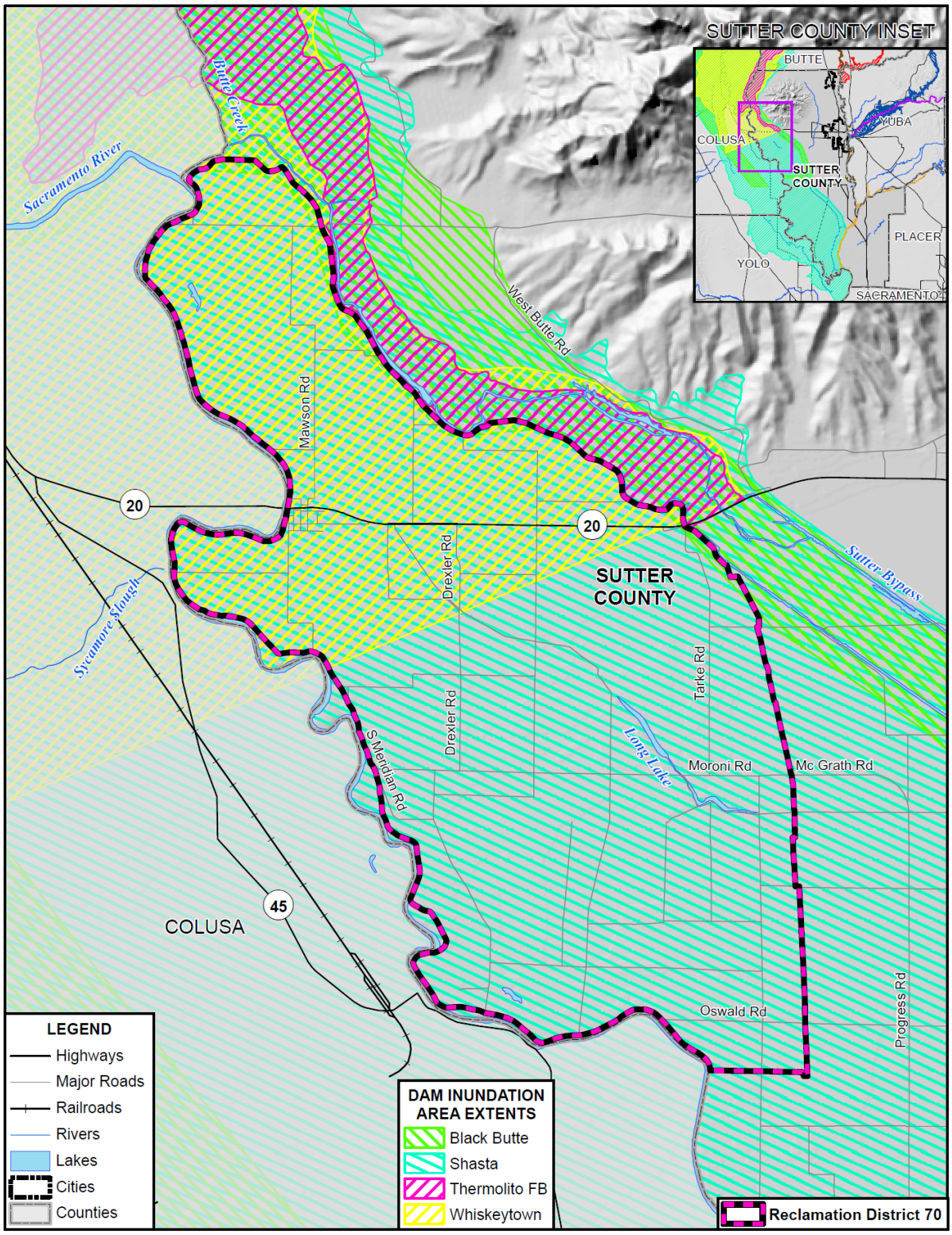
While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The District would be affected for as long as the flood waters from the dam failure took to drain downstream. Figure D-3 shows the extremely high hazard dam inundation area that intersect RD 70. Figure D-4 shows the high hazard dam inundation area that intersect RD 70.

Figure D-3 RD 70 – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure D-4 RD 70 – High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident. This can be seen on Table D-5.

Table D-5 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

The District noted no other dam failure occurrences that have affected the District.

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the District from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant.

Specific details are difficult to estimate. During the 1997 levee breach the district experienced erosion and wave wash on both the landside and waterside of different levee segments. With a dam failure the District would likely see the same result as well as possible overtopping, levee slips, erosion, and likely levee failure.

Assets at Risk

As seen on Figure D-3 and Figure D-4 above, all District assets from Table D-4 would be at risk from dam failure.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and cities. RD 70 will continue to work with Sutter County in the future to ensure that any future development of RD 70 facilities is properly sited and constructed.

Drought & Water Shortage

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined

regionally based on its effects. Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue and is critical for agriculture, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

Location and Extent

Drought and water shortage are regional phenomenon. The whole of the County, as well as the whole of the District, is at risk. The US Drought Monitor categorizes drought conditions with the following scale:

- None
- D0 – Abnormally dry
- D1 – Moderate Drought
- D2 – Severe Drought
- D3 – Extreme drought
- D4 – Exceptional drought

Drought has a slow speed of onset and a variable duration. Drought can last for a short period of time, which does not usually affect water shortages and for longer periods. Should a drought last for a long period of time, water shortage becomes a larger issue. Current drought conditions in the District and the County are shown in Section 4.2.11 of the Base Plan.

Past Occurrences

Since drought is a regional phenomenon, past occurrences of drought for the District are the same as those for the County and includes 5 multi-year droughts over an 85-year period. Details on past drought occurrences can be found in Section 4.2.11 of the Base Plan.

Vulnerability to and Impacts from Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the District, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users.

Reclamation District 70 is primarily made up farmland, and the District relies on assessment from the local landowners. If the District were to experience a long term drought and or water shortages, it could affect the local landowners with paying their assessment.

Assets at Risk

Drought will not affect District assets. However long-term drought may affect landowner's ability to farm with would result in affecting their ability to pay district assessments.

Future Development

Drought is unlikely to affect future development in the RD. RD 70 does not control future development in areas protected by levees, that is the purview of the County or cities of Live Oak and Yuba City. RD 70 will continue to work with these entities in the future to ensure that future development is sited in proper areas.

Earthquake

Likelihood of Future Occurrence–Unlikely
Vulnerability–Medium

Hazard Profile and Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction.

Location and Extent

Since earthquakes are regional events, the whole of the District is at risk to earthquake. RD 70 and the surrounding area are relatively free from significant seismic and geologic hazards. There are no known or inferred active faults within the District.

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales, as discussed in Section 4.2.12 of the Base Plan. The faults identified in Sutter County include the Quaternary Faults, located in the northern section of the County within the Sutter Buttes, and the Pre Quaternary Fault, located in the southeastern corner of the Planning Area, just east of where Highway 70 enters into the County. Both faults are listed as non-active faults, but have the potential for seismic activity.

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. The District is located in an area where few earthquakes of significant magnitude occur, so both magnitude and intensity of earthquakes are expected to remain low. Seismic shaking maps for the area show Sutter County and the District fall within a low to moderate shake risk.

Past Occurrences

The District noted no past occurrences of earthquakes or that affected the District in any meaningful way.

Vulnerability to and Impacts from Earthquake

The combination of plate tectonics and associated California coastal mountain range building geology generates earthquake as a result of the periodic release of tectonic stresses. Sutter County's mountainous terrain lies in the center of the North American and Pacific tectonic plate activity. There have been earthquakes as a result of this activity in the historic past, and there will continue to be earthquakes in the future of the California north coastal mountain region.

Fault ruptures itself contributes very little to damage unless the structure or system element crosses the active fault; however, liquefaction can occur further from the source of the earthquake. In general, newer construction is more earthquake resistant than older construction due to enforcement of improved building codes. Manufactured housing is very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Locally generated earthquake motions and associated liquefaction, even from very moderate events, tend to be more damaging to smaller buildings, especially those constructed of unreinforced masonry (URM) and soft story buildings. There are no URM or soft story buildings in the District.

The Uniform Building Code (UBC) identifies four seismic zones in the United States. The zones are numbered one through four, with Zone 4 representing the highest level of seismic hazard. The UBC establishes more stringent construction standards for areas within Zones 3 and 4. All of California lies within either Zone 3 or Zone 4. The RD 70 is within the less hazardous Zone 3.

Impacts from earthquake in the District will vary depending on the fault that the earthquake occurs on, the depth of the earthquake strike, and the intensity of shaking. Large events could cause damages to infrastructure, critical facilities, residential and commercial properties, and possible injuries or loss of life. An earthquake could potentially cause a levee failure. Although it is unlikely, there is concern if it did happen in the winter months when the river and bypass are full of water.

Assets at Risk

The District noted no specific assets at risk to this hazard.

Future Development

California Building Code helps regulate how buildings are built, and incorporates earthquake shaking hazards into construction of new facilities. RD 70 does not control future development in areas protected by levees, that is the purview of the County. RD 70 will continue to work with these entities in the future to ensure that future development is sited in proper areas.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

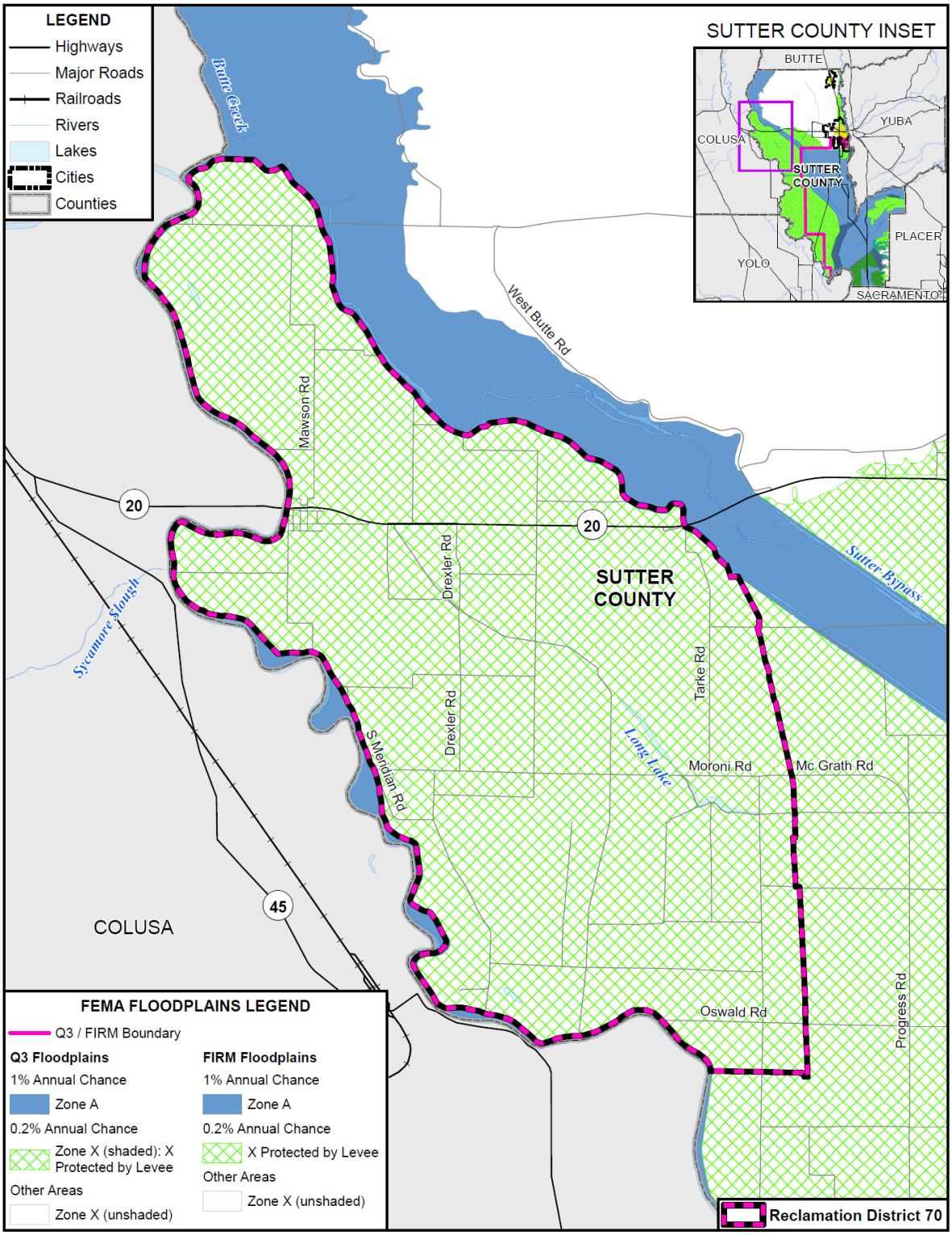
This hazard analyzes the FEMA DFIRM 1%, 0.5%, and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the District, and have caused damages in the past. Flooding is a significant problem in Sutter County and the District. Historically, the District has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1%, 0.5%, and 0.2% annual chance floodplains and in other localized areas.

As previously described in Section 4.2.13 of the Base Plan, the Sutter County Planning Area and the RD 70 have been subject to historical flooding. RD 70 is traversed by several stream systems and is at risk to the 1% and 0.2% flood.

Location and Extent

The RD 70 has areas located in the 1% and 0.2% annual chance floodplain. This is seen in Figure D-5.

Figure D-5 RD 70 – FEMA Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (combination of Q3 and DFIRM: FEMA_FIRMS.shp, FEMA NFHL 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table D-6 details the DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the District.

Table D-6 RD 70– DFIRM Flood Hazard Zones

Flood Zone	Description	Present in the District
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	
AE	1% annual chance flood: Base flood elevations provided	
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	
X (unshaded)	No flood hazard	
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	
AE	100-year Flood: Base flood elevations provided	
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	X
X (unshaded)	No flood hazard	
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the District vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the District tends to have a shorter speed of onset, due to the amount of water that flows through the District.

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table D-7. These events also likely affected the District to some degree.

Table D-7 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

The District noted that in n March of 1940 flooding occurred, but no details were available. Flooding occurred in 1997. Details on this flooding can be found in the Past Occurrences section of the Levee Failure hazard below.

January 3 through January 12, 2017 (FEMA Disaster Declaration DR-4301)– As a direct result of the Severe Winter Storms, Flooding, and Mudslides occurring throughout the State of California during the declared incident period of January 3 through January 12, 2017, Reclamation District 70 in Sutter County was directly affected. RD 70 provides flood control and water drainage services within a service of 21,000 acres which includes 3 levee miles adjacent to the Sacramento River and 8 miles adjacent to the Sutter Bypass. RD 70 & RD 1660 make up the entirety of the drainage area. The severe winter storms resulted in excessive pumping, levee patrols and debris removal

February 1 through February 23, 2017 (FEMA Disaster Declaration DR-4308) – As a direct result of the Severe Winter Storms, Flooding, and Mudslides occurring throughout the State of California during the declared incident period of January 3 through January 12, 2017, Reclamation District 1660 in Sutter County was directly affected. RD 70 provides flood control and water drainage services within a service of 21,000 acres which includes 3 levee miles adjacent to the Sacramento River and 8 miles adjacent to the Sutter Bypass. RD 70 & RD 1660 make up the entirety of the drainage area. The severe winter storms resulted in excessive pumping, levee patrols and debris removal after the storm event

Vulnerability to and Impacts from Flood

Two significant hazards facing the District are winter storms and flooding. Flooding would occur as a result of levee failure or overtopping. The representative for the Districts describes the potential effects of flooding within the boundaries as extensive and potentially catastrophic. Meridian Basin is surrounded by levees maintained and monitored by Reclamation District 70 and Reclamation District 1660. All water coming into this Basin must be pumped or gravity feed out. During high water, the release of water at Shasta Dam and high Sacramento River water flows will not allow for gravity feed so that all water must be pumped out of the basin. The drainage facilities under the ownership and control of the District are at risk to damage from excessive rainfall, storm water runoff and flooding.

Levee failure from either breaching or overtopping would result in the total loss of levee embankment material, as was the case in the 1997 flood event (see discussion in levee failure section of this document). In addition, localized flooding can overwhelm pumping plants. This is discussed in the next section.

The Sutter County Local Agency Formation Commission (LAFCO) performed municipal service reviews and found that Reclamation District 70 has sufficient infrastructure planning and practices to ensure that infrastructure and capital facilities can be maintained within the planning period of five years. As a result, the District has sufficient flood and drainage resources to accommodate projected service demands within its current boundaries over the next five years. Floods have been a part of the District's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, loss of environmental resources, and economic impacts.

Assets at Risk

All District assets (from Table D-4) are at risk from this hazard.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 70 will continue to work with Sutter County in the future to ensure that any future development of LD facilities is properly sited and constructed.

Levee Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–High

Hazard Profile and Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for

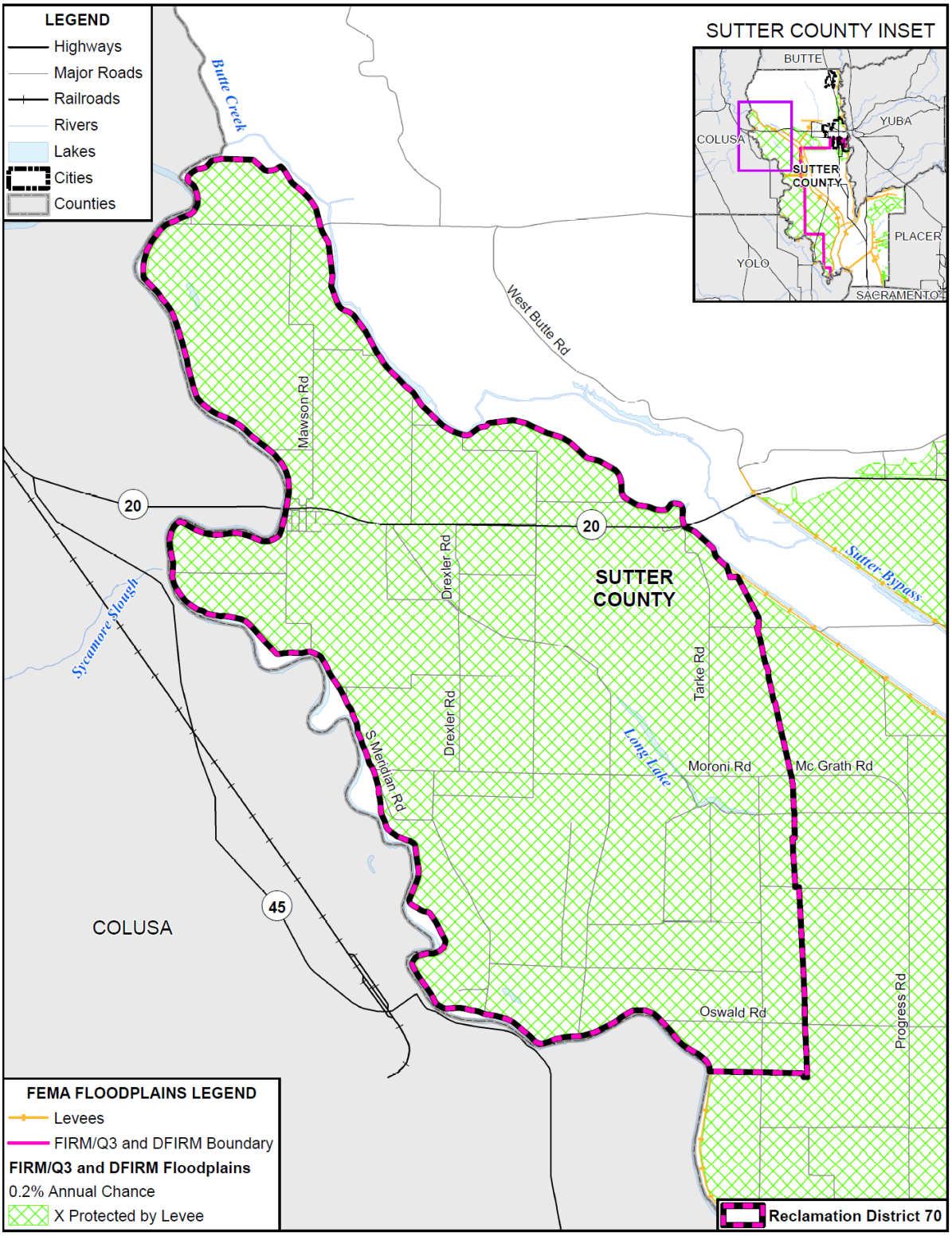
which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the District are not known. The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. When northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees.

Location of levees and DFIRM flood zones is shown on Figure D-6.

Figure D-6 RD 70 – Levees and Q3/DFIRM Flood Zones



FOSTER MORRISON CONSULTING

0 1 2 Miles

Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

The MSR noted that local landowners originally constructed the levees on a small scale in the 1800s prior to the official creation of the District. The Army Corps of Engineers (ACOE) and the State of California upgraded the levees to project levees, or those that meet Federal standards, in the early 1900s. The ACOE and the State of California updated the levees again after major flooding in 1940. The improved infrastructure affords every parcel within the District equal protection, and there are no variations in the levels of service provided by RD 70.

Levee failure is a major concern for the district. In January 1997, a levee breach on the Sutter Bypass caused flooding to approximately 75% of the Meridian Basin. Damage to property and infrastructure was in the millions. Highway 20 and county roads were closed for weeks.

In 2017, two separate portions of the levee were damaged. The levees did not fail, but a 50-foot and another 100-foot section were damaged on the waterside of the levee. Erosion undercut and damages portions of the levees. The levees were repaired using rock slope protection.

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Assets at Risk

All District assets (from Table D-4) are at risk from this hazard.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 70 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD facilities is properly sited and constructed.

RD 70 does not control future development in areas protected by levees, that is the purview of the County or cities of Live Oak and Yuba City. RD 70 will continue to work with these entities in the future to ensure that future development is sited in proper areas.

Pandemic

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity. It is important to realize that this LHMP Update does not examine pandemic contingency plans, but instead focuses on examining the risk of a normal hazard occurrence.

A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the World Health Organization to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning and preparation. An especially severe a pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the District, County, and surrounding region is at risk, as pandemic is a regional, national, or international event. The speed of onset of pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by number who die from complications from the pandemic.

Past Occurrences

There has been one state and federal disaster declaration due to pandemic, as shown in Table D-8.

Table D-8 Sutter County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

The 20th century saw three outbreaks of pandemic flu.

- The **1918-1919 Influenza Pandemic (H1N1)**
- The **February 1957-1958 Influenza Pandemic (H2N2)**
- The **1968 Influenza Pandemic (H3N2)**

To date, the 21st century has seen two acknowledged pandemics.

- **2009 Swine Flu (H1N1)**
- **2019/2020 COVID 19**

Although the District has not been affected by Covid-19 yet, an outbreak could result in loss of work hours that would result in operations and maintenance not getting accomplished.

Vulnerability to Pandemic

Pandemic has and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public health officials can use to combat pandemic flu. Constant surveillance regarding current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent spread of pandemic flu by staying home, or "self-quarantining," if they suspect they are infected. Pandemic does not affect the buildings, critical facilities, and infrastructure in the District. Pandemic can have varying levels of impact to the citizens of the District and greater County, depending on the nature of the pandemic.

Impacts

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently) an unemployment rose significantly. Supply chains for food can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Future Development

Future development is not expected to be significantly impacted by this hazard, though population growth in the District could increase exposure to pandemic flu, and increase the ability of each disease to be transmitted among the population of the District.

Severe Weather: Heavy Rains and Storms (Hail, Lightning)

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Storms in the District occur annually and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the District falls mainly in the fall, winter, and spring months.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the District. All portions of the District are at risk to heavy rains. Most of the severe rains occur during the fall, winter, and spring months. There is no scale by which heavy rains and severe storms are measured. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of severe storms in California, Sutter County, and the District can range from minutes to hours to days. Information on precipitation extremes can be found in Section 4.2.3 of the Base Plan.

Past Occurrences

According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the District. This is the cause of many of the federal disaster declarations related to flooding. Past occurrences were discussed in the Flood section above.

Winter storms periodically occur that overwhelm the drainage system and pumping plants and cause local flooding. Localized storms could also cause power outages that would prevent the District's pumps from operating.

Vulnerability to and Impacts from Heavy Rain and Storms

Heavy rain and severe storms are the most frequent type of severe weather occurrences in the District. These events can cause localized flooding. Elongated events, or events that occur during times where the ground is already saturated can cause 1% and 0.2% annual chance flooding. Wind often accompanies these storms and has caused damage in the past. Hail and lightning are rare in the District.

Problems associated with the primary effects of severe weather include flooding, pavement deterioration, washouts, high water crossings, landslide/mudslides, debris flows, and downed trees. However, it is the secondary effects of heavy rain and storms that are of concern to RD 70. Heavy rains can cause riverine flooding, localized flooding, levee failure, and stream bank erosion. Heavy rain storms usually accompany strong winds; Strong winds could cause a power failure which would leave the districts pumps non-operational. This could cause localized flooding.

Assets at Risk

The District Pumping Plant and Office are at risk from this hazard.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 70 will continue to work with Sutter County in the future to ensure that any future development of RD 70 facilities is properly sited and constructed.

D.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

D.6.1. Regulatory Mitigation Capabilities

Table D-9 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the RD 70. FILL OUT LAST CELL

Table D-9 RD 70 Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan	Y	Levee Maintenance Plan identifies hazards and has mitigation strategy to address levee failure.
Capital Improvements Plan	N	
Economic Development Plan	N	
Local Emergency Operations Plan	N	
Continuity of Operations Plan	N	
Transportation Plan	N	
Stormwater Management Plan/Program	N	
Engineering Studies for Streams	N	
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y	Levee maintenance plan addresses hazards and includes actions to be implemented.
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	N/A	Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score	N/A	Score:
Fire department ISO rating:	N/A	Rating:
Site plan review requirements	N/A	
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	N/A	
Subdivision ordinance	N/A	

Floodplain ordinance	N/A
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	N/A
Flood insurance rate maps	N/A
Elevation Certificates	N/A
Acquisition of land for open space and public recreation uses	N/A
Erosion or sediment control program	N/A
Other	
How can these capabilities be expanded and improved to reduce risk?	
A PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT	

Source: RD 70

D.6.2. Administrative/Technical Mitigation Capabilities

Table D-10 identifies the District department(s) responsible for activities related to mitigation and loss prevention in RD 70. FILL OUT LAST CELL

Table D-10 RD 70's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	N	
Mitigation Planning Committee	N	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	N	
Mutual aid agreements	N	
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	N/A	
Floodplain Administrator	N/A	
Emergency Manager	N/A	
Community Planner	N/A	
Civil Engineer	N/A	
GIS Coordinator	N/A	
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	N	
Hazard data and information	N	

Grant writing	N
Hazus analysis	N
Other	
How can these capabilities be expanded and improved to reduce risk?	
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT	

Source: RD 70

D.6.3. Fiscal Mitigation Capabilities

Table D-11 identifies financial tools or resources that the District could potentially use to help fund mitigation activities. FILL OUT LAST CELL.

Table D-11 RD 70's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	N	
Authority to levy taxes for specific purposes	Y	Ongoing Operations and Maintenance
Fees for water, sewer, gas, or electric services	N	
Impact fees for new development	N	
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	N	
Incur debt through private activities	N	
Community Development Block Grant	N	
Other federal funding programs	N	
State funding programs	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: RD 70

D.6.4. Mitigation Education, Outreach, and Partnerships

Table D-12 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information. FILL OUT LAST CELL.

Table D-12 RD 70's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	N	
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	N	
Natural disaster or safety related school programs	N	
StormReady certification	N	
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: RD 70

D.6.5. Other Mitigation Efforts

The District has many other completed or ongoing mitigation efforts that include the following:

- The District has a regular levee maintenance plans that include levee slope dragging, levee crown grading, patrolling, rodent control, thinning and pruning of trees, disking fire breaks, vegetation spraying, and vegetation burning. Regular ditch maintenance includes ditch cleaning, burning, and vegetation spraying.

D.7 Mitigation Strategy

D.7.1. Mitigation Goals and Objectives

The RD 70 adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

D.7.2. Mitigation Actions

The planning team for the RD 70 identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Aquatic Invasive Species
- Climate Change
- Dam Failure
- Drought & Water shortage
- Earthquake
- Floods: 1%/0.2% annual chance
- Levee Failure
- Pandemic
- Severe Weather: Heavy Rains and Storms

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement.

Multi-Hazard Actions

Action 1. Water Hyacinth in West Burrow Canal Sutter Bypass

Hazards Addressed: Aquatic Invasive Species

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Water Hyacinth is blocking the natural flow of water in the west burrow canal of the Sutter bypass.

Other Alternatives:

Existing Planning Mechanisms through which Action will be Implemented: Bypass Maintenance

Responsible Office: Department of Water Resources

Priority (H, M, L): Medium

Cost Estimate: $500,000

Potential Funding: Department of Water Resources

Benefits (avoided Losses): Flooding Property

Schedule: To be determined

Action 2. Prepare for Higher Precipitation

Hazards Addressed: Climate Change, Earthquake, Flood, Dam Failure, Levee Failure, Pandemic, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Higher precipitation results in the District pumping plant to operate longer as well as increased levee patrols.

Other Alternatives: No action

Existing Planning Mechanisms through which Action will be Implemented: Ongoing Maintenance

Responsible Office: Reclamation District

Priority (H, M, L): Medium

Cost Estimate: Varies year to year

Potential Funding: Reclamation Districts

Benefits (avoided Losses): Flooding Property

Schedule: Annual Maintenance

Action 3. Complete Projects from the CVFPP 2022 Update

Hazards Addressed: Climate Change, Earthquake, Flood, Dam Failure, Levee Failure, Pandemic, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Central Valley Flood Protection Project seeks to reduce risk to flooding in the Central Valley of California. The District participates in the CVFPP and will be putting forth a variety of multi-hazard related actions.

Other Alternatives: No action

Existing Planning Mechanisms through which Action will be Implemented: Ongoing Maintenance

Responsible Office: Reclamation District

Priority (H, M, L): Medium

Cost Estimate: Varies by project

Potential Funding: Reclamation District budget. Grants from FEMA, Cal OES, CA DWR, and others.

Benefits (avoided Losses): Reduced risk of flooding to people and property.

Schedule: Varies by project.

Annex E Reclamation District 1001

E.1 Introduction

This Annex details the hazard mitigation planning elements specific to Reclamation District 1001 (RD 1001 or District), a previously participating jurisdiction of the 2013 Sutter County Local Hazard Mitigation Plan (LHMP) Update. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the District. This Annex provides additional information specific to RD 1001, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

E.2 Planning Process

As described above, the District followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the District formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table E-1. Additional details on plan participation and District representatives are included in Appendix A.

Table E-1 RD 1001 – Planning Team

Name	Position/Title	How Participated
Michael Phillips	District Manager	Meeting participation and document reviews
Tom Engler	District Engineer	Meeting participation and document reviews

Coordination with other community planning efforts is paramount to the successful implementation of this LHMP Update. This section provides information on how the District integrated the previously approved 2013 Plan into existing planning mechanisms and programs. Specifically, the District incorporated into or implemented the 2013 LHMP through other plans and programs shown in Table E-2.

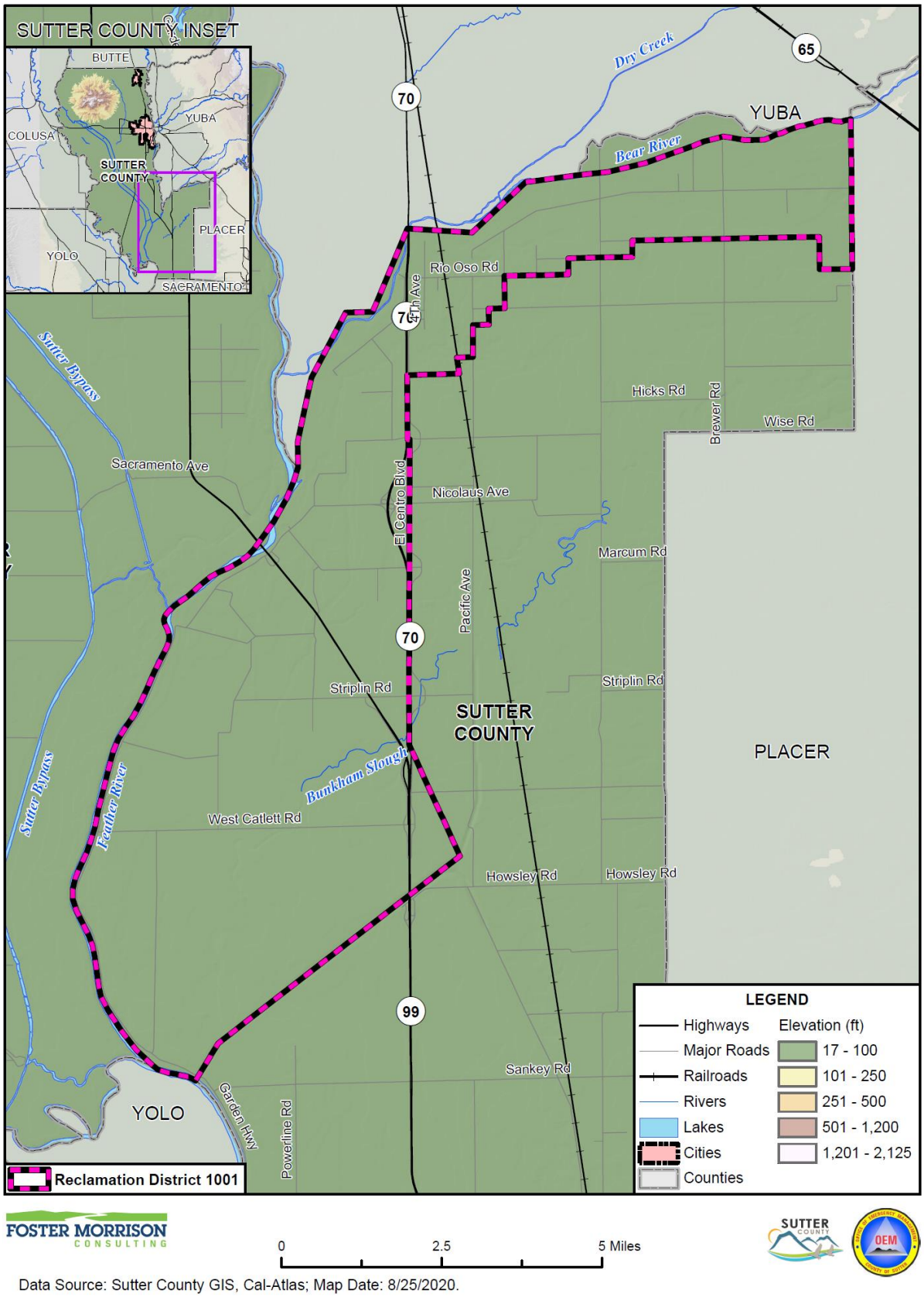
Table E-2 2013 LHMP Incorporation

Planning Mechanism 2013 LHMP Was Incorporated/Implemented In.	Details: How was it incorporated?
Natomas Cross Canal Auxiliary Propane Pump Station 9Alternate Power Source)	HMGP Grant (4344-399-114 (Phase 1)) received in 2019, Phase 1 (Design and Environmental) nearing completion and Phase 2 (Construction) anticipated to begin in 2021

E.3 District Profile

The District profile for the RD 1001 is detailed in the following sections. Figure E-1 displays a map and the location of the District within Sutter County.

Figure E-1 RD 1001



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

E.3.1. Overview and Background

RD 1001 provides water drainage and flood control to its landowners. The District is located within Sutter County, approximately 25 miles north of the City of Sacramento, California and 20 miles south of the City of Yuba City with a gross service area of approximately 32,000 acres. The District's topography is relatively flat and is confined by surface water features and engineered channels (Bear River, Feather River, Sacramento River, Natomas Cross Canal, and East Side Canal).

RD 1001 was formed by an act of the State Legislature in 1911 for the purposes of providing drainage and reclamation of lands within its boundaries. The District's enabling legislation grants it authority to perform its functions. The District is able to fulfill its mission and purpose under the guidelines of the State Water Code under the section identified as Reclamation Districts section 50000.

The District has 140 miles of drain laterals of various sizes and ages maintained on an as-needed basis. District maintains a pumping facility that was built in 1914/1915. The pumps discharge summer irrigation run-off from farmlands and discharge excess drainage water resulting from annual winter season storm events with a pumping capacity of approximately 300,000 gallons per minute. The entire District is within the scope of the Sacramento River Flood Control Project, as approved by the United States and the State of California.

E.4 Hazard Identification

RD 1001 identified the hazards that affect the District and summarized their location, extent, frequency of occurrence, potential magnitude, and significance specific to District (see Table E-3).

Table E-3 RD 1001—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Likely	Limited	Medium	Medium
Climate Change	Extensive	Likely	Limited	Medium	–
Dam Failure	Significant	Unlikely	Catastrophic	High	Medium
Drought & Water shortage	Significant	Occasional	Limited	Low	High
Earthquake	Extensive	Unlikely	Catastrophic	Low	Low
Floods: 1%/0.2% annual chance	Extensive	Occasional	Catastrophic	High	Medium
Floods: Localized Stormwater	Extensive	Likely	Critical	High	Medium
Levee Failure	Extensive	Likely	Catastrophic	High	Medium
Pandemic	Extensive	Likely	Limited	Low	Medium
Severe Weather: Extreme Cold and Freeze	Significant	Occasional	Negligible	Low	Medium
Severe Weather: Extreme Heat	Significant	Occasional	Negligible	Low	High
Severe Weather: Heavy Rains and Storms	Extensive	High	Critical	High	Medium
Wildfire	Limited	Occasional	Limited	Low	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

E.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile the District's hazards and assess the District's vulnerability separate from that of the Sutter County Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Sutter County Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the District is included in this Annex. This vulnerability assessment analyzes the property and other assets at risk to hazards ranked of medium or high significance specific to the District. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

E.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section E.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table E-3) affects the District and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Sutter County Planning Area.

E.5.2. Vulnerability Assessment and Assets at Risk

This section identifies the District's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within the District.

Assets at Risk and Critical Facilities

This section considers the RD 1001's assets at risk, with a focus on key District assets such as critical facilities, infrastructure, and other District assets and their values. With respect to District assets, the majority of these assets are considered critical facilities as defined for this LHMP Update. Critical facilities are defined for this Plan as:

> ***Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.***

Table E-4 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. RD 1001's physical assets, valued at over $14.4 million, consist of the buildings and infrastructure to support the District's operations. The District's levees (names, values, and statuses) are shown in Table E-5.

Table E-4 RD 1001 Critical Facilities, Infrastructure, and Other District Assets

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
Main Pumping Plan	Pumping Plan	$3,000,000	
Pump House Auto	Pumps	$7,500,000	
Yankee Slough Pump - Swanson	Pump	$150,000	
Yankee Slough Pump – Brewer	Pump	$150,000	
Yankee Slough Pump –UPRR	Pump	$150,000	
Office and Shop	Buildings	$1,000,000	
House #2	Employee Residence	$500,000	
Pump House	Employee Residence	$500,000	
Mobile Equipment	Equipment	$1,500,000	
Total		**$14,450,000**	

Source: RD 1001

Table E-5 RD 1001 – Levee Status

Levee Unit	Waterway	Improvements Required	Estimated Cost	Status	Existing Level of Protection	Proposed Level of Protection
1	Yankee Slough right bank	Seepage, Stability, and Erosion	N/A	Pre-feasibility	<50-year	TBD
2	Yankee Slough left bank	Seepage	$28,647,200	Feasibility Study Completed to achieve 100-year protection (SCFRR[1], June 2020). Implementation funding has not been identified.	<50-year	100-year
3.A	Bear River below Yankee Slough	Seepage and Erosion	$54,736,300	Feasibility Study Completed to achieve 100-year protection (SCFRR[1], June 2020). Implementation funding has not been identified.	<50-year	100-year
3.B	Bear River above Yankee Slough	Seepage and Erosion	N/A	Pre-feasibility	<50-year	TBD
4	Feather River	Seepage, Stability, and Erosion	$228,322,900	Feasibility Study Completed to achieve 100-year protection (SCFRR[2], June 2020). Implementation funding has not been identified.	<50-year	100-year

Levee Unit	Waterway	Improvements Required	Estimated Cost	Status	Existing Level of Protection	Proposed Level of Protection
5	Natomas Cross Canal	Seepage and Stability	$153,971,800	Feasibility Study Completed to achieve 100-year protection (SCFRR[2], June 2020). Implementation funding has not been identified.	<50-year	100-year
	Natomas Cross Canal	Seepage and Stability	$6,042,500	Project in design to complete stability berm along entire levee. Implementation expected 2022. Funding from Proposition 1 - Central Valley Tributaries Program	<50-year	<100-year
6	East Side Canal	Seepage and Stability	N/A	Pre-feasibility	<50-year	TBD
		Total	**$471,720,700**			

1. State of California, Department of Water Resources Small Communities Flood Risk Reduction Program, Rio Oso Flood Risk Reduction Feasibility Study
2. State of California, Department of Water Resources Small Communities Flood Risk Reduction Program, Nicolaus Flood Risk Reduction Feasibility Study

Source: RD 1001

Natural Resources

RD 1001 has a variety of natural resources of value to the District. These natural resources parallel that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan. The District also maintains an active mining operation to supply soil to local contractors for levee and other miscellaneous projects.

Historic and Cultural Resources

RD 1001 has a variety of historic and cultural resources of value to the District. These historic and cultural resources parallel that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Growth and Development Trends

General growth in the District parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan. The District is currently mapped in the FEMA 100-year floodplain which limits types and amount of development. Development is limited to agricultural structures and occasional residential improvements that meet FEMA building restrictions

Development since 2013

No District facilities have been constructed or improved since 2013.

Future Development

According to the District's Municipal Service Review, the District is in a highly rural setting and the growth rate is nominal. While areas for growth remain, the service area is essentially agricultural and rural and in a flood risk area. Also, there are limited community services and resources for supporting significant construction and population expansion. Thus, significant additional growth is unlikely to occur. Current facilities are adequate for existing land uses and minimal growth is expected in the area.

The District has no control over future development in areas the District provides levee protection in. Future development in these areas parallels that of Sutter County. More general information on growth and development in Sutter County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sutter County Vulnerability and Assets at Risk of the Base Plan.

E.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table E-3 as high or medium significance hazards. Impacts of past events and vulnerability of the District to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the District to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, critical facilities and infrastructure, populations at risk, and future development.

Aquatic Invasive Species

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

The introduction of nonnative species into coastal marine and estuarine waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability.

Boats discharge ballast water that has been obtained from waters throughout the state, country, or the world. This water might include non-native organisms, untreated sewage, and other contaminants. Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. Examples include the zebra mussel infestation in the Great Lakes and the propagation of water hyacinth in the California Delta. Both the zebra mussel and the quagga mussel are concerns for California and Sutter County. These mussels have not affected the waters in Sutter County yet, but are still a cause for concern.

Some of California's most serious weed problems occur in waterways, lakes and streams. The aquatic plant hydrilla is considered one of the most serious aquatic weed problems in the world and the California Department of Food and Agriculture (CDFA) maintains an intensive program to survey and eradicate this aquatic weed pest. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, while impeding water flow and delivery. Its rapid growth and ease of spread by boats makes it critical to detect early and eradicate.

The effects of nonnative fish on native fish are generally in the form of predation and competition for food and breeding sites. There are also several non-fish, nonnative invasive species found in aquatic natural communities that can damage such communities. The introduced bullfrog is an important riparian invasive in the plan area. Many varieties of non-native aquatic weeds compete for the entire water column and shoreline in Sutter County, crowding out native species and degrading the aquatic and riparian habitat.

The District has significant infestation of aquatic Primrose and Arundo in area waterways. The Primrose can cause drainage canals and drainage pumps to become clogged resulting in localized flooding. Arundo is causing flow diversions and sediment accumulation to occur, most notably along the Bear River. The invasive wed is resulting in areas of channel aggradation and bank erosion resulting in increased flood risk. Although the District has not yet seen aquatic invasive mussel damage to its facilities, they continually monitor these facilities for the presence of mussels.

Location and Extent

All freshwater lakes, streams, and rivers are potentially at risk from aquatic invasive species. There is no established scale for these invasive species. Magnitude is measured by the presence and counts of aquatic invasive species in waterways in Sutter County. Speed of onset of these invasive species is short, as it only

takes a careless boater or visitor to the area to accidentally introduce an invasive species. However, the duration is long as once established they can take years to eradicate, if at all.

Past Occurrences

The District has implemented a more aggressive aquatic herbicide application program to better control Primrose. The District maintains a catch screen at the main pumping plant that must be continually cleaned with an excavator during pumping operations. The District is also working with neighboring Districts along the Bear River to develop a Corridor Management Plan that will include an aggressive control and eradication program for Arundo along the channel.

Vulnerability and Impacts to Invasive Aquatics

The introduction of NAS into rivers and lakes can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability. Ships ballast water obtained from some other foreign location (outside the County) can include non-native organisms, untreated sewage, and other contaminants. Once introduced, NAS are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and economic havoc.

Aquatic invasive species can jeopardize and damage any part of the entire system ranging from human economy dependent infrastructure to natural aquatic, riparian and wetland habitat. Entire watersheds can be affected when an aggressive invasive species infests the rivers, shorelines, tributaries, drainage, irrigation and domestic delivery systems. Impacts to the District are mostly related to water recreation activities that may be hampered by these invasive species.

Assets at Risk

Assets at risk include pump stations, pumps, drainage canals, and levees.

Future Development

The District plans to work with DWR and grant programs to remove and prevent against invasive species where possible. The Bear River Corridor Management Plan is currently underway and is being funded by DWR through the Feather River Regional Flood Management Plan.

Climate Change

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by

as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing. In Sutter County and the District, the HMPC the HMPC noted that each year it seems to get a bit warmer each year. It was also noted that 2017 was one of the wettest and 2019 one of the hottest years on record.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the District, Sutter County, and State of California. There is no scale to measure the extent of climate change. Climate change exacerbates other hazards, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Climate change has never been directly linked to any declared disasters. While the District noted that climate change is of concern, no specific impacts of climate change could be recalled. The District and HMPC members noted that the strength of storms does seem to be increasing and the temperatures seem to be getting hotter.

Vulnerability to and Impacts from Climate Change

The California Adaptation Planning Guide (APG) prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change. California's APG: Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Sutter County falls within the North Sierra Region characterized as a sparsely settled mountainous region where the region's economy is primarily tourism-based. The region is rich in natural resources, biodiversity, and is the source for the majority of water used by the state. This information can be used to guide climate adaptation planning in the District and Sutter County Planning Area.

The California APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Sutter County Planning Area is part of:

- Temperature increases
- Decreased precipitation
- Reduced snowpack
- Reduced tourism
- Ecosystem change
- Sensitive species stress
- Increased wildfire

Risks to the District include the precipitation variability and potential for more extreme precipitation events that could lead to flooding or flood events that exceed the levee system design

Assets at Risk

Assets include levees, buildings, canals and pumping systems that could be overwhelmed by extreme precipitation events.

Future Development

Future development of District facilities is unlikely to be affected by climate change. RD 1001 does not control future development in areas protected by levees, that is the purview of the County. RD 1001 will continue to work with Sutter County in the future to ensure that future development is sited in proper areas.

Dam Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–Extremely High

Hazard Profile and Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

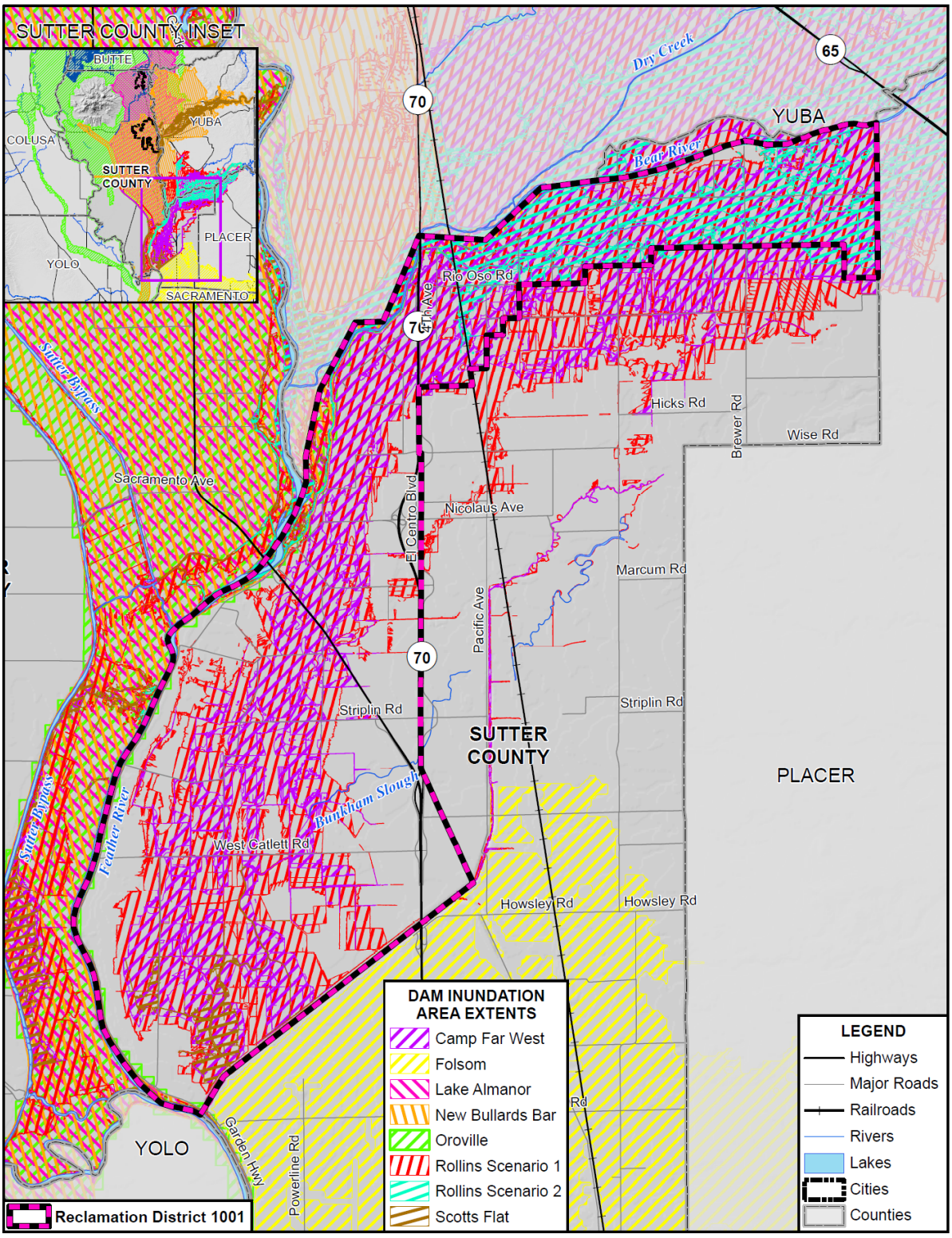
Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, Cal DWR Division of Safety of Dams (DOSD) assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.2.10 of the Base Plan.

While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The District would be affected for as long as the flood waters from the dam failure took to drain downstream.

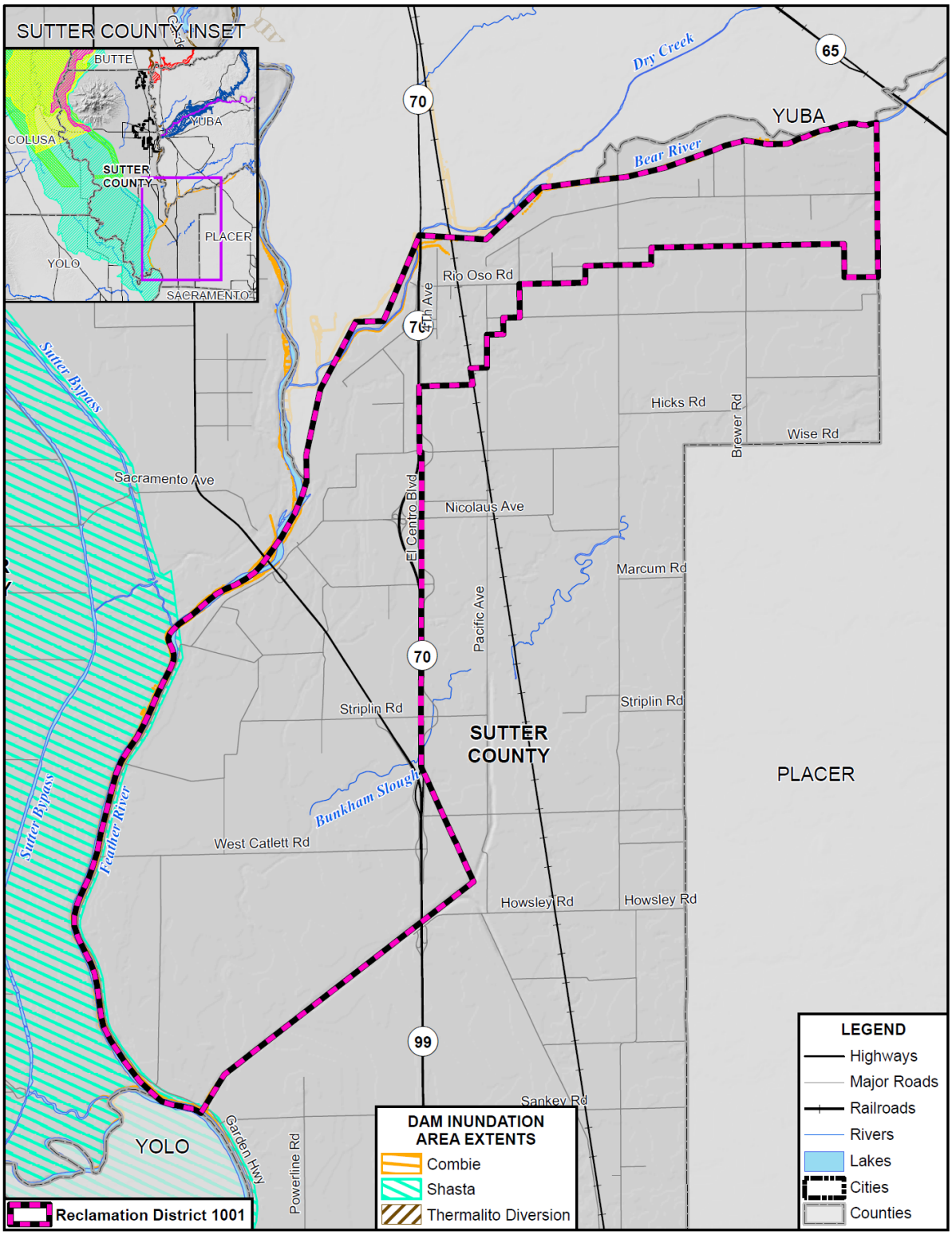
The District falls in the path of multiple dam inundation areas. Dam inundation areas from extremely high hazard dams that could affect the District can be found on Figure E-2, while Figure E-3 shows the dam inundation areas from high hazard dams that could affect the District.

Figure E-2 RD 1001 – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure E-3 RD 1001 – High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident. This can be seen on Table E-6.

Table E-6 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

The 2017 Oroville Spillway Incident caused additional seepage which resulted in levee instability and localized agricultural crop damages. The levee issues were repaired through DWR flood fighting direct assistance and Federal PL84-99 repairs. Property damages are being considered through legal proceedings by the property owners.

The District noted no other dam failure occurrences that have affected the District.

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the District from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant. Dam failures could also cause increased stress and/or overtopping of District levees that would greatly increase the potential for levee breaches.

Assets at Risk

As seen on Figure E-2 and Figure E-3 above, all District assets from Table E-4 would be at risk from dam failure.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1001 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1001 facilities is properly sited and constructed.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

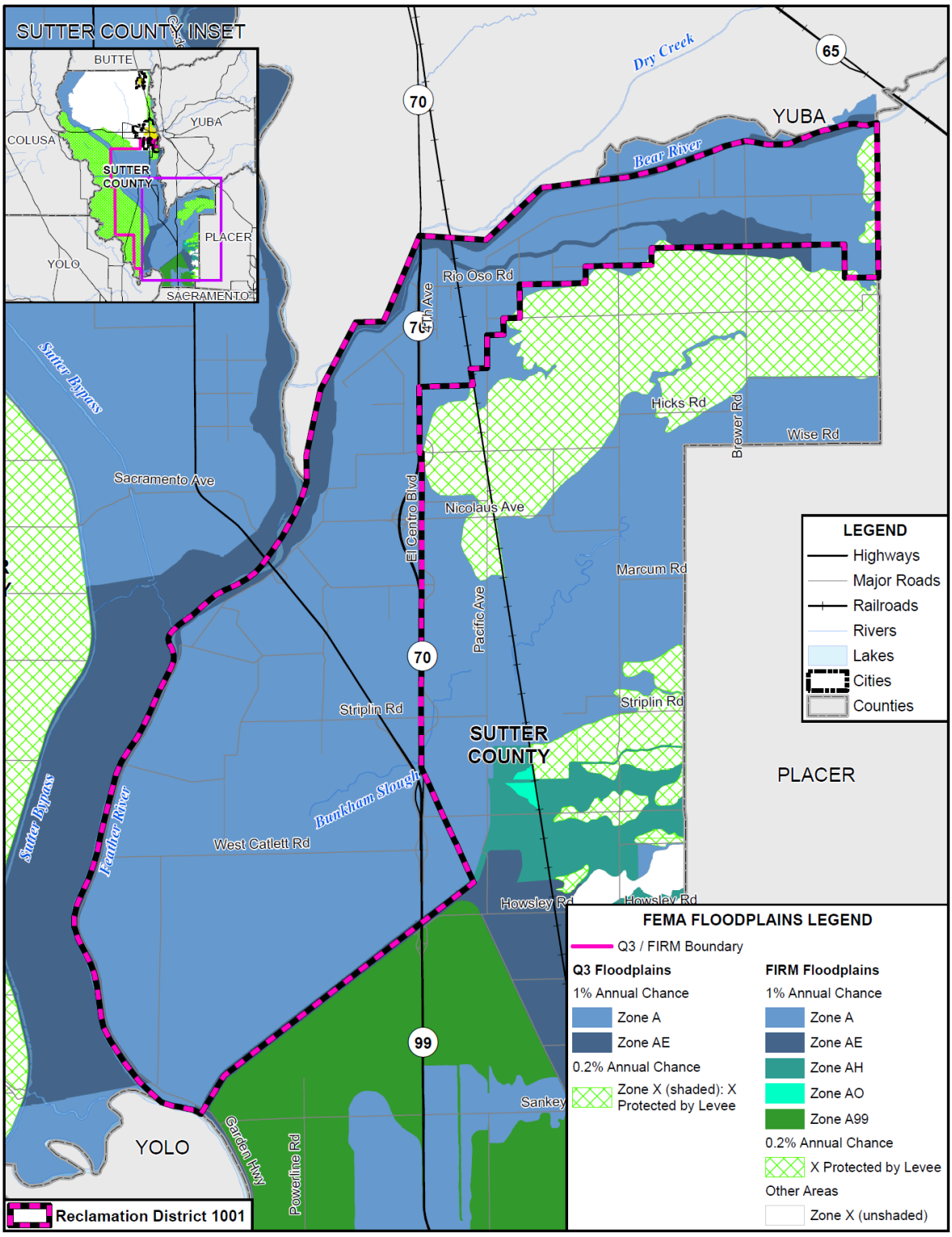
This hazard analyzes the FEMA DFIRM 1%, 0.5%, and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the District, and have caused damages in the past. Flooding is a significant problem in Sutter County and the District. Historically, the District has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1% and 0.2% annual chance floodplains and in other localized areas.

As previously described in Section 4.2.13 of the Base Plan, the Sutter County Planning Area and the RD 1001 have been subject to historical flooding. RD 1001 is traversed by several stream systems and is at risk to the 1%, 0.5%, and 0.2% flood.

Location and Extent

The RD 1001 has areas located in the 1% and 0.2% annual chance floodplain. This is seen in Figure E-4.

Figure E-4 RD 1001 – Q3/FEMA DFIRM Flood Zones



Data Source: Sutter County Flood Data (combination of Q3 and DFIRM: FEMA_FIRMS.shp, FEMA NFHL 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table E-7 details the DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the District.

Table E-7 RD 1001– Q3/DFIRM Flood Hazard Zones

Flood Zone	Description	Present in District
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	X
AE	1% annual chance flood: Base flood elevations provided	X
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	
X (unshaded)	No flood hazard	
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	
AE	100-year Flood: Base flood elevations provided	
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	
X (unshaded)	No flood hazard	
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the District vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the District tends to have a shorter speed of onset, due to the amount of water that flows through the District.

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table E-8. These events also likely affected the District to some degree. More information on past flood events is shown in the Levee Failure Past Occurrences section.

Table E-8 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

Vulnerability to and Impacts from Flood

Floods have been a part of the District's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

The District is responsible for operations and maintenance of the flood control system including levees and drainage facilities. Flood events result in significant effort to manage flood waters, both internally and behind levees, to prevent flooding to its residents. The levee system and facilities are aged and in need of repair, but the costs far exceed what can be accomplished by the District. As a result, large flood events result in evacuation o residents and significant flood fighting, drainage pumping, and emergency repairs.

Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, loss of environmental resources, and economic impacts.

Assets at Risk

The two significant hazards facing the drainage district are winter storms and flooding. District assets are shown in Table E-4. All assets identified in Table E-4 are considered critical to the operations of the District and in providing adequate flood and drainage control within its boundaries. Should any of these identified assets fail, excessive flooding will occur within the District. Depending on the location of the failure, flooding could cause a small number of residents and property to be inundated to a very large area of the District. Flood water elevations could be anywhere from one to twenty feet in depth for an undetermined amount of time.

Flooding of this magnitude would cause major loss to property owners, close two major state highways used as commuter routes to jobs in the Sacramento, destroy historical landmarks, impact local transportation, agricultural crops and public utilities.

Future Development

The District continues to plan levee and drainage system rehabilitation and improvement projects. Depending on the project and available funding, the District strives to address the worst-first deficiencies and design them to meet Federal flood control standards for the Federally authorized flood control project and FEMA base flood standards. General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1001 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1001 facilities is properly sited and constructed.

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

Flooding occurs in areas other than the FEMA mapped 1% and 0.2% annual chance floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate maintenance. Localized, stormwater flooding occurs throughout the County during the rainy season from November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration.

Location and Extent

The RD 1001 is subject to localized flooding throughout the District. Flood extents are usually measured in areas affected, velocity of flooding, and depths of flooding. Expected flood depths in the District vary by location. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Localized flooding in the District tends to have a shorter speed of onset, especially when antecedent rainfall has soaked the ground and reduced its capacity to absorb additional moisture.

The District tracks localized flooding areas. The main flooding areas occur at the District pumping facilities and are managed by pumping operations. The District is not responsible for roads or roadway crossing, but does monitor canal levels and address issues as they arise.

Past Occurrences

The District noted that localized flooding has occurred in numerous past events either when electrical service is interrupted to the pumping facilities or the magnitude of precipitation exceeds pumping capacity. Fortunately there are few structures located near these localized flood areas and damage has not occurred beyond local adjacent farm field inundation.

Vulnerability to and Impacts from Localized Flooding

Historically, much of the growth in the District and County has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff.

RD1001 include lateral drains and a pumping facility. The pumps function to remove excess water from the District with a capacity of pumping approximately 300,000 gallons per minute. The drains are repaired on an as-needed basis. Recent repairs to the pumping facility include rebuilding two pumps (150 & 250 horsepower) in 2005 and replacement of a 52-inch elbow and replacement and/or rebuild of intake and discharge pipes within the pump facility. The District is also nearing completion of design for a propane powered auxiliary pump station that will be capable of pumping approximately 60,000 gallons per minute. The auxiliary pump station will be located on the Natomas Cross Canal and will be connected to the main drainage canal via Lateral 4 to minimize flooding from events beyond the main pumping facility and to act as a backup during power outages.

All drainage water in the District flows mostly by gravity into drain laterals that all flow to Reclamation District 1001 Main Pumping Plant in the southern portion of the District. This pump facility pumps water into the Natomas Cross Canal one mile east of the Sacramento River. Should there be a major levee break, this facility could not handle the volume of water pouring into the District thus backing up flood water for miles.

Assets at Risk

No District assets are directly threatened by localized flooding. Localized flooding can cause transportation issues with District staff as they travel to and from work, as well as to and from District facilities.

Future Development

RD 1001 does not control future development in areas protected by levees, that is the purview of the County. RD 1001 will continue to work with Sutter County in the future to ensure that future development is sited in proper areas.

Levee Failure

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

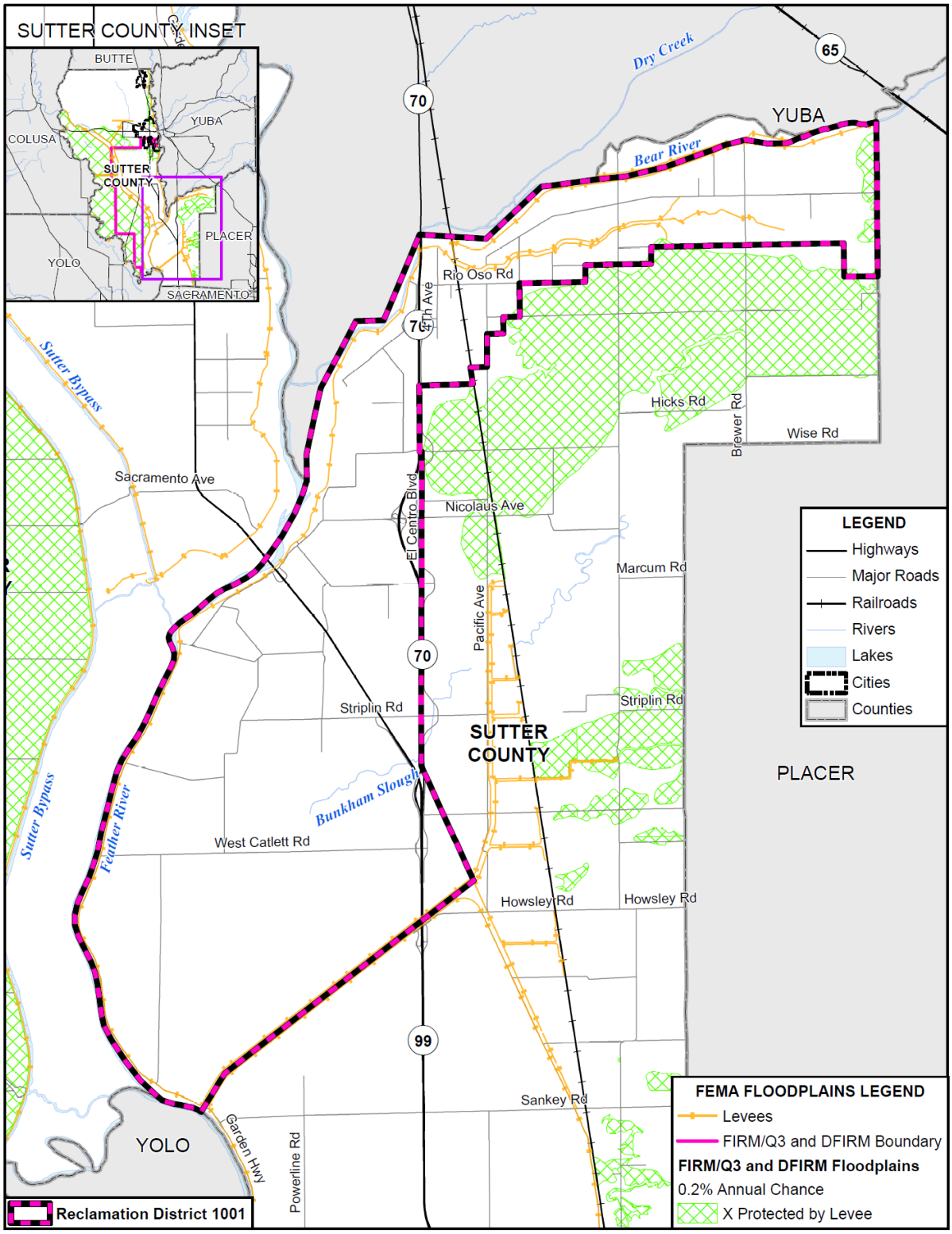
Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the District are not known. The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. When northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees.

Leveed areas and DFIRM flood zones are shown on Figure E-5.

Figure E-5 RD 1001 – Levees and Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

The District had a major levee failure in 1955. No failures have occurred since.

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

Floods can threaten the District from several sources. Usually, the possibility of flooding can be anticipated from eight to twenty hours before the "Emergency Period" is reached. However, as demonstrated in Linda, California, in February 1986, it is possible for a levee to collapse with little or no warning when there are still four or more feet of freeboard available.

Generally, levees fail due to overtopping or collapse. A catastrophic levee failure resulting from collapse probably will occur very quickly with relatively little warning. Such a failure would occur where the levee is saturated and the high hydrostatic water pressure on the river side, coupled with erosion of the levee from high water flows or an inherent defect in the levee, causes an almost instant collapse of a portion of the levee. Under such circumstances, structures located relatively near the break will suffer immediate and extensive damage. Several hundred yards away from the break the energy of the flood waters will be dispersed sufficiently to reduce, but not eliminate, flooding damage to structures in its path. The flood water will flow in a relatively shallow path toward any low point in the affected area. Flood water will collect in these low areas and the levels will rise as the flow continues. When the rivers are high, it is not possible to close or repair a levee break until the water surface in the river and the flooded area equalize.

A major overtopping of a levee, if flow persists, will result in severe erosion of the levee crowns on the landward side and cause levee failure over a period of minutes to several hours. A severe levee overtopping can, therefore, be considered as a levee break for the purpose of determining the extent of flooding that any area will suffer. Generally, overtopping can be predicted based on river stages and the warning given depending on the source of the flood waters.

The levees within the district boundaries were built between 1912 and 1914. Recent repairs to the levees include 2011 slip repair and stability berm on the Natomas cross Canal; 2017 emergency rock seepage berms installed by DWR; 2017 post storm event storm damage boil repairs by USACE, one along the Feather River and a second on the Natomas Cross Canal; post 2017 storm repair of erosion sites along the Bear River and Yankee Slough; 2017 erosion repair on Yankee Slough completed by the District; levee patrol road repairs completed by the District in 2015, 2016, and 2017; and large erosion site at Feather River Mile 1.0 repaired by USACE under the Sacramento River Bank Protection Program in 2019. Levees are maintained to USACE maintenance standards and inspected by DWR twice a year. The USACE, DWR and the District's Board of Trustees are the parties responsible for levee improvements. The District also passed a new benefit assessment district in 2014 to increase assessment revenue for improved operations and maintenance of the District facilities.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and

economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Breach Analysis

RD 1001 leveed areas were reviewed for CA DWR Small Communities Flood Risk Reduction Program. This program performed breach analysis for the Nicolaus and Rio Oso areas. A brief summation of those breach analysis is presented below.

Nicholas and Rio Osos Areas Breach Analysis

The levee sections along the Feather River South Levees at SR 99 and the South Bear River Levees at SR 70 were breached to determine the resulting flood inundation. The breach along the Feather River Levees at a location just south of the Bear/Feather Rivers confluence has the potential to draw in a large volume of water from the Feather and Bear Rivers and was a point of failure during the significant flood event that occurred in December of 1955. The breach on the South Bear River Levees was selected because it is representative of a higher initial breach water surface elevation for the basin, which has the potential to result in greater flood depths and a flood wave through the community of Rio Oso provided that there is sufficient flood volume emanating from the Bear River.

- A breach on the Feather River results in southwesterly flows and the filling of the RD 1001 basin. Once flood depth in the basin exceeds the crown elevation of SR 99, the floodwater backs up northeasterly towards SR 70 in the area of Rio Oso. Flood depths in this scenario reach measure more than 20 feet in the lower lying areas. The floodwaters also have the potential to overtop the north (right bank) Natomas Cross Canal Levee.
- For a breach on the Bear River, floodwaters overtop SR 70 and flow southwesterly towards RD 1001. Similar to the Feather River Levee breach, floodwater fills the RD 1001 basin to an elevation that floods all of the area between the Bear/Feather/Natomas Cross Canal and SR 99 to the northeast. The flood source from this breach is not solely from the Bear River watershed. The breach opening size has the potential to divert most of the Bear River and draw additional water from the Feather River into the basin.

Assets at Risk

All assets identified in Table E-4 above are considered critical to the operations of the District and in providing adequate flood and drainage control within its boundaries. Should any of these identified assets fail, excessive flooding will occur within the District. Depending on the location of the failure, flooding could cause a small number of residents and property to be inundated to a very large area of the District. Flood water elevations could be anywhere from one to twenty feet in depth for an undetermined amount of time.

Flooding of this magnitude would cause major loss to property owners, close two major state highways used as commuter routes to jobs in the Sacramento, destroy historical landmarks, impact local transportation, agricultural crops and public utilities.

Future Development

The District continues to evaluate levee risks and implements projects to address the highest risk areas as State and Federal funding programs become available. Levee failure events are the highest risk to the District and are treated as such in planning and implementation efforts. General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1001 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD facilities is properly sited and constructed.

Severe Weather: Heavy Rains and Storms (Hail, Lightning)

Likelihood of Future Occurrence–Highly Likely
Vulnerability–High

Hazard Profile and Problem Description

Storms in the District occur annually and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the District falls mainly in the fall, winter, and spring months.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the District. All portions of the District are at risk to heavy rains. Most of the severe rains occur during the fall, winter, and spring months. There is no scale by which heavy rains and severe storms are measured. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of severe storms in California, Sutter County, and the District can range from minutes to hours to days. Information on precipitation extremes can be found in Section 4.2.3 of the Base Plan.

Past Occurrences

According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the District. This is the cause of many of the federal disaster declarations related to flooding.

Vulnerability to and Impacts from Heavy Rain and Storms

Heavy rain and severe storms are the most frequent type of severe weather occurrences in the District. These events can cause localized flooding. Elongated events, or events that occur during times where the ground is already saturated can cause 1% and 0.2% annual chance flooding. Wind often accompanies these storms and has caused damage in the past. Hail and lightning are rare in the District.

Actual damage associated with the effects of severe weather include impacts to property, critical facilities (such as utilities), and life safety. Heavy rains and storms often result in localized flooding creating significant issues. Roads can become impassable and ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Floodwaters and downed trees can break utilities and interrupt services.

Assets at Risk

District facilities including pumping facilities, buildings, and mobile equipment are at risk during storms.

Future Development

The District addresses these hazards in all new projects by meeting strict building and design standards for all facilities. General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1001 will continue to work with Sutter County in the future to ensure that any future development of RD 1001 facilities is properly sited and constructed.

E.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

E.6.1. Regulatory Mitigation Capabilities

Table E-9 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the RD 1001.

Table E-9 RD 1001 Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan	N	
Capital Improvements Plan	Y 2020	State of California, Department of Water Resources Small Communities Flood Risk Reduction Program, Nicolaus and Rio Oso Flood Risk Reduction Feasibility Studies (June 2020) addresses flood hazards and levee failures, provides alternatives to mitigate these risks and can be used for implementation.
Economic Development Plan	N	
Local Emergency Operations Plan	N	
Continuity of Operations Plan	N	
Transportation Plan	N	

Stormwater Management Plan/Program	N	
Engineering Studies for Streams	N	
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	N	
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	N/A	Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score	N/A	Score:
Fire department ISO rating:	N/A	Rating:
Site plan review requirements	N/A	
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	N/A	
Subdivision ordinance	N/A	
Floodplain ordinance	N/A	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	N/A	
Flood insurance rate maps	N/A	
Elevation Certificates	N/A	
Acquisition of land for open space and public recreation uses	N/A	
Erosion or sediment control program	N/A	
Other		
How can these capabilities be expanded and improved to reduce risk?		
Local flood operations plans should be coordinated with neighboring agencies including Yuba and Sutter Counties to allow for coordinated evacuations and flood operations to avoid evacuation chaos as was experienced in the Oroville Spillway Incident.		

Source: RD 1001

E.6.2. Administrative/Technical Mitigation Capabilities

Table E-10 identifies the District department(s) responsible for activities related to mitigation and loss prevention in RD 1001.

Table E-10 RD 1001's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	N	
Mitigation Planning Committee	N	

Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	Levees are maintained yearly. Coordination is effective.
Mutual aid agreements	N	
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	N/A	
Floodplain Administrator	N/A	
Emergency Manager	N/A	
Community Planner	N/A	
Civil Engineer	N/A	
GIS Coordinator	N/A	
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	N	
Hazard data and information	N	
Grant writing	N	
Hazus analysis	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
Levee maintenance is always a priority. Additional maintenance will be completed as funding is available. The District seeks multiple funding streams to increase levee strength and stability.		

Source: RD 1001

E.6.3. Fiscal Mitigation Capabilities

Table E-11 identifies financial tools or resources that the District could potentially use to help fund mitigation activities.

Table E-11 RD 1001's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	Y	Although it has not yet been used, the District has obtained a credit line that can be financed through dedicated capital improvement funds of $59,000 annually collected through the District Benefit Assessments.
Authority to levy taxes for specific purposes	N	

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Fees for water, sewer, gas, or electric services	N	
Impact fees for new development	N	
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	Y	Capital Improvement funds collected through the benefit assessment district can be used to secure bond funding, if needed.
Incur debt through private activities	N	
Community Development Block Grant	N	
Other federal funding programs	Y	USACE Civil Works Program, FEMA PDM, HMGP, and or BRIC programs
State funding programs	Y	DWR and CDFW grants for flood control and restoration work. Grants previously used include FSRP, CVT, YFFPP. And SCFRR
Other		
How can these capabilities be expanded and improved to reduce risk?		
Outside funding is necessary for the District to be capable of completing costly mitigation projects. The District seeks multiple funding streams to increase levee strength and stability.		

Source: RD 1001

E.6.4. Mitigation Education, Outreach, and Partnerships

Table E-12 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table E-12 RD 1001's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	N	
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	N	
Natural disaster or safety related school programs	N	
StormReady certification	N	
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	N	
Other		

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
How can these capabilities be expanded and improved to reduce risk?		
The District utilizes direct mailing to inform its residents of risks and mitigation activities. The District also relies on County, State, and Federal risk notification programs for public education.		

Source: RD 1001

The District continues to work with state, federal, and local agencies to ensure levee stability. In accordance with Public Law 84-99, Standard Operating Procedures for Responding to Flood Emergencies, the District has an adopted "Slow Rise Emergency Plan". The District also partners with the following entities for mitigation activities:

- Yuba Sutter Flood Fight Coalition:
- LD #1
- Marysville Levee District
- RD #10
- RD #784
- RD #817
- RD #2103

E.6.5. Other Mitigation Efforts

The District has many other completed or ongoing mitigation efforts that include the following:

- Alternative Power Source at Pump House
- Coordination with State DWR Flood Emergency Response Project
- Critical Repair Projects through State Flood System Repair (FSRP), Small Communities Flood Risk Reduction (SCFRR), Central Valley Tributaries (CVT), Flood Maintenance Assistance (FMAP), Deferred Maintenance Pipe (DMP) and other State bond funded programs
- USACE System-Wide Improvement Framework Plan to maintain Federal Rehabilitation assistance Eligibility after flood events while addressing deficiencies noted in Federal Inspections.

E.7 Mitigation Strategy

E.7.1. Mitigation Goals and Objectives

The RD 1001 adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

E.7.2. Mitigation Actions

The planning team for the RD 1001 identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and

timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Aquatic Invasive Species
- Climate Change
- Dam Failure
- Floods: 1%/0.2% annual chance
- Floods: Localized Stormwater
- Levee Failure
- Severe Weather: Heavy Rains and Storms

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement.

Multi-Hazard Actions

Action 1. Flood Potential from Overgrowth River Bottoms, River Fronts and Levee Sides

Hazards Addressed: Aquatic Invasive Species, Flood, Localized Flood, Levee Failure, Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Many areas in Reclamation District 1001 are overgrown with trees, shrubs, and grasses. These areas are either out of our jurisdictional reach or difficult to access. This overgrowth has the potential to become serious issue of slowing the flow of streams, river and other water ways. Overgrowth can create water channels that can redirect water flowing towards levees increasing erosion. Slowing over the river means more water seepage increasing chances of levee failure. In the past the District would control burn or be allowed to maintain these areas.

Project Description: Gain access to funding to apply for more burn funding. Either for assistance with permits or to hire third party companies to take on the responsibility. Another option would be to gain access to these areas with equipment for maintenance.

Other Alternatives: No action

Existing Planning Mechanism(s) through which Action Will Be Implemented: Reclamation District 1001, FEMA, DWR

Responsible Agency/ Department/Partners: Reclamation District 1001, Department of Water Resources

Cost Estimate: $1,000,000

Benefits (Losses Avoided): Increase flow of water and alleviate stress on levee system

Potential Funding: Grant Funding

Timeline: 2025

Project Priority (H, M, L): Medium

Action 2. Drainage Canal Cleaning (Sediment and Aquatic Plant Life)

Hazards Addressed: Aquatic Invasive Species, Climate Change, Flood, Localized Flood, Levee Failure, Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: RD 1001 has multiple canals/creeks draining into one main canal. This main canal over time has become increasingly full of sediment decreasing its overall capacity. The invasive and natural aquatic plant life found in these canals slows the water flow to the pumping stations. Aquatic plant life also has the potential of clogging and damaging pumps on arrival, causing a need for large screens that require constant maintenance during both high and lower water intervals.

The main canal drainage system is one of only a few ways waters can escape a natural basin RD1001's Pumping station was designed to protect. Farmland, important highway systems (99/70) and many small communities rely on this drainage capacity to keep them safe during high water events.

Project Description: To excavate the main canal for a distance of up to 6-8 miles and a dept of 1-4 feet. After excavation of canal an Integrated Management Plan (IPM) would need to be developed for the invasive aquatic species to prevent future pumping or flow problems with the system. This plan would not only help with future maintenance cause but help stop spreading of any unwanted invasive species.

Other Alternatives: No action

Existing Planning Mechanism(s) through which Action Will Be Implemented: Reclamation District 1001, California Department of Fish and Wildlife

Responsible Agency/ Department/Partners: Reclamation District 1001, Department of Water Resources

Cost Estimate: $1,000,000

Benefits (Losses Avoided): Reduce drainage flooding

Potential Funding: Grant Funding

Timeline: 2022

Project Priority (H, M, L): High

Action 3. Feather River: Seepage, Stability, and Erosion

Hazards Addressed: Aquatic Invasive Species, Climate Change, Flood, Localized Flood, Levee Failure, Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Unit 4 Feather River Levee in Reclamation District 1001 (rd1001) has Seepage, Stability issues, and Erosion problems

Project Description: Unit 4 Feather River Levee in RD1001 is in need of rehabilitation. The full length of the system is need of slope/height adjustments, stability berms added and to be re-rocked on the water side. The levee should be brought up to a minimum 100-year flood plan (or 200 year) standard to protect the communities, farmland and the major infrastructure within the greater south Sutter county area. The section of levee is know for its history of seepage, instability and Erosion.

Other Alternatives: No action

Existing Planning Mechanism(s) through which Action Will Be Implemented: Reclamation District 1001, FEMA, DWR

Responsible Agency/ Department/Partners: Reclamation District 1001, Department of Water Resources

Cost Estimate: $230,000,000

Benefits (Losses Avoided): Reduce drainage and flooding

Potential Funding: Grant Funding

Timeline: 2025

Project Priority (H, M, L): High

Action 4. Public Signage

Hazards Addressed: Preparedness for hazards that threaten our communities, improve public awareness, critical facilities.

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: District 1001 has a few different signs used throughout the district. All of them to warn the public of different hazards or to stop interference with Reclamation operations. Most of the time these signs are homemade or printed at a considerable expense. This however means little to the public who

make it a constant battle to keep destroying them or removing them. Many who are caught in violation of these signs claim they were not found or were not legible.

Project Description: To get funding to be able to afford large high-quality signage in bulk so maintenance will become simple and information more available to the public. Or else find a cost-effective means for the District to be able to make they own signage.

Other Alternatives: No action

Existing Planning Mechanism(s) through which Action Will Be Implemented: Reclamation District 1001, FEMA, DWR

Responsible Agency/ Department/Partners: Reclamation District 1001, Department of Water Resources

Cost Estimate: $50,000

Benefits (**Losses Avoided**): A more educated public

Potential Funding: Grant Funding, Cost Share

Timeline: 2022

Project Priority (H, M, L): Medium

Action 5. Controlled Burn or Physical (mechanical) Maintenance of Overgrown (Vegetation) Areas

Hazards Addressed: Wildfire, Extreme Heat, Drought, Climate Change

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Overgrowth of canals, river bottoms, stream, sloughs, and levees throughout the District, are become a serious hazard. These areas in the past were normal burned or physically (mechanically) maintained. Over time with new burn laws and other regulations, RD1001 has lost its ability to maintain these areas. Now these areas pose a potential fire hazard endangering natural habitat and the community at large. Along with the dense vegetation being a hamper on the flow of the water ways though out the district. The slowing of water flows leads to seepage, increase erosion and making pumping stations less productive.

Project Description: To clear (or selective thinning) the overgrowth of these areas. This can be accomplished by either control burns or physical (mechanical) maintenance means.

Other Alternatives: Rely on other agencies

Existing Planning Mechanism(s) through which Action Will Be Implemented: Reclamation District 1001, FEMA, DWR, California Fish and Wild Life

Responsible Agency/ Department/Partners: Reclamation District 1001, Department of Water Resources

Cost Estimate: $1,000,000

Benefits (Losses Avoided): Increase drainage efficiency in RD1001 and control future wildfire hazards

Potential Funding: Grant Funding

Timeline: 2023

Project Priority (H, M, L): Medium

Action 6. Levee access (Maintenance, Monitoring and Emergency)

Hazards Addressed: Preparedness for hazards that threaten our communities

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Levee roads along the top, toe and water side of Reclamation District 1001 are very limited.

Most access to the Levee system is only along the levee road tops of the Levees themselves. Access to the lower parts of the levee are limited, ramps in many parts of the system are miles apart. This limitation makes it difficult to monitor or maintain a large portion of levee system from anywhere except for the top. Let alone to get equipment to where it needs to go in case of an emergency.

Any larger vehicles (semi-truck and trails) would have difficulty driving, entering or exiting many units throughout the district. Most the of roads and gates were designed for standard vehicles. Meaning almost no room for vehicles to take wide turns, turn around or even to unload.

Project Description: Widen the tops of the levee to 12' in width throughout (or part of) the district. Add turn around/loading areas even 1-2 mines based on unit size. Add fire trails (water side roads) to the levee system. Build roads on the land side toe of the levees.

Other Alternatives: No action

Existing Planning Mechanism(s) through which Action Will Be Implemented: Reclamation District 1001, FEMA, DWR

Responsible Agency/ Department/Partners: Reclamation District 1001, Department of Water Resources

Cost Estimate: $10,000,000

Benefits (Losses Avoided): Increase access to all parts of the levee system for maintenance, monitoring and emergency services.

Potential Funding: Grant Funding

Timeline: 2024

Project Priority (H, M, L): Medium

Annex F Reclamation District 1500

F.1 Introduction

This Annex details the hazard mitigation planning elements specific to Reclamation District 1500 (RD 1500 or District), a previously participating jurisdiction of the 2013 Sutter County Local Hazard Mitigation Plan (LHMP) Update. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the District. This Annex provides additional information specific to RD 1500, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

F.2 Planning Process

As described above, the District followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the District formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table F-1. Additional details on plan participation and District representatives are included in Appendix A.

Table F-1 RD 1500 – Planning Team

Name	Position/Title	How Participated
Brad Mattson	General Manager	Planning team Meetings; Annex Development and Review; Final Draft and Public Draft reviews for the overall planning process.

Coordination with other community planning efforts is paramount to the successful implementation of this LHMP Update. This section provides information on how the District integrated the previously approved 2013 Plan into existing planning mechanisms and programs. Specifically, the District incorporated into or implemented the 2013 LHMP through other plans and programs shown in Table F-2.

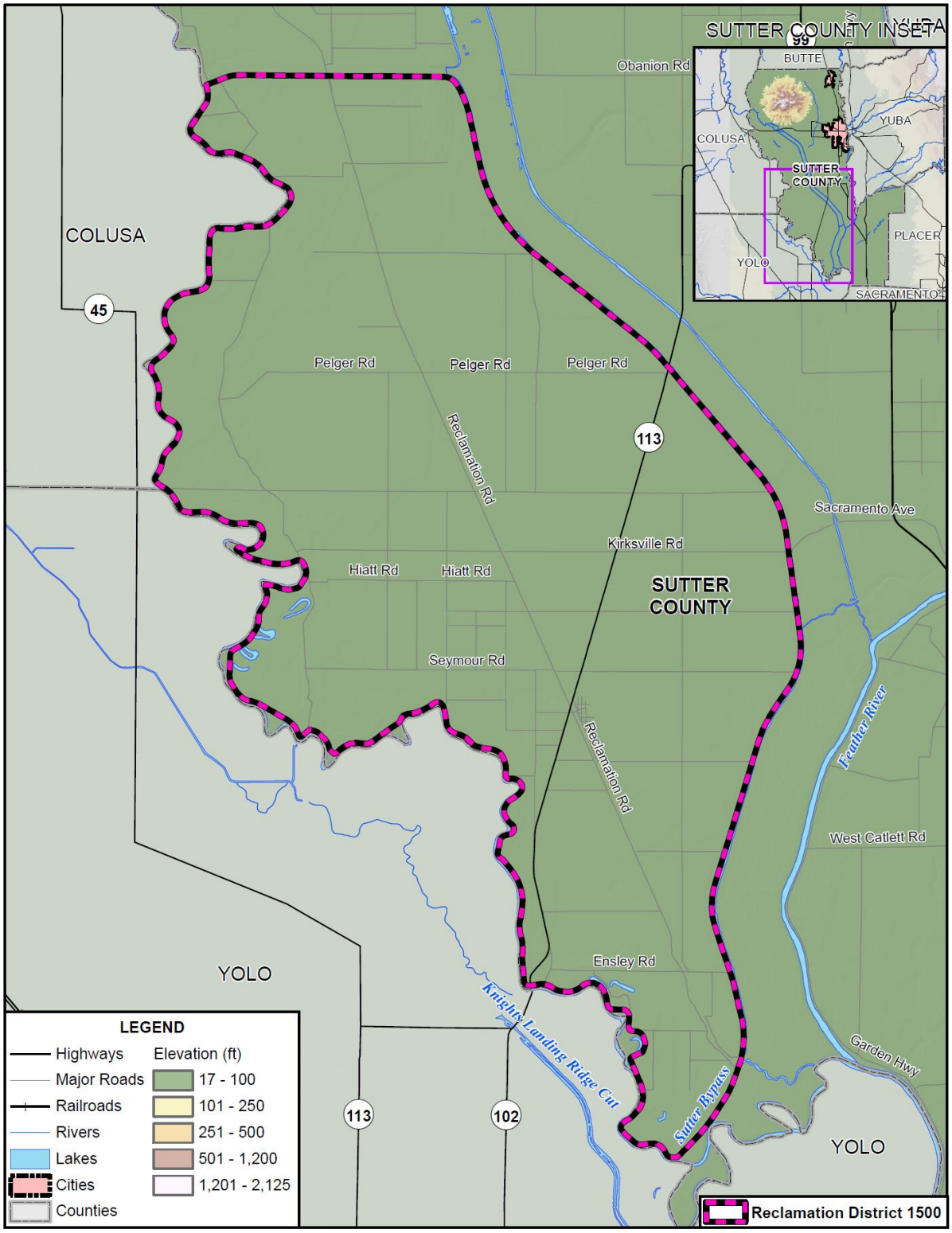
Table F-2 2013 LHMP Incorporation

Planning Mechanism 2013 LHMP Was Incorporated/Implemented In.	Details: How was it incorporated?
N/A	No relevant mitigation planning was done that incorporated the 2013 LHMP.

F.3 District Profile

The District profile for the RD 1500 is detailed in the following sections. Figure F-1 displays a map and the location of the District within Sutter County.

Figure F-1 RD 1500



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

F.3.1. Overview and Background

RD 1500 was established by the State Legislature in 1913 for the purposes of providing drainage and reclamation of lands within its boundaries. RD 1500 provides water drainage and flood control to its landowners while ensuring the long-term reliability of the District's systems and facilities. It is also a District's goal to provide a beneficial, stimulating, and safe environment that will promote competence and stability in the workplace.

The District is located within Sutter County, approximately 45 miles northwest of the City of Sacramento, California with a gross service area of 67,851 acres. The District's topography is relatively flat and is confined by surface water features and engineered channels (the Sacramento River, the Tisdale Bypass, and the Sutter Bypass) and encompasses the following surface water purveyors, Sutter Mutual Water Company (SMWC) and Pelger Mutual Water Company (PMWC), in addition to several independent irrigators (mostly, private landowners known as Rimlanders in the westerly portion of the District, outside of SMWC and PMWC.)

RD 1500 was formed by a special act of the State Legislature in 1913 for the purposes of providing drainage and reclamation of lands within its boundaries. The District's enabling statutes grant the District authority to perform its functions. The District is able to fulfill its mission and purpose under the guidelines of the State Water Code under the section identified as Reclamation Districts section 50000.

The District is comprised of two Drainage Pumping Facilities, approximately 18.5 miles of main drains, and approximately 500 miles of drainage canals, ditches, and laterals. The pumps discharge summer irrigation run-off from farmlands and discharge excess drainage water resulting from annual winter season storm events. The levees run adjacent to the Sacramento River along approximately 36 miles and adjacent to the Sutter Bypass along approximately 21 miles. The entire District is within the scope of the Sacramento River Flood Control Project, as approved by the United States and the State of California.

F.4 Hazard Identification

RD 1500 identified the hazards that affect the District and summarized their location, extent, frequency of occurrence, potential magnitude, and significance specific to District (see Table F-3).

Table F-3 RD 1500—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Highly Likely	Critical	Medium	Medium
Climate Change	Extensive	Likely	Critical	Medium	–
Dam Failure	Limited	Occasional	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Critical	High	High
Earthquake	Extensive	Unlikely	Critical	Low	Low
Floods: 1%/0.2% annual chance	Extensive	Occasional	Critical	High	Medium
Floods: Localized Stormwater	Limited	Occasional	Limited	Medium	Medium
Levee Failure	Limited	Likely	Catastrophic	High	Medium
Pandemic	Extensive	Likely	Critical	High	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Limited	Medium	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Medium	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Critical	Medium	Medium
Wildfire	Limited	Unlikely	Negligible	Low	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

F.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile the District's hazards and assess the District's vulnerability separate from that of the Sutter County Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Sutter County Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the District is included in this Annex. This vulnerability assessment analyzes the property and other assets at risk to hazards ranked of medium or high significance specific to the District. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

F.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section F.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table F-3) affects the District and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Sutter County Planning Area.

F.5.2. Vulnerability Assessment and Assets at Risk

This section identifies the District's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within the District.

Assets at Risk and Critical Facilities

This section considers the RD 1500's assets at risk, with a focus on key District assets such as critical facilities, infrastructure, and other District assets and their values. With respect to District assets, the majority of these assets are considered critical facilities as defined for this LHMP Update. Critical facilities are defined for this Plan as:

> ***Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.***

Table F-4 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. RD 1500's physical assets, valued at over $11 million, consist of the buildings and infrastructure to support the District's operations.

Table F-4 RD 1500 Critical Facilities, Infrastructure, and Other District Assets

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
Karnak Pump Plant	Pump Station	$10,000,000	Aquatic invasive species, Climate Change, Earthquake, Flooding, Levee Failure, Pandemic, Extreme Cold, Heavy Rains
District Communication Center	Communication Facility	$1,000,000	Aquatic invasive species, Climate Change, Earthquake, Flooding, Levee Failure, Pandemic, Extreme Cold, Extreme Heat, Heavy Rains
Total		**$11,000,000**	

Source: RD 1500

Levee status in the District is shown on

Figure F-2 RD 1500 – Levee Status

NLD Segment Name and ID	NLD Segment ID Number	Current Status	Improvements
RD1500 Sutter Basin, Unit 1, Sacramento River (STR1)	5204000931	Unacceptable	Various improvements needed – Funding required
RD1500 Sutter Basin, Unit 1, Sutter Bypass (STR2)	5204000932	Unacceptable	Various improvements needed – Funding required
Tisdale Bypass, Unit 2, South Levee (TBP2)	5204001082	Unacceptable	Various improvements needed – Funding required

Source: RD 1500

Significant "barriers" to levee improvements is the long and expensive permitting processes, and general shortages of federal, state, and local funding for such projects. The District was formed in 1913, and it would follow that most, if not all, the drains, ditches, and laterals were essentially established at that time or soon thereafter. The same would hold true for the main Pump Plant No. 1, while Pump Plant No. 3 was established in 1952.

Natural Resources

RD 1500 has a variety of natural resources of value to the District. These natural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Historic and Cultural Resources

RD 1500 has a variety of historic and cultural resources of value to the District. These historic and cultural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Growth and Development Trends

The District Municipal Service Review noted that The District is in a highly rural setting and the growth rate is nominal. The current population is about 300 permanent persons and about 500 seasonal persons. The population level is considered stable for at least the next 5-10 years. A few homes have recently been built and occupied in Robbins; however, the service area is essentially agricultural and rural and in a flood risk area. Also, there are limited community services and resources for supporting significant construction and population expansion. Most of the lands in the District are agricultural, with the exception of the town of Robbins. Current facilities are adequate for existing land uses and minimal growth is expected in the area.

General growth in the District parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Development since 2013

No new District facilities have been constructed since 2013.

Future Development

The District has no control over future development in areas the District provides levee protection in. Future development in these areas parallels that of Sutter County. The District noted that it has sufficient resources to accommodate projected service demands, given existing growth constraints, over the next 10 years and beyond.

More general information on growth and development in Sutter County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sutter County Vulnerability and Assets at Risk of the Base Plan.

F.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table F-3 as high or medium significance hazards. Impacts of past events and vulnerability of the District to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the District to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.

- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, critical facilities and infrastructure, populations at risk, and future development.

Aquatic Invasive Species

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

The introduction of nonnative species into coastal marine and estuarine waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability.

Boats discharge ballast water that has been obtained from waters throughout the state, country, or the world. This water might include non-native organisms, untreated sewage, and other contaminants. Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. Examples include the zebra mussel infestation in the Great Lakes and the propagation of water hyacinth in the California Delta. Both the zebra mussel and the quagga mussel are concerns for California and Sutter County. These mussels have not affected the waters in Sutter County yet, but are still a cause for concern.

Some of California's most serious weed problems occur in waterways, lakes and streams. The aquatic plant hydrilla is considered one of the most serious aquatic weed problems in the world and the California Department of Food and Agriculture (CDFA) maintains an intensive program to survey and eradicate this aquatic weed pest. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, while impeding water flow and delivery. Its rapid growth and ease of spread by boats makes it critical to detect early and eradicate.

The effects of nonnative fish on native fish are generally in the form of predation and competition for food and breeding sites. There are also several non-fish, nonnative invasive species found in aquatic natural communities that can damage such communities. The introduced bullfrog is an important riparian invasive in the plan area. Many varieties of non-native aquatic weeds compete for the entire water column and shoreline in Sutter County, crowding out native species and degrading the aquatic and riparian habitat.

The major concern for RD 1500 is water primrose and watermilfoil.

Location and Extent

All freshwater lakes, streams, and rivers are potentially at risk from aquatic invasive species. There is no established scale for these invasive species. Magnitude is measured by the presence and counts of aquatic invasive species in waterways in Sutter County. Speed of onset of these invasive species is short, as it only takes a careless boater or visitor to the area to accidentally introduce an invasive species. However, the duration is long as once established they can take years to eradicate, if at all.

Past Occurrences

The District faces invasive species concerns each year. See the Assets at Risk discussion below for more information.

Vulnerability and Impacts to Invasive Aquatics

The introduction of NAS into rivers and lakes can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability. Ships ballast water obtained from some other foreign location (outside the County) can include non-native organisms, untreated sewage, and other contaminants. Once introduced, NAS are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and economic havoc.

Aquatic invasive species can jeopardize and damage any part of the entire system ranging from human economy dependent infrastructure to natural aquatic, riparian and wetland habitat. Entire watersheds can be affected when an aggressive invasive species infests the rivers, shorelines, tributaries, drainage, irrigation and domestic delivery systems. Impacts to the District are mostly related to water recreation activities that may be hampered by these invasive species.

Assets at Risk

Most of the District's major facilities are at risk from aquatic invasive species. In particular, the drainage canals and Karnak Pump Station is at risk of clogging from the invasive species. Karnak Pump Station is the only means for internal drainage to leave the RD 1500 basin. If Karnak Pump Station and the associated drainage canals fail, ponding would occur within the community of Robbins.

Future Development

The District plans to work with DWR and other grant programs to remove and prevent against invasive species where possible.

Climate Change

Likelihood of Future Occurrence–Likely

Vulnerability–Medium

Hazard Profile and Problem Description

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

In Sutter County and the District, the HMPC the HMPC noted that each year it seems to get a bit warmer each year. It was also noted that 2017 was one of the wettest and 2019 one of the hottest years on record. The majority of climate change concerns only directly affect the District if the reservoirs are unable to manage the discharges in a high water year. During the past 5 years, there were some increases to projected flows due to climate change and the District has taken those into consideration. As part of the 2022 Central Valley Flood Protection Plan update those flows will be evaluated again.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the District, Sutter County, and State of California. There is no scale to measure the extent of climate change. Climate change exacerbates other hazards, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Climate change has never been directly linked to any declared disasters. While the District noted that climate change is of concern, no specific impacts of climate change could be recalled. The District and HMPC members noted that the strength of storms does seem to be increasing and the temperatures seem to be getting hotter.

Vulnerability to and Impacts from Climate Change

The California Adaptation Planning Guide (APG) prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change. California's APG: Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Sutter County falls within the North Sierra Region characterized as a sparsely settled mountainous region where the region's economy is primarily tourism-based. The region is rich in natural resources, biodiversity, and is the source for the majority of water used by the state. This information can be used to guide climate adaptation planning in the District and Sutter County Planning Area.

The California APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Sutter County Planning Area is part of:

- Temperature increases
- Decreased precipitation
- Reduced snowpack
- Reduced tourism
- Ecosystem change
- Sensitive species stress
- Increased wildfire
- Increased or decreased flows in the Sacramento River, Sutter Bypass, Tisdale Bypass and District drainage canals, depending on the water year
- More intense shorter duration weather events

Assets at Risk

The District noted that all of its facilities from Table F-4 will most likely be at risk from climate change.

Future Development

Future development of District facilities is unlikely to be affected by climate change. RD 1500 does not control future development in areas protected by levees, that is the purview of the County. RD 1500 will continue to work with the County in the future to ensure that future development is sited in proper areas.

Dam Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–High

Hazard Profile and Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

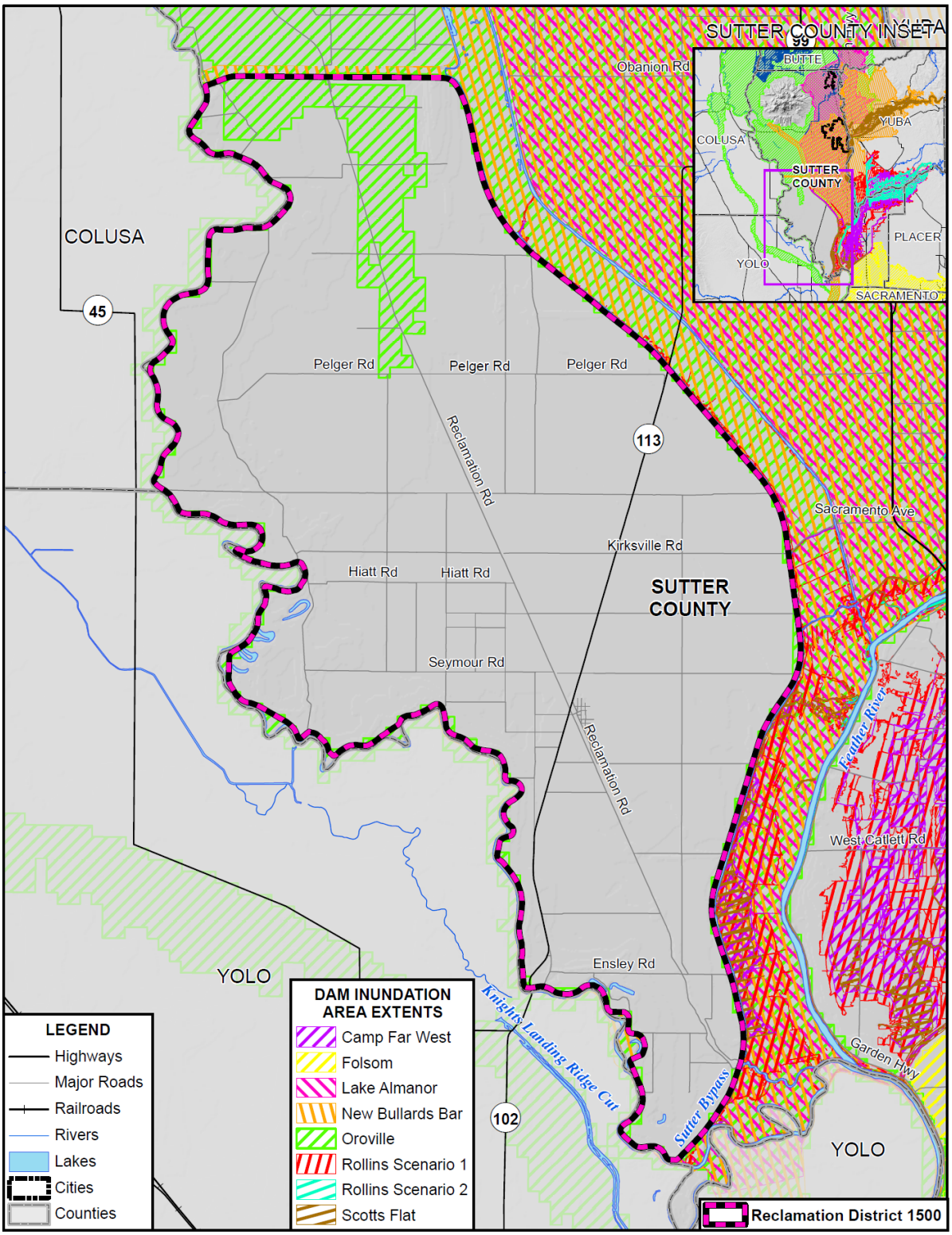
Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, Cal DWR Division of Safety of Dams (DOSD) assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the

potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.2.10 of the Base Plan.

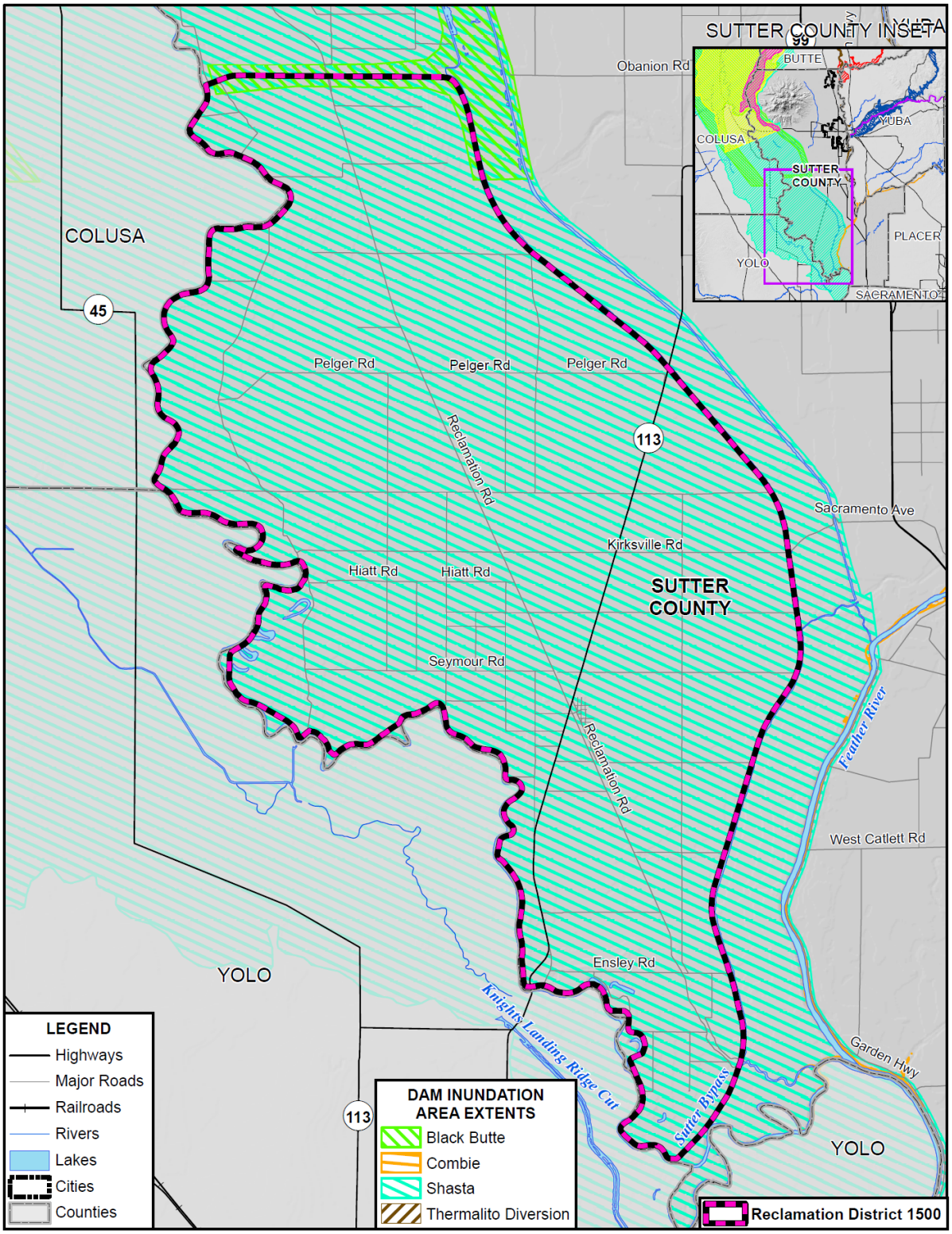
While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The District would be affected for as long as the flood waters from the dam failure took to drain downstream.

Figure F-3 RD 1500 – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure F-4 RD 1500 – High Hazard Dam Inundation Areas



FOSTER MORRISON CONSULTING

0 2.5 5 Miles

Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident. This can be seen on Table F-5.

Table F-5 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

The District noted no other dam failure occurrences that have affected the District. The District experience sedimentation issues within the adjacent river channels as a result of the Oroville Spillway Incident. The District and Robbins basin also experienced hardships due to the emergency evacuations.

Vulnerability to and Impacts from Dam Failure

As shown above, the District falls in the dam inundation zone of multiple dams. Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the District from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant.

Following a dam breach in a dam upstream of the RD 1500 basin, it is likely that flows within the Sutter Bypass, Sacramento River and Tisdale Bypass would be high enough to cause a breach within the levee system and cause deep flooding throughout the entire Robbins basin.

Assets at Risk

Depending on the dam that fails, most to all of the District's facilities shown in Table F-4 would be at risk to dam failure.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1500 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1500 facilities is properly sited and constructed.

Drought & Water Shortage

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects. Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue and is critical for agriculture, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

Location and Extent

Drought and water shortage are regional phenomenon. The whole of the County, as well as the whole of the District, is at risk. The US Drought Monitor categorizes drought conditions with the following scale:

- None
- D0 – Abnormally dry
- D1 – Moderate Drought
- D2 – Severe Drought
- D3 – Extreme drought
- D4 – Exceptional drought

Drought has a slow speed of onset and a variable duration. Drought can last for a short period of time, which does not usually affect water shortages and for longer periods. Should a drought last for a long period of time, water shortage becomes a larger issue. Current drought conditions in the District and the County are shown in Section 4.2.11 of the Base Plan.

Past Occurrences

Since drought is a regional phenomenon, past occurrences of drought for the District are the same as those for the County and includes 5 multi-year droughts over a 85-year period. Details on past drought occurrences can be found in Section 4.2.11 of the Base Plan.

Vulnerability to and Impacts from Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the District, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. In drought conditions, groundwater levels could drop significantly. Since the water supply for the residents of the RD 1500 basin is primarily groundwater, if water levels drop

past well depths, the community of Robbins or property owners within the basin could experience water scarcity issues.

Assets at Risk

No District assets from Table F-4 are risk from drought or water shortage.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1500 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1500 facilities is properly sited and constructed.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

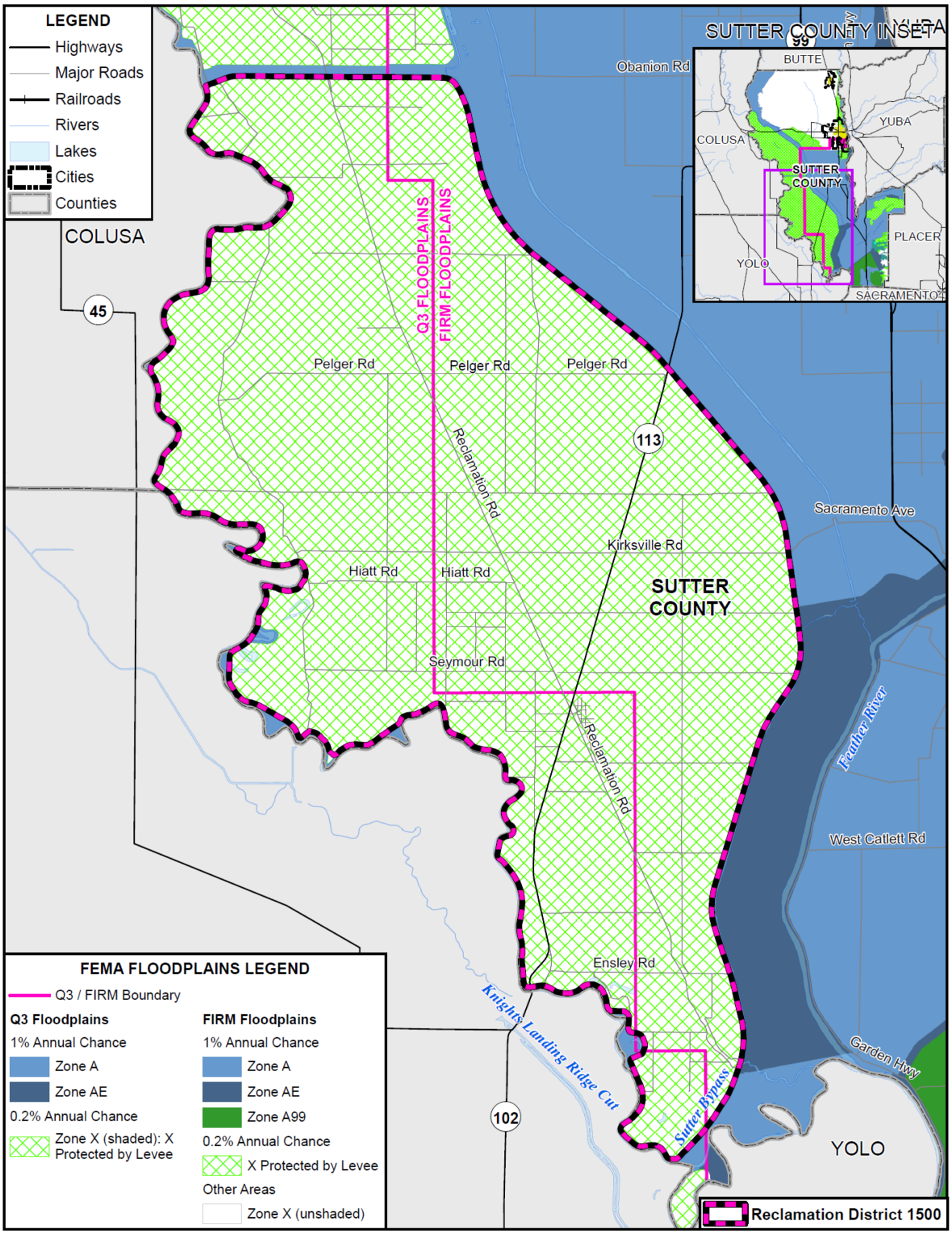
This hazard analyzes the FEMA Q3/DFIRM 1%, 0.5%, and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the District, and have caused damages in the past. Flooding is a significant problem in Sutter County and the District. Historically, the District has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1% and 0.2% annual chance floodplains and in other localized areas.

As previously described in Section 4.2.13 of the Base Plan, the Sutter County Planning Area and the RD 1500 have been subject to historical flooding. RD 1500 is traversed by several stream systems and is at risk to the 0.2% flood.

Location and Extent

The RD 1500 has areas located in the 0.2% annual chance floodplain. This is seen in Figure F-5.

Figure F-5 RD 1500 – FEMA Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (combination of Q3 and DFIRM: FEMA_FIRMS.shp, FEMA NFHL 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table F-6 details the Q3/DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the District.

Table F-6 RD 1500– Q3/DFIRM Flood Hazard Zones

Flood Zone	Description	Present in the District
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	
AE	1% annual chance flood: Base flood elevations provided	
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	X
X (unshaded)	No flood hazard	X
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	X
AE	100-year Flood: Base flood elevations provided	X
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	
X (unshaded)	No flood hazard	X
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	X

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the District vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the District tends to have a shorter speed of onset, due to the amount of water that flows through the District.

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table F-7. These events also likely affected the District to some degree.

Table F-7 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

Vulnerability to and Impacts from Flood

Floods have been a part of the District's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

Large flood events cause high water levels in the Sutter Bypass, Sacramento River, and Tisdale Bypass. When water levels increase the District must increase levee monitoring activities and patrols.

Assets at Risk

The drainage facilities under the ownership and control of the district are at risk to damage from excessive rainfall, stormwater runoff and flooding. Of greatest concern to RD1500 is excessive flooding that could occur should the Karnak Pumping Facility Fail. Sutter Basin is surrounded by levees maintained and monitored by Reclamation District 1500. All water coming into this Basin must be pumped or gravity feed out. During high water, the release of water at Oroville Dam and high Feather River water flows will not allow for gravity feed so that all water must be pumped out of the basin. If the pumps at Karnak fail, then flooding in the south end of the District will start immediately; and within 4 to 6 hours water will be in the Sutter Basin Growers Co-Op and the town of Robbins. The Co-Op's approximate annual revenue to its growers is $22 million with assets valued at about $8.3 million. Flooding the town of Robbins would cause considerable damage to its residents, school and businesses. If flooding occurs in the Basin, then Hwy 113 a major north-south transportation route from Yuba City south, with a bridge over the Sutter Bypass, could close, which in the 1997 storm and flood events was one of the few emergency routes out of Yuba City that remained opened. The following photo is of the Karnak Pump Plant.

Figure F-6 RD 1500 – Karnak Power Plant

Source:

Large flood events cause high water levels in the Sutter Bypass, Sacramento River, and Tisdale Bypass. When water levels increase the District must increase levee monitoring activities and patrols.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1500 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1500 facilities is properly sited and constructed. Large flood events cause high water levels in the Sacramento River, Sutter Bypass, and Tisdale Bypass. High water levels make levee failure more likely. Large flood events are the driving factor for considering levee improvement projects.

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

Flooding occurs in areas other than the FEMA mapped 1% and 0.2% annual chance floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate maintenance. Localized, stormwater flooding occurs throughout the County during the rainy season from November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration.

Location and Extent

The RD 1500 is subject to localized flooding throughout the District. Flood extents are usually measured in areas affected, velocity of flooding, and depths of flooding. Expected flood depths in the District vary by location. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Localized flooding in the District tends to have a shorter speed of onset, especially when antecedent rainfall has soaked the ground and reduced its capacity to absorb additional moisture.

Additionally the community of Robbins is located at a relatively low elevations within RD 1500, and is typically the first place where floodwaters begin to pond. If Karnak Pump Station were to fail, the community of Robbins may experience localized flooding.

Winter storms periodically occur that overwhelm the drainage system and pumping plants and cause local flooding.

Past Occurrences

The District noted the following past occurrences of localized flooding:

- See Sutter County info. All areas adjacent to the levees are vulnerable from under seepage and through seepage due to riverine flooding.

Vulnerability to and Impacts from Localized Flooding

Historically, much of the growth in the District and County has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff.

Primary concerns associated with stormwater flooding include impacts to infrastructure that provides a means of ingress and egress throughout the community. Ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Objects can also be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt

services. Standing water can cause damage to crops, roads, and foundations. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Assets at Risk

All facilities from Table F-4 are at risk for localized stormwater flooding.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1500 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1500 facilities is properly sited and constructed. Localized flooding events could be reduced if levee underseepage and through seepage were fixed in levee improvement projects.

Levee Failure

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

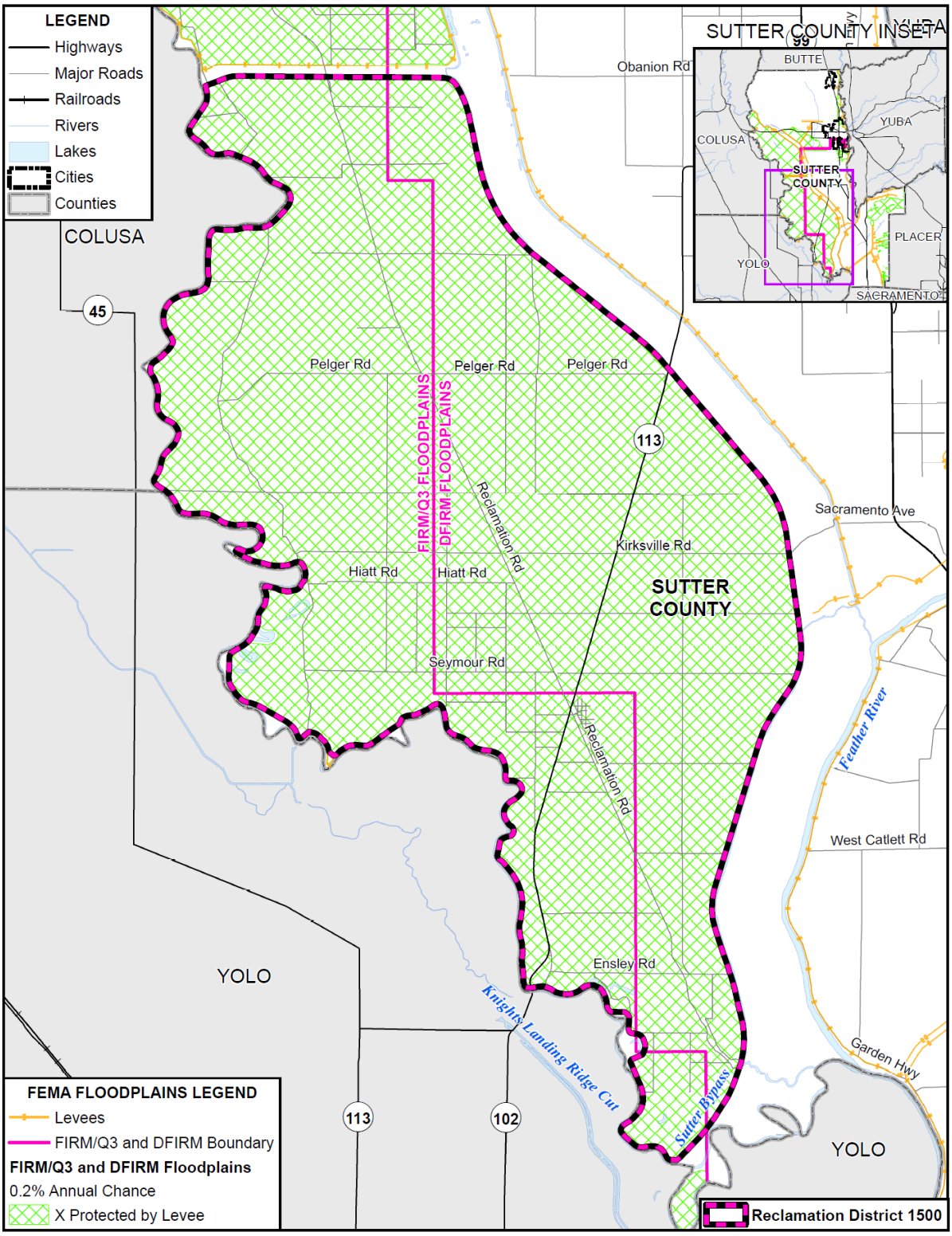
Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the District are currently being studied, and have not been published as of February 2021. The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. When northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees.

Levee locations and DFIRM flood zones for RD 1500 are shown on Figure F-7.

Figure F-7 RD 1500 – Levee Locations and Q3/DFIRM Flood Zones



FOSTER MORRISON CONSULTING

0 2.5 5 Miles

Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

The District Planning Team noted no past occurrences of levee failures that resulted in inundating the RD 1500 jurisdiction.

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. For RD 1500, the primary danger associated with levee failure is the severe flooding depths within the basin as a result of a breach.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

The District Communications Center on Kirkville Road is located on relatively high ground within the basin, but may still be impacted by flooding due to a levee breach. The District Communications Center may be inundated by a breach that occurs along Sutter Bypass and Sacramento River.

Karnak Pump Station may become flooded and unusable during a levee breach event along the Sutter Bypass. Karnak Pump Station should be flood proofed at to flooding depths at least 1' above the BFE in order to maintain pumping capabilities through the complete duration of a breach event.

Assets at Risk

All District assets contained in Table F-4 are at risk from levee failure.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1500 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1500 facilities is properly sited and constructed. Various levee failure scenarios have been modeled. The results of the modelling shows that levee failures could be catastrophic for the entire Robbins basin.

Pandemic

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur

when a new virus appears against which the human population has no immunity. It is important to realize that this LHMP Update does not examine pandemic contingency plans, but instead focuses on examining the risk of a normal hazard occurrence.

A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the World Health Organization to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning and preparation. An especially severe a pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the District, County, and surrounding region is at risk, as pandemic is a regional, national, or international event. The speed of onset of pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by number who die from complications from the pandemic.

Past Occurrences

There has been one state and federal disaster declaration due to pandemic, as shown in Table F-8.

Table F-8 Sutter County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

The 20th century saw three outbreaks of pandemic.

- The **1918-1919 Influenza Pandemic (H1N1)**
- The **February 1957-1958 Influenza Pandemic (H2N2)**
- The **1968 Influenza Pandemic (H3N2)**

To date, the 21st century has seen two acknowledged pandemics.

- **2009 Swine Flu (H1N1**)
- **2019/2020 COVID 19**

Vulnerability to Pandemic

Pandemic has and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public

health officials can use to combat pandemic. Constant surveillance regarding current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent spread of pandemic by staying home, or "self-quarantining," if they suspect they are infected. Pandemic does not affect the buildings, critical facilities, and infrastructure in the District. Pandemic can have varying levels of impact to the citizens of the District and greater County, depending on the nature of the pandemic.

Impacts

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently) an unemployment rose significantly. Supply chains for food can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Future Development

Future development is not expected to be significantly impacted by this hazard, though population growth in the District could increase exposure to pandemic, and increase the ability of each disease to be transmitted among the population of the District.

Severe Weather: Extreme Cold and Freeze

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

According to the National Weather Service), extreme cold often accompanies a winter storm or is left in its wake. Winter snowstorms can include heavy snow, ice, blizzard conditions, and cold temperatures. Freezing temperatures can also occur without the accompanying winter storm.

Location and Extent

Extreme cold and freeze are regional issues, meaning the entire City is at risk to cold weather and freeze events. While there is no scale (i.e. Richter, Enhanced Fujita) to measure the effects of extreme cold and freeze, temperature data from the County from the WRCC indicates that there are 21.8 days that fall below 32°F in western Sutter County. Freeze has a slow onset and can be generally be predicted in advance for the County. Freeze events can last for hours (in a cold overnight), or for days to weeks at a time. It is rare for snow to fall in the District, and even rarer that snow accumulates in the District. Snowfall has an onset that is similar to freeze.

Past Occurrences

There has been one federal and one state disaster declaration for freeze. This can be seen in Table F-9.

Table F-9 Sutter County – State and Federal Freeze Disaster Declarations 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Freeze	1	1990	1	1990

Source: Cal OES, FEMA

The District noted that freeze and winter storm is a regional phenomenon; events that affected the lower elevations of the County also affected the District. Those past occurrences were shown in the Base Plan in Section 4.2.5.

Vulnerability to and Impacts from Severe Weather: Freeze and Winter Storms

The District experiences temperatures below 32 degrees during the winter months. The temperature moves to the teens in rather extreme situations. Freeze can cause injury or loss of life to residents of the District. While it is rare for buildings to be affected directly by freeze, damages to pipes that feed building can be damaged during periods of extreme cold. The freeze thaw cycle can also weaken levees.

Assets at Risk

All District assets from Table F-4 are at risk from this hazard

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1500 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1500 facilities is properly sited and constructed. The freeze thaw cycle can also weaken levees.

Severe Weather: Extreme Heat

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

According to FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In extreme heat and high humidity, evaporation is slowed, and the body must work extra hard to maintain a normal temperature." Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat.

In addition to the risks faced by citizens of the District, there are risk to the built environment from extreme heat. While extreme heat on its own does not usually affect structure, extreme heat during times of drought can cause wildfire risk to heighten. Extreme heat and high winds can cause Public Safety Power Shutdowns (PSPS) events, causing issues to buildings in the District.

Location and Extent

Heat is a regional phenomenon and affects the whole of the District. Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly affect vulnerable populations and communities. Heat waves do not generally cause damage or elicit the immediate response of floods, fires, earthquakes, or other more "typical" disaster scenarios.

The NWS has in place a system to initiate alert procedures (advisories or warnings) when extreme heat is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. The NWS HeatRisk forecast provides a quick view of heat risk potential over the upcoming seven days. The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. This can be seen in Section 4.2.2 of the Base Plan.

Past Occurrences

The District Planning Team note that since extreme heat is a regional phenomenon, events that affected the County also affected the District. Those past occurrences were shown in the Base Plan in Section 4.2.2. The District noted that during the summer months the construction crews will follow OSHA requirements during heat events.

Vulnerability to and Impacts from Extreme Heat

The District experiences temperatures in excess of 100°F during the summer and fall months. The temperature moves to 105-115°F in rather extreme situations. During these times, drought conditions may worsen. Also, PSPS events may occur during these times as well. Health impacts are the primary concern with this hazard, though economic impacts are also an issue.

Days of extreme heat have been known to result in medical emergencies, and unpredictable human behavior. Periods of extended heat and dryness (droughts) can have major economic, agricultural, and water resources impacts. Extreme heat can also dry out vegetations, making it more vulnerable to wildfire ignitions. During periods of extreme heat (with high winds), PG&E can institute the Public Safety Power Shutoff (PSPS).

Assets at Risk

While some District assets are at risk, it is District crews that work in the heat that are more at risk from this hazard.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1500 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1500 facilities is properly sited and constructed.

Severe Weather: Heavy Rains and Storms (Hail, Lightning)

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Storms in the District occur annually and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the District falls mainly in the fall, winter, and spring months.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the District. All portions of the District are at risk to heavy rains. Most of the severe rains occur during the fall, winter, and spring months. There is no scale by which heavy rains and severe storms are measured. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of severe storms in California, Sutter County, and the District can range from minutes to hours to days. Information on precipitation extremes can be found in Section 4.2.3 of the Base Plan.

Past Occurrences

According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the District. This is the cause of many of the federal disaster declarations related to flooding.

Vulnerability to and Impacts from Heavy Rain and Storms

Heavy rain and severe storms are the most frequent type of severe weather occurrences in the District. These events can cause localized flooding. Elongated events, or events that occur during times where the ground is already saturated can cause 1% and 0.2% annual chance flooding. Wind often accompanies these storms and has caused damage in the past. Hail and lightning are rare in the District.

Actual damage associated with the effects of severe weather include impacts to property, critical facilities (such as utilities), and life safety. Heavy rains and storms often result in localized flooding creating significant issues. Roads can become impassable and ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Floodwaters and downed trees can break utilities and interrupt services. However, it is the secondary effects of heavy rain and storms that are of concern to RD 1500. Heavy rains can cause riverine flooding, localized flooding, levee failure, and stream bank erosion.

Assets at Risk

All District assets from Table F-4 are at risk from heavy rains and storms. Specifically, Karnak Pump Station will be relied on to pump storm runoff into the Sacramento River. Failure of the Karnak Pump Station could result in significant flooding within the Robbins basin.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1500 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1500 facilities is properly sited and constructed. Increased occurrence of heavy rain events is causing a higher urgency with levee improvements projects.

F.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

F.6.1. Regulatory Mitigation Capabilities

Table F-10 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the RD 1500.

Table F-10 RD 1500 Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan	Y	Levee Maintenance Plan identifies hazards and has mitigation strategy to address levee failure.
Capital Improvements Plan	N	
Economic Development Plan	N	
Local Emergency Operations Plan	Y	
Continuity of Operations Plan	Y	Used during Pandemic
Transportation Plan	N	
Stormwater Management Plan/Program	N	
Engineering Studies for Streams	Y	Small Communities Flood Risk Reduction Study for the Community of Robbins
Community Wildfire Protection Plan	N	

Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	N	
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	N/A	Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score	N/A	Score:
Fire department ISO rating:	N/A	Rating:
Site plan review requirements	N/A	
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	N/A	
Subdivision ordinance	N/A	
Floodplain ordinance	N/A	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	N/A	
Flood insurance rate maps	N/A	
Elevation Certificates	N/A	
Acquisition of land for open space and public recreation uses	N/A	
Erosion or sediment control program	N/A	
Other		
How can these capabilities be expanded and improved to reduce risk?		
More funding for the District to conduct activities noted.		

Source: RD 1500

F.6.2. Administrative/Technical Mitigation Capabilities

Table F-11 identifies the District department(s) responsible for activities related to mitigation and loss prevention in RD 1500.

Table F-11 RD 1500's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	N	
Mitigation Planning Committee	N	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	Y	
Mutual aid agreements	N	
Other		

Staff	Y/N FT/PT	Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	N/A	
Floodplain Administrator	N/A	
Emergency Manager	N/A	
Community Planner	N/A	
Civil Engineer	N/A	
GIS Coordinator	N/A	
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	N	
Hazard data and information	Y	
Grant writing	Y	
Hazus analysis	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
These capabilities can be expanded and improved with additional annual funding opportunities to either contract some of these administrative and technical duties out or additional staffing for the District could be an option.		

Source: RD 1500

F.6.3. Fiscal Mitigation Capabilities

Table F-12 identifies financial tools or resources that the District could potentially use to help fund mitigation activities.

Table F-12 RD 1500's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	N	
Authority to levy taxes for specific purposes	Y	
Fees for water, sewer, gas, or electric services	N	
Impact fees for new development	N	
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	N	
Incur debt through private activities	N	
Community Development Block Grant	N	
Other federal funding programs	N	

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
State funding programs	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
These capabilities can be expanded and improved with additional annual funding opportunities to either contract some of these fiscal duties out or additional staffing for the District could be an option.		

Source: RD 1500

F.6.4. Mitigation Education, Outreach, and Partnerships

Table F-13 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table F-13 RD 1500's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	N	
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	N	
Natural disaster or safety related school programs	N	
StormReady certification	N	
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	N	
Other	Y	Small Communities Flood Risk Reduction study for the community of Robbins helped to educate the community of flood risk due to levee failure
How can these capabilities be expanded and improved to reduce risk?		
These capabilities can be expanded and improved with additional annual funding opportunities.		

Source: RD 1500

F.6.5. Other Mitigation Efforts

The District has many other completed or ongoing mitigation efforts that include the following:

Small Communities Flood Risk Reduction Feasibility Studies

On behalf of Sutter County, RD 1500 is conducting a Small Community Flood Risk Reduction Feasibility Studies for the community of Robbins. Robbins is protected by the Sutter Bypass West Levee, the Sacramento River East Levee and the Tisdale Bypass South Levee. The study will include a summary of known flooding issues and problems with the existing flood management systems. Ultimately, the study will determine a preferred flood risk reduction solution and include potential funding sources to pay for implementation. The feasibility studies are fully funded under the CA DWR's Small Community Flood Risk Reduction Program.

Karnak Pump Station Rehabilitation

Reclamation District 1500 (RD 1500 or District) has been awarded a Watershed Planning grant by the US Department of Agriculture/Natural Resources Conservation Service (USDA/NRCS) to complete initial (Phase 1) planning needed to support identification and development of an effective flood management solution within the RD 1500 service area. NRCS funding requirements stipulate that RD 1500 must complete a PL 83-566 Watershed Plan - Environmental Assessment (EA) / Environmental Impact Statement (EIS). The project Watershed Plan – EA/EIS will identify and evaluate project alternatives for providing critical flood protection benefits to the RD 1500 service area, identify the preferred alternative, and provide a determination regarding preferred next steps. The identification and evaluation of alternatives, resulting in the selection of the preferred alternative, will be conducted pursuant to NRCS guidelines and National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) requirements. The Natural Resources Conservation Service-California (NRCS-CA) will be the Lead Federal Agency for NEPA and RD 1500 will be the lead agency for CEQA.

The NRCS Watershed Planning grant received by RD 1500 will support the development of a Watershed Plan, environmental compliant documents, initiate permitting, develop 30% plans of the preferred alternative, and complete the economic analysis to support the preferred alternative. The Watershed Plan developed during Phase I will serve to support identification and development of an effective flood management solution, and Phase II will serve to complete final design and project construction/implementation once the planning elements of Phase I have been completed and approved by NRCS.

F.7 Mitigation Strategy

F.7.1. Mitigation Goals and Objectives

The RD 1500 adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

F.7.2. Mitigation Actions

The planning team for the RD 1500 identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and

timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Aquatic Invasive Species
- Climate Change
- Dam Failure
- Drought & Water shortage
- Floods: 1%/0.2% annual chance
- Floods: Localized Stormwater
- Levee Failure
- Pandemic
- Severe Weather: Heavy Rains and Storms
- Wildfire

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement.

Multi-Hazard Actions

Action 1. Karnak Pump Station Rehabilitation

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance, Aquatic Invasive Species, Climate Change, Localized Flooding, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Karnak pump station was constructed in 1914 and provides drainage to the entire RD 1500 basin. Major improvements are required in order to provide continued service.

Project Description: Improvements consist of the entire rehabilitation of the existing pumping station.

Other Alternatives: N/A

Existing Planning Mechanism(s) through which Action Will Be Implemented: Mid and Upper Sacramento River Regional Flood Management Plan, Sutter Bypass Comprehensive Management Plan

Responsible Agency/ Department/Partners: Reclamation District 1500

Cost Estimate: $60,000,000

Benefits (Losses Avoided): Provides drainage to over 67,000 acres and protects the entire small community of Robbins from flooding.

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 2. Sacramento River East Levee Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance, Localized Flooding, Severe Weather: Heavy Rains and Storms, Dam Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Sacramento River east levee, which borders the entire west side of the RD 1500 basin, is unimproved and does not meet current standards. This section of levee is susceptible to through and under-seepage.

Project Description: Levee improvements would consist of the installation of a seepage barrier cutoff wall, levee geometry improvements, and encroachments compliance work.

Other Alternatives: Installation of a seepage berm instead of a cutoff wall

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Mid and Upper Sacramento River Regional Flood Management Plan.

Responsible Agency/ Department/Partners: Reclamation District 1500

Cost Estimate: $200,000,000

Benefits (Losses Avoided): Protects over 67,000 acres along with the entire small community of Robbins.

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 3. Sediment and Invasive Species Removal

Hazards Addressed: Floods: 1%/0.2% annual chance; Levee Failure; Aquatic Invasive Species; Climate Change, Localized Flooding, Severe Weather: Heavy Rains and Storms, Drought and Water Shortage

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Sutter Bypass cannot convey its design flow at the design flood stage primarily due to excessive sedimentation and vegetation growth. The Department of Water Resources' (DWR) 2016 Flood System Status Report also found that not all Sutter Bypass levees meet freeboard requirements, that levee seepage is "particularly prevalent along the Sutter Bypass", and that the Bypass has inadequate channel conveyance capacity to convey intended flood flows. If sediment and vegetation management practices within the Sutter Bypass do not change and necessary levee repairs are not implemented, the flood conveyance capacity of the bypass will decrease, the integrity of the existing levees will be degraded, and the flood system's resiliency will be diminished, resulting in increased flood risk and reduced public safety. Sediment and invasive species buildup in portions of the existing drainage canals has also severely impacted the ability to provide adequate drainage and flood protection to residents living within the RD1500 basin.

Project Description: Remove sediment, vegetation, and invasive species within portions of the Sutter Bypass and within the RD1500 basin drainage canals.

Other Alternatives: N/A

Existing Planning Mechanism(s) through which Action Will Be Implemented: Mid and Upper Sacramento River Regional Flood Management Plan, and the Sutter Bypass Comprehensive Management Plan

Responsible Agency/ Department/Partners: Reclamation District 1500

Cost Estimate: $45,000,000

Benefits (Losses Avoided): Protect over 67,000 acres and the entire small community of Robbins.

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 4. Levee Penetration and Encroachments Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance, Localized Flooding, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The levees along the Sacramento River and Sutter Bypass which protect the RD 1500 basin from flooding contain hundreds of levee penetrations (pipes, structures) and encroachments. Many of these penetrations/encroachments have not yet been improved to current standards and could fail, which could result in levee failure.

Project Description: Levee penetration/encroachments improvements would consist of the repair or replacement of the penetrations, and possibly the modification or relocation of the encroachments to comply with current levee design standards.

Other Alternatives: Removal of the penetration or encroachment

Existing Planning Mechanism(s) through which Action Will Be Implemented: Mid and Upper Sacramento River Regional Flood Management Plan

Responsible Agency/ Department/Partners: Reclamation District 1500

Cost Estimate: 8,000,000

Benefits (Losses Avoided): Protects over 67,000 acres along with the entire small community of Robbins.

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 5. Sutter Bypass West Levee Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance, Localized Flooding, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Sutter Bypass functions as the central backbone of the Sacramento River Flood Control Project. The Bypass conveys overflow flood waters away from the Sacramento River at a capacity substantially greater than the river, and in doing so, protects vital infrastructure of statewide importance, thousands of acres of agricultural lands, which play a key role in California's economy. However, a 2013 hydraulic analysis found that the Sutter Bypass cannot convey its design flow at the design flood stage primarily due to excessive sedimentation and vegetation growth. The Department of Water Resources' (DWR) 2016 Flood System Status Report also found that not all Sutter Bypass levees meet freeboard requirements, that levee seepage is "particularly prevalent along the Sutter Bypass", and that the Bypass has inadequate channel conveyance capacity to convey intended flood flows. If sediment and vegetation management practices within the Sutter Bypass do not change and necessary levee repairs are not implemented, the flood conveyance capacity of the bypass will decrease, the integrity of the existing levees will be degraded, and the flood system's resiliency will be diminished, resulting in increased flood risk and reduced public safety.

Project Description: Levee improvements would consist of the installation of a seepage barrier cutoff wall.

Other Alternatives: Installation of a seepage berm instead of a cutoff wall

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Mid and Upper Sacramento River Regional Flood Management Plan, and Sutter Bypass Comprehensive Management Plan

Responsible Agency/ Department/Partners: Reclamation District 1500

Cost Estimate: $500,000,000

Benefits (Losses Avoided): Protects over 67,000 acres along with the entire small community of Robbins

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 6. Complete Projects from the CVFPP 2022 Update

Hazards Addressed: Climate Change, Earthquake, Flood, Dam Failure, Levee Failure, Pandemic, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Central Valley Flood Protection Project seeks to reduce risk to flooding in the Central Valley of California. The District participates in the CVFPP and will be putting forth a variety of multi-hazard related actions.

Other Alternatives: No action

Existing Planning Mechanisms through which Action will be Implemented: Ongoing Maintenance

Responsible Office: Reclamation District

Priority (H, M, L): Medium

Cost Estimate: Varies by project

Potential Funding: Reclamation District budget. Grants from FEMA, Cal OES, CA DWR, and others.

Benefits (avoided Losses): Reduced risk of flooding to people and property.

Schedule: Varies by project.

Annex G Reclamation District 1660

G.1 Introduction

This Annex details the hazard mitigation planning elements specific to RD 1660 (RD 1660 or District), a previously participating jurisdiction of the 2013 Sutter County Local Hazard Mitigation Plan (LHMP) Update. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the District. This Annex provides additional information specific to RD 1660, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

G.2 Planning Process

As described above, the District followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the District formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table G-1. Additional details on plan participation and District representatives are included in Appendix A.

Table G-1 RD 1660 – Planning Team

Name	Position/Title	How Participated
Andy Duffey	General Manager	Meetings and Phone calls. Informed hazard ID table. Gave past occurrences. Gave impacts, capabilities, and mitigation actions.

Coordination with other community planning efforts is paramount to the successful implementation of this LHMP Update. This section provides information on how the District integrated the previously approved 2013 Plan into existing planning mechanisms and programs. Specifically, the District incorporated into or implemented the 2013 LHMP through other plans and programs shown in Table G-2.

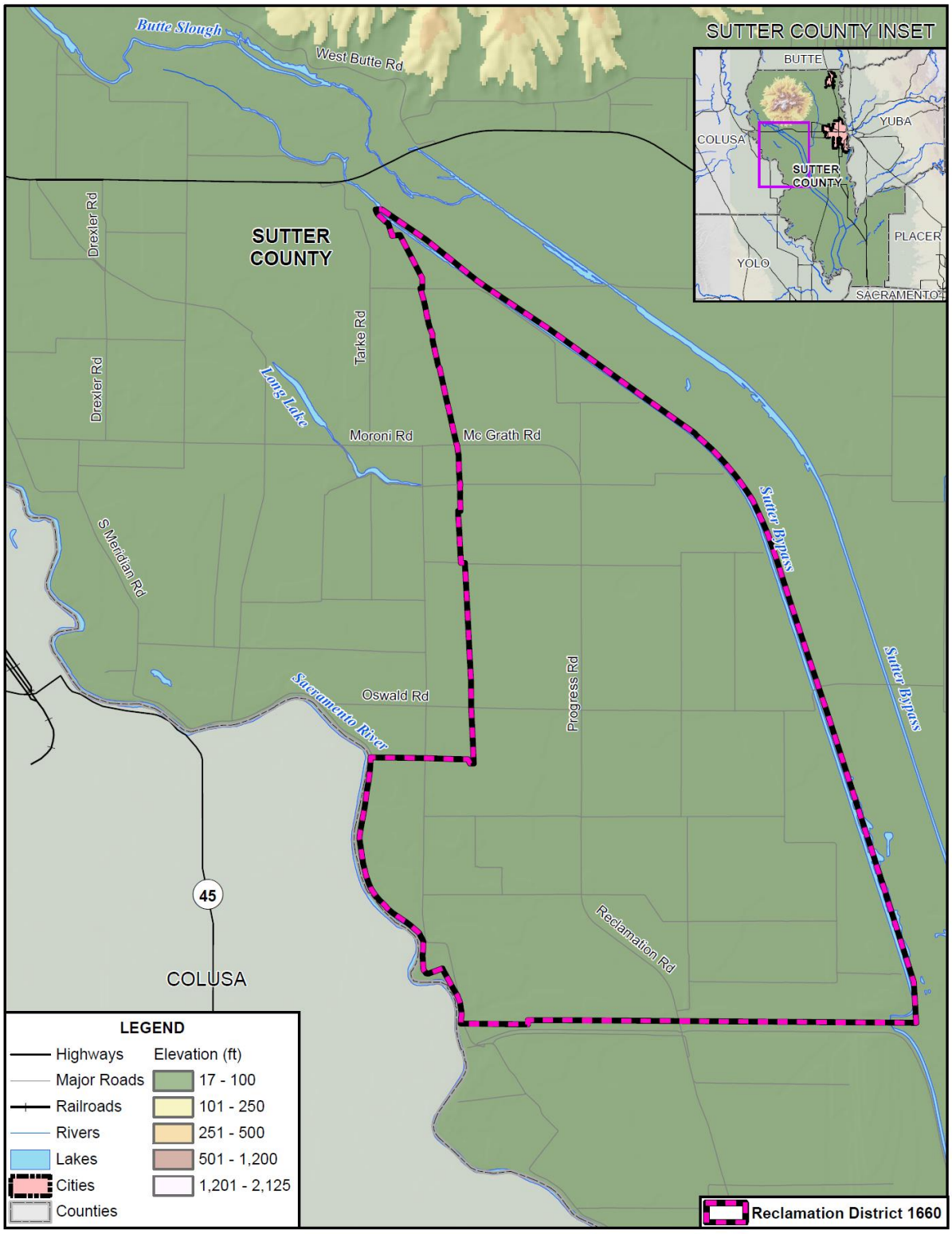
Table G-2 2013 LHMP Incorporation

Planning Mechanism 2013 LHMP Was Incorporated/Implemented In.	Details: How was it incorporated?
N/A	No hazard related planning was done since 2013.

G.3 District Profile

The District profile for the RD 1660 is detailed in the following sections. Figure G-1 displays a map and the location of the District within Sutter County.

Figure G-1 RD 1660



FOSTER MORRISON CONSULTING

0 1 2 Miles

Data Source: Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

G.3.1. Overview and Background

RD 1660 was established by voters in 1915 with the purpose of providing drainage and flood protection in western Sutter County. The District is approximately 17 miles west of Yuba City, and serves an area of approximately 14,832.81 gross acres, or 23.14 square miles. The District provides flood protection and drainage by maintaining approximately 12.2 miles of levees, and 100 miles of drainage ditches. The District is generally bounded by the Sacramento River to the west, RD 70 to the north and the Sutter By-Pass to the east. The predominant land uses within the District are agricultural.

G.4 Hazard Identification

RD 1660 identified the hazards that affect the District and summarized their location, extent, frequency of occurrence, potential magnitude, and significance specific to District (see Table G-3).

Table G-3 RD 1660—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Significant	Likely	Limited	Medium	Medium
Climate Change	Extensive	Likely	Critical	High	–
Dam Failure	Extensive	Unlikely	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Critical	High	High
Earthquake	Limited	Unlikely	Limited	Medium	Low
Floods: 1%/0.2% annual chance	Extensive	Occasional	Catastrophic	High	Medium
Floods: Localized Stormwater	Extensive	Occasional	Critical	Low	Medium
Levee Failure	Extensive	Occasional	Catastrophic	High	Medium
Pandemic	Significant	Occasional	Limited	Medium	Medium
Severe Weather: Extreme Cold and Freeze	Limited	Occasional	Negligible	Low	Medium
Severe Weather: Extreme Heat	Limited	Likely	Negligible	Low	High
Severe Weather: Heavy Rains and Storms	Significant	Occasional	Critical	High	Medium
Wildfire	Limited	Unlikely	Negligible	Low	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

G.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile the District's hazards and assess the District's vulnerability separate from that of the Sutter County Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Sutter County Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the District is included in this Annex. This vulnerability assessment analyzes the property and other assets at risk to hazards ranked of medium or high significance specific to the District. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

G.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section 0, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table G-3) affects the District and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Sutter County Planning Area.

G.5.2. Vulnerability Assessment and Assets at Risk

This section identifies the District's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within the community.

Assets at Risk and Critical Facilities

This section considers the RD 1660's assets at risk, with a focus on key District assets such as critical facilities, infrastructure, and other District assets and their values. With respect to District assets, the majority of these assets are considered critical facilities as defined for this LHMP Update. Critical facilities are defined for this Plan as:

> ***Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.***

Table G-4 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. RD 1660's physical assets, valued at over $25 million, consist of the buildings and infrastructure to support the District's operations.

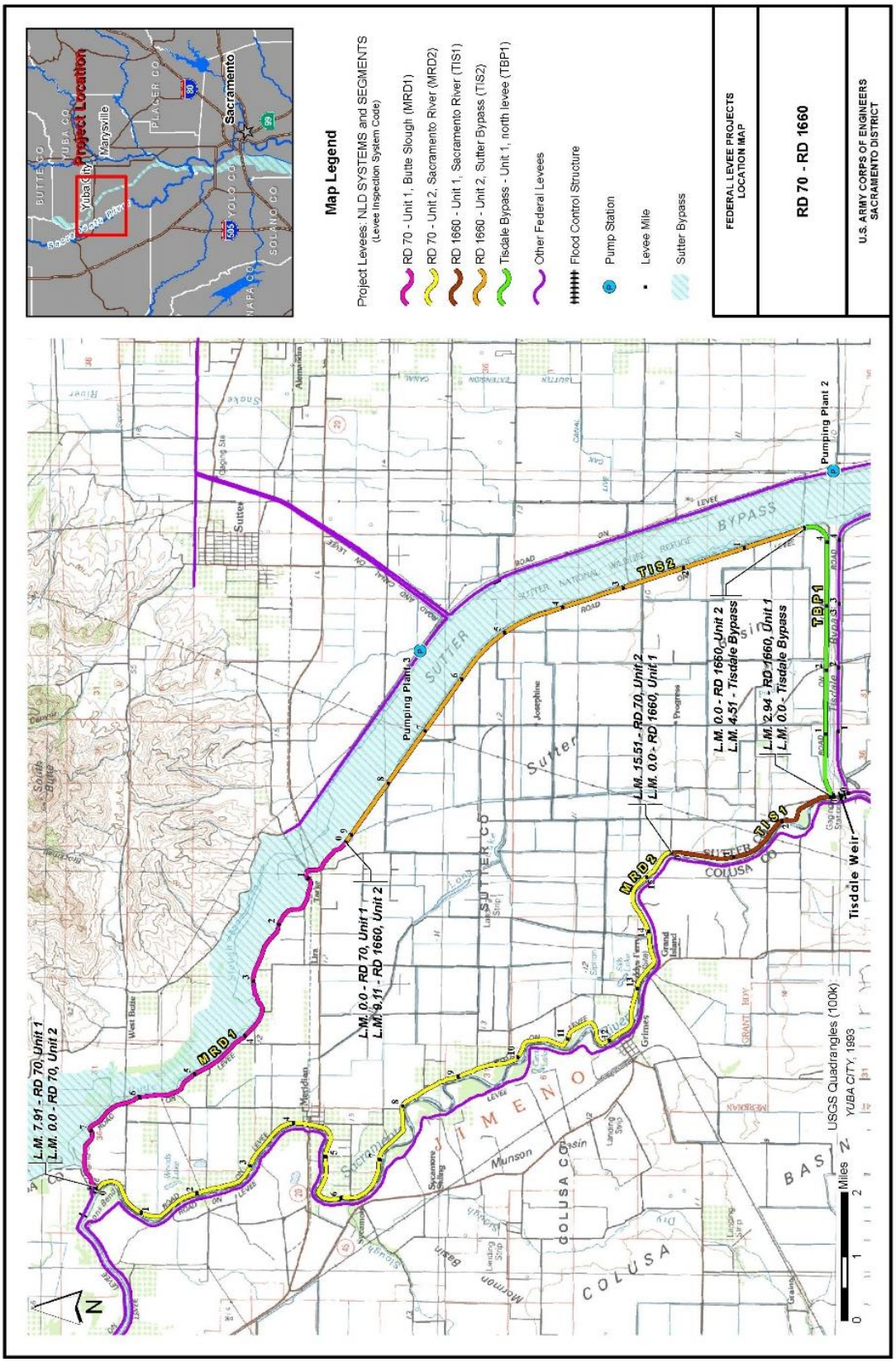
Table G-4 RD 1660 Critical Facilities, Infrastructure, and Other District Assets

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
RD 1660 Pumping Plant	Pump	$24,000,000	Flood
RD 1660 Office	Office	$150,000	Flood
RD 1660 House	Dwelling	$200,000	Flood
RD 1660 Shop	Shop	$100,000	Flood
RD 1660 Pump	Pump	$200,000	Flood
RD 1660 Pump	Pump	$200,000	Flood
RD 1660 Pump	Pump	$200,000	Flood
Total		**$25,050,000**	

Source: RD 1660

RD 1660 provided a District Levee map, which is shown on Figure G-2.

Figure G-2 RD 1660 – Levee Status



Natural Resources

RD 1660 has a variety of natural resources of value to the District. These natural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Historic and Cultural Resources

RD 1660 has a variety of historic and cultural resources of value to the District. These historic and cultural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Growth and Development Trends

Reclamation District 1660 will experience minimal rural growth throughout its service area due to County zoning policies that regulate agricultural parcel sizes. Large agricultural parcels limit the ability of rural subdivision development and therefore population growth. Agricultural uses will likely not expand as well given that the majority of land currently exists in agricultural uses.

General growth in the District parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Development since 2013

No District facilities have been constructed since 2013.

Future Development

Future development in the District, in general, parallels that of the Sutter County Planning Area. More general information on growth and development in Sutter County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sutter County Vulnerability and Assets at Risk of the Base Plan.

G.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table G-3 as high or medium significance hazards. Impacts of past events and vulnerability of the District to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the District to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, critical facilities and infrastructure, populations at risk, and future development.

Aquatic Invasive Species

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

The introduction of nonnative species into coastal marine and estuarine waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability.

Boats discharge ballast water that has been obtained from waters throughout the state, country, or the world. This water might include non-native organisms, untreated sewage, and other contaminants. Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. Examples include the zebra mussel infestation in the Great Lakes and the propagation of water hyacinth in the California Delta. Both the zebra mussel and the quagga mussel are concerns for California and Sutter County. These mussels have not affected the waters in Sutter County yet, but are still a cause for concern.

Some of California's most serious weed problems occur in waterways, lakes and streams. The aquatic plant hydrilla is considered one of the most serious aquatic weed problems in the world and the California Department of Food and Agriculture (CDFA) maintains an intensive program to survey and eradicate this aquatic weed pest. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, while impeding water flow and delivery. Its rapid growth and ease of spread by boats makes it critical to detect early and eradicate.

The effects of nonnative fish on native fish are generally in the form of predation and competition for food and breeding sites. There are also several non-fish, nonnative invasive species found in aquatic natural communities that can damage such communities. The introduced bullfrog is an important riparian invasive in the plan area. Many varieties of non-native aquatic weeds compete for the entire water column and

shoreline in Sutter County, crowding out native species and degrading the aquatic and riparian habitat. The District's greatest concern is with Water Hyacinth.

Location and Extent

All freshwater lakes, streams, and rivers are potentially at risk from aquatic invasive species. There is no established scale for these invasive species. Magnitude is measured by the presence and counts of aquatic invasive species in waterways in Sutter County. Speed of onset of these invasive species is short, as it only takes a careless boater or visitor to the area to accidentally introduce an invasive species. However, the duration is long as once established they can take years to eradicate, if at all.

Past Occurrences

The District has not seen Water Hyacinth before. This invasive species could cause drainage canals as well as culvert to become clogged causing water to back up into roads and agricultural lands. The currently cost to remove is not available. However yearly the District spends tens of thousands of dollars removing other aquatic weeds.

Vulnerability and Impacts to Invasive Aquatics

The introduction of NAS into rivers and lakes can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability. Ships ballast water obtained from some other foreign location (outside the County) can include non-native organisms, untreated sewage, and other contaminants. Once introduced, NAS are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and economic havoc.

Aquatic invasive species can jeopardize and damage any part of the entire system ranging from human economy dependent infrastructure to natural aquatic, riparian and wetland habitat. Entire watersheds can be affected when an aggressive invasive species infests the rivers, shorelines, tributaries, drainage, irrigation and domestic delivery systems. Impacts to the District are mostly related to water recreation activities that may be hampered by these invasive species.

Assets at Risk

The Drainage Pumping Plant is at risk from this hazard.

Future Development

The District plans to work with DWR and grant programs to remove and prevent against invasive species where possible. The District purchased a grass rake that attaches to an excavator. Aquatic weeds have been removed from District drains using this grass rake to fork out this floating weed.

Climate Change

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing. In Sutter County and the District, the HMPC the HMPC noted that each year it seems to get a bit warmer each year. It was also noted that 2017 was one of the wettest and 2019 one of the hottest years on record. Higher precipitation directly affects the District's ability to provide adequate drainage from the basin. This results in water overflowing drainage canals. The district has been working to rebuilt pump stations and cleaning drainage canals to handle excess precipitation.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the District, Sutter County, and State of California. There is no scale to measure the extent of climate change. Climate change exacerbates other hazards, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Climate change has never been directly linked to any declared disasters. While the District noted that climate change is of concern, no specific impacts of climate change could be recalled. The District and HMPC members noted that the strength of storms does seem to be increasing and the temperatures seem to be getting hotter.

Vulnerability to and Impacts from Climate Change

The California Adaptation Planning Guide (APG) prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change. California's APG: Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Sutter County falls within the North Sierra Region characterized as a sparsely settled mountainous region where the region's economy is primarily tourism-based. The region is rich in natural resources, biodiversity, and is the source for the

majority of water used by the state. This information can be used to guide climate adaptation planning in the District and Sutter County Planning Area.

The California APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Sutter County Planning Area is part of:

- Temperature increases
- Decreased precipitation
- Reduced snowpack
- Reduced tourism
- Ecosystem change
- Sensitive species stress
- Increased wildfire

Assets at Risk

The District noted that its facilities will most likely not be at risk from climate change.

Future Development

Future development of District facilities is unlikely to be affected by climate change. RD 1660 does not control future development in areas protected by levees, that is the purview of the County. RD 1660 will continue to work with the County in the future to ensure that future development is sited in proper areas.

Dam Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–Extremely High

Hazard Profile and Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

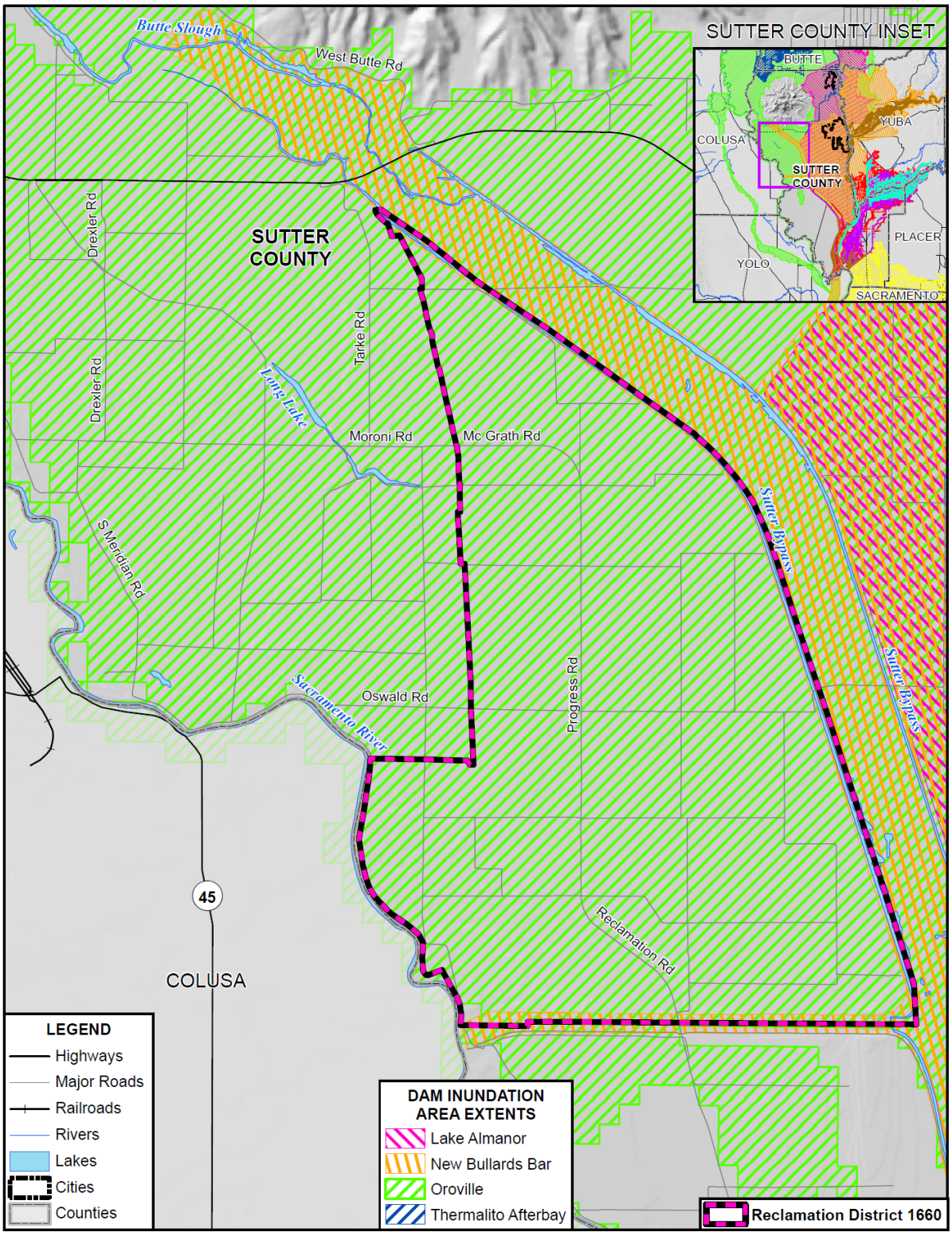
Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, Cal DWR Division of Safety of Dams (DSOD) assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the

potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.2.10 of the Base Plan.

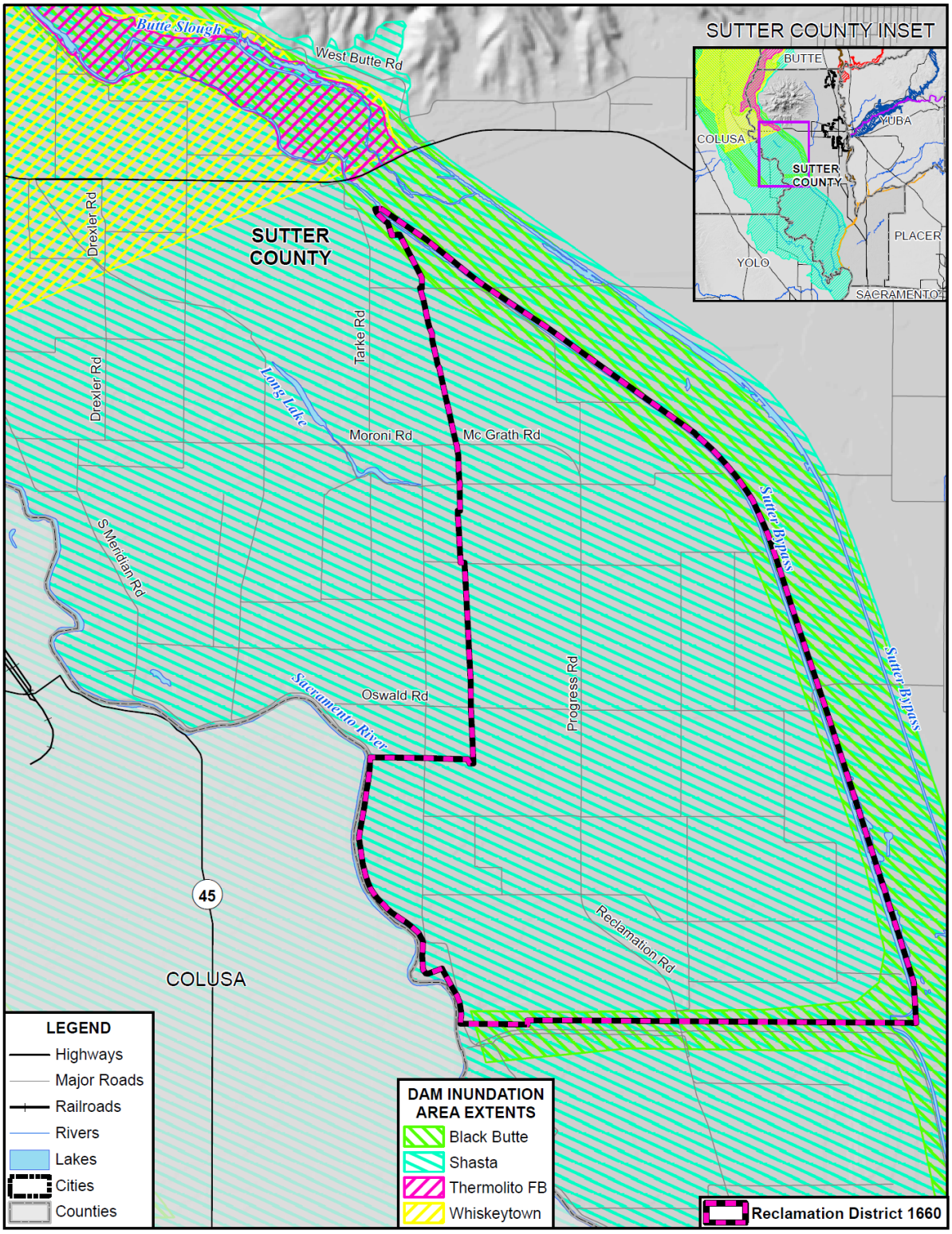
While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The District would be affected for as long as the flood waters from the dam failure took to drain downstream. Figure G-3 shows the extremely high hazard dam inundation area that intersect RD 1660. Figure G-4 shows the high hazard dam inundation area that intersect RD 1660.

Figure G-3 RD 1660 – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure G-4 RD 1660 – High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident. This can be seen on Table G-5.

Table G-5 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

The District noted no other dam failure occurrences that have affected the District.

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the District from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant. Specific details are difficult to estimate. During the 1997 levee breach the district experienced erosion and wave wash on both the landside and waterside of different levee segments. With a dam failure we would likely see the same result as well as possible overtopping, levee slips, erosion and likely levee failure.

Assets at Risk

As seen on Figure G-3 and Figure G-4 above, all District assets from Table G-4 would be at risk from dam failure.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1660 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1660 facilities is properly sited and constructed.

Drought & Water Shortage

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects. Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and

economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue and is critical for agriculture, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

Location and Extent

Drought and water shortage are regional phenomenon. The whole of the County, as well as the whole of the District, is at risk. The US Drought Monitor categorizes drought conditions with the following scale:

- None
- D0 – Abnormally dry
- D1 – Moderate Drought
- D2 – Severe Drought
- D3 – Extreme drought
- D4 – Exceptional drought

Drought has a slow speed of onset and a variable duration. Drought can last for a short period of time, which does not usually affect water shortages and for longer periods. Should a drought last for a long period of time, water shortage becomes a larger issue. Current drought conditions in the District and the County are shown in Section 4.2.11 of the Base Plan.

Past Occurrences

Since drought is a regional phenomenon, past occurrences of drought for the District are the same as those for the County and includes 5 multi-year droughts over an 85-year period. Details on past drought occurrences can be found in Section 4.2.11 of the Base Plan.

Vulnerability to and Impacts from Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the District, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users.

Reclamation District 1660 is primarily made up farmland, and the District relies on assessment from the local landowners. If the District were to experience a long term drought and or water shortages, it could affect the local landowners with paying their assessment.

Assets at Risk

Drought will not affect District assets. However long-term drought may affect landowner's ability to farm with would result in affecting their ability to pay district assessments.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. LD 1 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD 1 facilities is properly sited and constructed.

Earthquake

Likelihood of Future Occurrence–Unlikely
Vulnerability–Medium

Hazard Profile and Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction.

Location and Extent

Since earthquakes are regional events, the whole of the District is at risk to earthquake. RD 1660 and the surrounding area are relatively free from significant seismic and geologic hazards. There are no known or inferred active faults within the District.

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales, as discussed in Section 4.2.12 of the Base Plan. The faults identified in Sutter County include the Quaternary Faults, located in the northern section of the County within the Sutter Buttes, and the Pre Quaternary Fault, located in the southeastern corner of the Planning Area, just east of where Highway 70 enters into the County. Both faults are listed as non-active faults, but have the potential for seismic activity.

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. The District is located in an area where few earthquakes of significant magnitude occur, so both magnitude and intensity of earthquakes are expected to remain low. Seismic shaking maps for the area show Sutter County and the District fall within a low to moderate shake risk.

Past Occurrences

The District noted no past occurrences of earthquakes or that affected the District in any meaningful way.

Vulnerability to and Impacts from Earthquake

The combination of plate tectonics and associated California coastal mountain range building geology generates earthquake as a result of the periodic release of tectonic stresses. Sutter County's mountainous terrain lies in the center of the North American and Pacific tectonic plate activity. There have been earthquakes as a result of this activity in the historic past, and there will continue to be earthquakes in the future of the California north coastal mountain region.

Fault ruptures itself contributes very little to damage unless the structure or system element crosses the active fault; however, liquefaction can occur further from the source of the earthquake. In general, newer construction is more earthquake resistant than older construction due to enforcement of improved building codes. Manufactured housing is very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Locally generated earthquake motions and associated liquefaction, even from very moderate events, tend to be more damaging to smaller buildings, especially those constructed of unreinforced masonry (URM) and soft story buildings. There are no URM or soft story buildings in the District.

The Uniform Building Code (UBC) identifies four seismic zones in the United States. The zones are numbered one through four, with Zone 4 representing the highest level of seismic hazard. The UBC establishes more stringent construction standards for areas within Zones 3 and 4. All of California lies within either Zone 3 or Zone 4. The RD 70 is within the less hazardous Zone 3.

Impacts from earthquake in the District will vary depending on the fault that the earthquake occurs on, the depth of the earthquake strike, and the intensity of shaking. Large events could cause damages to infrastructure, critical facilities, residential and commercial properties, and possible injuries or loss of life. An earthquake could potentially cause a levee failure. Although it is unlikely, there is concern if it did happen in the winter months when the river and bypass are full of water.

Assets at Risk

The District noted no specific assets at risk to this hazard.

Future Development

RD 1660 does not control future development in areas protected by levees, that is the purview of the County. RD 1660 will continue to work with Sutter County in the future to ensure that future development is sited in proper areas and built to withstand expected shaking.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

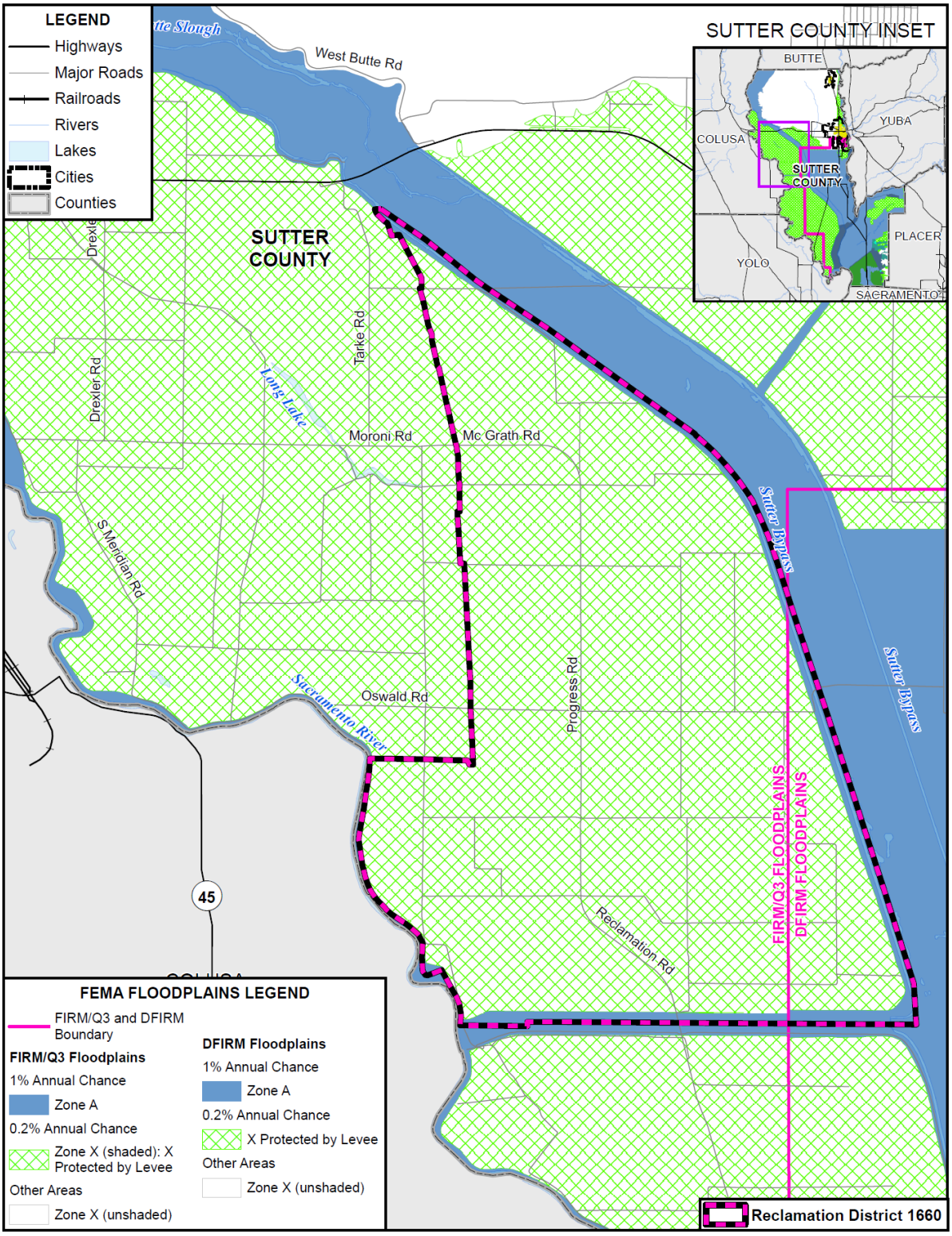
This hazard analyzes the FEMA Q3/DFIRM 1%, 0.5%, and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the District, and have caused damages in the past. Flooding is a significant problem in Sutter County and the District. Historically, the District has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 0.2% annual chance floodplains and in other localized areas.

As previously described in Section 4.2.13 of the Base Plan, the Sutter County Planning Area and the RD 1660 have been subject to historical flooding. RD 1660 is traversed by several stream systems and is at risk to the 0.2% flood.

Location and Extent

The RD 1660 has areas located in the 0.2% annual chance floodplain. This is seen in Figure G-5.

Figure G-5 RD 1660 – FEMA Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table G-6 details the DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the District.

Table G-6 RD 1660– Q3/DFIRM Flood Hazard Zones

Flood Zone	Description	Present in the District
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	X
AE	1% annual chance flood: Base flood elevations provided	X
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	X
X (unshaded)	No flood hazard	X
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	X
AE	100-year Flood: Base flood elevations provided	
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	
X (unshaded)	No flood hazard	X
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	X

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the District vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the District tends to have a shorter speed of onset, due to the amount of water that flows through the District.

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table G-7. These events also likely affected the District to some degree.

Table G-7 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

The District Planning Team noted that in March of 1940 flooding occurred, but no details were available.

Levee failure from either breaching or overtopping would result in the total loss of levee embankment material, as was the case in the 1997 flood event (see discussion in levee failure section of this document). In addition, localized flooding can overwhelm pumping plants. This is discussed in the next section.

January 3 through January 12, 2017 (FEMA Disaster Declaration DR-4301)– As a direct result of the Severe Winter Storms, Flooding, and Mudslides occurring throughout the State of California during the declared incident period of January 3 through January 12, 2017, Reclamation District 70 in Sutter County was directly affected. RD 70 provides flood control and water drainage services within a service of 21,000 acres which includes 3 levee miles adjacent to the Sacramento River and 8 miles adjacent to the Sutter Bypass. RD 70 & RD 1660 make up the entirety of the drainage area. The severe winter storms resulted in excessive pumping, levee patrols and debris removal

February 1 through February 23, 2017 (FEMA Disaster Declaration DR-4308) – As a direct result of the Severe Winter Storms, Flooding, and Mudslides occurring throughout the State of California during the declared incident period of January 3 through January 12, 2017, Reclamation District 1660 in Sutter County was directly affected. RD 70 provides flood control and water drainage services within a service of 21,000 acres which includes 3 levee miles adjacent to the Sacramento River and 8 miles adjacent to the Sutter Bypass. RD 70 & RD 1660 make up the entirety of the drainage area. The severe winter storms resulted in excessive pumping, levee patrols and debris removal after the storm event

Vulnerability to and Impacts from Flood

Floods have been a part of the District's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

The representative for the District describes the potential effects of flooding within the boundaries as extensive and potentially catastrophic. Meridian Basin is surrounded by levees maintained and monitored by Reclamation District 70 and Reclamation District 1660. All water coming into this Basin must be pumped or gravity feed out. During high water, the release of water at Shasta Dam and high Sacramento River water flows will not allow for gravity feed so that all water must be pumped out of the basin. The drainage facilities under the ownership and control of the district are at risk to damage from excessive rainfall, storm water runoff and flooding.

Assets at Risk

The District Pumping Plant is at risk from this hazard.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1660 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1660 facilities is properly sited and constructed.

Levee Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–High

Hazard Profile and Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

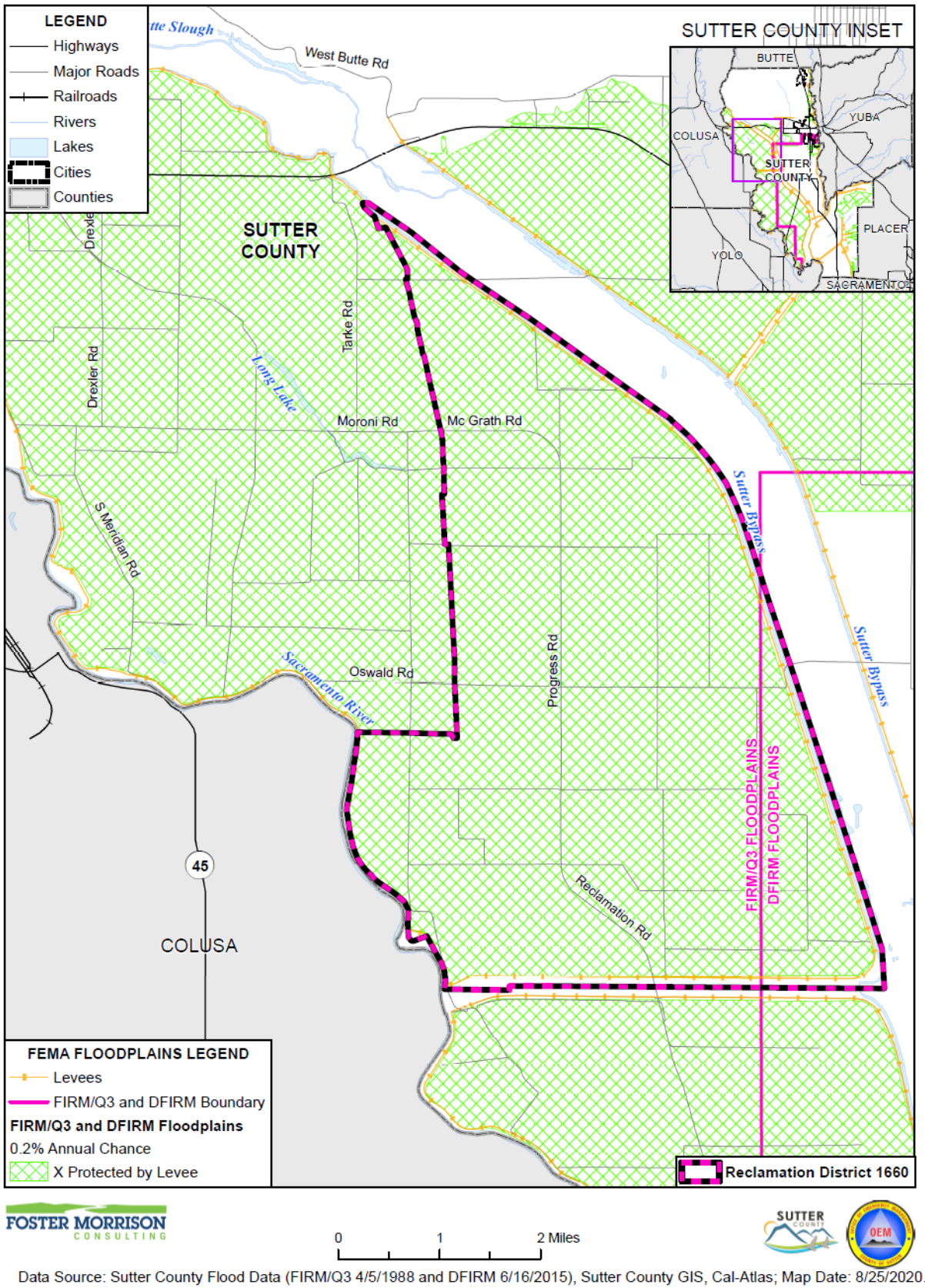
Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the District are not known. The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. When northern

California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees. Locations of levees and DFIRM flood zones in the District is shown on Figure G-6.

Figure G-6 RD 1660 – Levee Locations and Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

Levee failure is a major concern for the district. In January 1997, a levee breach on the Sutter Bypass caused flooding to approximately 75% of the Meridian Basin. Damage to property and infrastructure was in the millions. Highway 20 and county roads were closed for weeks.

OTHERS? ANY OTHER DETAILS TO ADD ABOVE?

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

A major overtopping of a levee, if flow persists, will result in severe erosion of the levee crowns on the landward side and cause levee failure over a period of minutes to several hours. A severe levee overtopping can, therefore, be considered as a levee break for the purpose of determining the extent of flooding that any area will suffer. Generally, overtopping can be predicted based on river stages and the warning given depending on the source of the flood waters.

Assets at Risk

All District assets from Table G-4 are at risk from levee failure.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1660 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1660 facilities is properly sited and constructed.

Pandemic

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity. It is important to realize

that this LHMP Update does not examine pandemic contingency plans, but instead focuses on examining the risk of a normal hazard occurrence.

A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the World Health Organization to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning and preparation. An especially severe a pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the District, County, and surrounding region is at risk, as pandemic is a regional, national, or international event. The speed of onset of pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by number who die from complications from the pandemic.

Past Occurrences

There has been one state and federal disaster declaration due to pandemic, as shown in Table G-8.

Table G-8 Sutter County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

The 20th century saw three outbreaks of pandemic.

- The **1918-1919 Influenza Pandemic (H1N1)**
- The **February 1957-1958 Influenza Pandemic (H2N2)**
- The **1968 Influenza Pandemic (H3N2)**

To date, the 21st century has seen two acknowledged pandemics.

- **2009 Swine Flu (H1N1**)
- **2019/2020 COVID 19**

Although the District has not been affected by Covid-19 yet, an outbreak could result in loss of work hours that would result in operations and maintenance not getting accomplished.

Vulnerability to Pandemic

Pandemic has and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public health officials can use to combat pandemic. Constant surveillance regarding current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent spread of pandemic by staying home, or "self-quarantining," if they suspect they are infected. Pandemic does not affect the buildings, critical facilities, and infrastructure in the District. Pandemic can have varying levels of impact to the citizens of the District and greater County, depending on the nature of the pandemic.

Impacts

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently) an unemployment rose significantly. Supply chains for food can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Future Development

Future development is not expected to be significantly impacted by this hazard, though population growth in the District could increase exposure to pandemic, and increase the ability of each disease to be transmitted among the population of the District.

Severe Weather: Heavy Rains and Storms (Hail, Lightning)

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

Storms in the District occur annually and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the District falls mainly in the fall, winter, and spring months.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the District. All portions of the District are at risk to heavy rains. Most of the severe rains occur during the fall, winter, and spring months. There is no scale by which heavy rains and severe storms are measured. Magnitude of

storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of severe storms in California, Sutter County, and the District can range from minutes to hours to days. Information on precipitation extremes can be found in Section 4.2.3 of the Base Plan.

Past Occurrences

According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the District. This is the cause of many of the federal disaster declarations related to flooding. Past occurrences were discussed in the Flood section above.

Vulnerability to and Impacts from Heavy Rain and Storms

Heavy rain and severe storms are the most frequent type of severe weather occurrences in the District. These events can cause localized flooding. Elongated events, or events that occur during times where the ground is already saturated can cause 1% and 0.2% annual chance flooding. Wind often accompanies these storms and has caused damage in the past. Hail and lightning are rare in the District.

Actual damage associated with the effects of severe weather include impacts to property, critical facilities (such as utilities), and life safety. Heavy rains and storms often result in localized flooding creating significant issues. Roads can become impassable and ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Floodwaters and downed trees can break utilities and interrupt services. However, it is the secondary effects of heavy rain and storms that are of concern to RD 1660. Heavy rains can cause riverine flooding, localized flooding, levee failure, and stream bank erosion.

Assets at Risk

The District Pumping Plant and Office are at risk from this hazard.

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. RD 1660 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of RD 1660 facilities is properly sited and constructed.

G.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

G.6.1. Regulatory Mitigation Capabilities

Table G-9 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the RD 1660. MAKE SURE TO FILL OUT LAST CELL.

Table G-9 RD 1660 Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan	Y	Levee Maintenance Plan identifies hazards and has mitigation strategy to address levee failure.
Capital Improvements Plan	N	
Economic Development Plan	N	
Local Emergency Operations Plan	N	
Continuity of Operations Plan	N	
Transportation Plan	N	
Stormwater Management Plan/Program	N	
Engineering Studies for Streams	N	
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y	Levee maintenance plan addresses hazards and includes actions to be implemented.
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code	N/A	Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score	N/A	Score:
Fire department ISO rating:	N/A	Rating:
Site plan review requirements	N/A	
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance	N/A	
Subdivision ordinance	N/A	
Floodplain ordinance	N/A	
Natural hazard specific ordinance (stormwater, steep slope, wildfire)	N/A	
Flood insurance rate maps	N/A	
Elevation Certificates	N/A	
Acquisition of land for open space and public recreation uses	N/A	

Erosion or sediment control program	N/A
Other	
How can these capabilities be expanded and improved to reduce risk?	
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT	

Source: RD 1660

G.6.2. Administrative/Technical Mitigation Capabilities

Table G-10 identifies the District department(s) responsible for activities related to mitigation and loss prevention in RD 1660. MAKE SURE TO FILL OUT LAST CELL.

Table G-10 RD 1660's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	N	
Mitigation Planning Committee	N	
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	N	
Mutual aid agreements	N	
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	N	
Floodplain Administrator	N	
Emergency Manager	N	
Community Planner	N	
Civil Engineer	N	
GIS Coordinator	N	
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	N	
Hazard data and information	N	
Grant writing	N	
Hazus analysis	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: RD 1660

G.6.3. Fiscal Mitigation Capabilities

Table G-11 identifies financial tools or resources that the District could potentially use to help fund mitigation activities. MAKE SURE TO FILL OUT LAST CELL.

Table G-11 RD 1660's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding	N	
Authority to levy taxes for specific purposes	Y	Ongoing Operations and Maintenance
Fees for water, sewer, gas, or electric services	N	
Impact fees for new development	N	
Storm water utility fee	N	
Incur debt through general obligation bonds and/or special tax bonds	N	
Incur debt through private activities	N	
Community Development Block Grant	N	
Other federal funding programs	N	
State funding programs	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: RD 1660

G.6.4. Mitigation Education, Outreach, and Partnerships

Table G-12 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information. MAKE SURE TO FILL OUT LAST CELL.

Table G-12 RD 1660's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	N	

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	N	
Natural disaster or safety related school programs	N	
StormReady certification	N	
Firewise Communities certification	N	
Public-private partnership initiatives addressing disaster-related issues	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: RD 1660

G.6.5. Other Mitigation Efforts

The District has many other completed or ongoing mitigation efforts that include the following:

- The District has regular levee maintenance plans that include levee slope dragging, levee crown grading, patrolling, rodent control, thinning and pruning of trees, disking fire breaks, vegetation spraying, and vegetation burning. Regular ditch maintenance includes ditch cleaning, burning, and vegetation spraying.

G.7 Mitigation Strategy

G.7.1. Mitigation Goals and Objectives

The RD 1660 adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

G.7.2. Mitigation Actions

The planning team for the RD 1660 identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Aquatic Invasive Species
- Climate Change
- Dam Failure
- Drought & Water shortage

- Earthquake
- Floods: 1%/0.2% annual chance
- Levee Failure
- Pandemic
- Severe Weather: Heavy Rains and Storms

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement. NEED ACTIONS FOR EACH OF THE HAZARDS BULLETED ABOVE. EACH ACTION CAN COVER MORE THAN ONE HAZARD.

Multi-Hazard Actions

Action 1. Complete Projects from the CVFPP 2022 Update

Hazards Addressed: Climate Change, Earthquake, Flood, Dam Failure, Levee Failure, Pandemic, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Central Valley Flood Protection Project seeks to reduce risk to flooding in the Central Valley of California. The District participates in the CVFPP and will be putting forth a variety of multi-hazard related actions.

Other Alternatives: No action

Existing Planning Mechanisms through which Action will be Implemented: Ongoing Maintenance

Responsible Office: Reclamation District

Priority (H, M, L): Medium

Cost Estimate: Varies by project

Potential Funding: Reclamation District budget. Grants from FEMA, Cal OES, CA DWR, and others.

Benefits (avoided Losses): Reduced risk of flooding to people and property.

Schedule: Varies by project.

Action 2.

Hazards Addressed:

Goals Addressed:

Issue/Background:

Other Alternatives:

Existing Planning Mechanisms through which Action will be Implemented:

Responsible Office:

Priority (H, M, L):

Cost Estimate:

Potential Funding:

Benefits (avoided Losses):

Schedule:

Annex H Sutter Butte Flood Control Agency

H.1 Introduction

This Annex details the hazard mitigation planning elements specific to the Sutter Butte Flood Control Agency (SBFCA or Agency), a new participating jurisdiction. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the Agency. This Annex provides additional information specific to SBFCA, with a focus on providing additional details on the risk assessment and mitigation strategy for this community.

H.2 Planning Process

As described above, the Agency followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the Agency formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table H-1. Additional details on plan participation and Agency representatives are included in Appendix A.

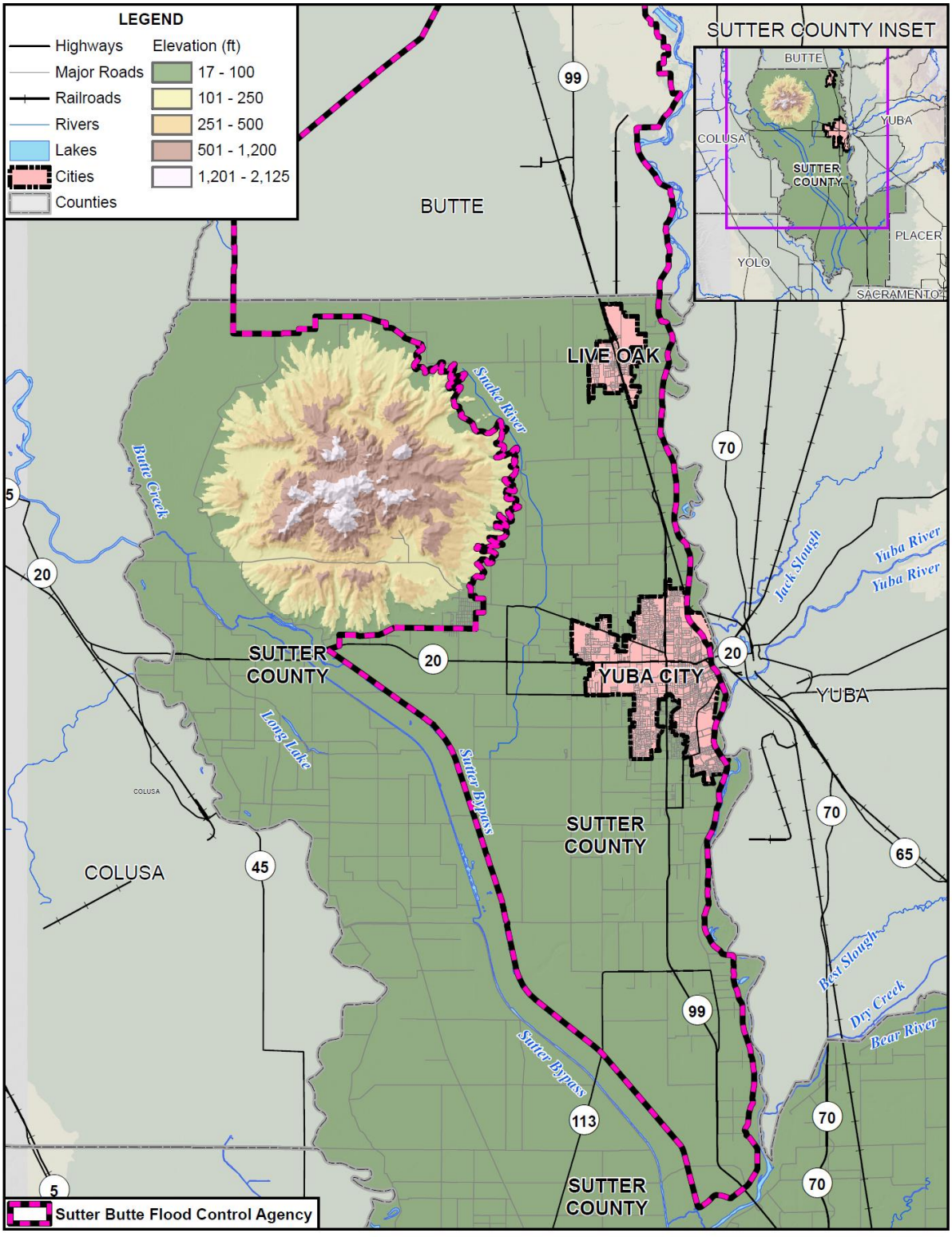
Table H-1 SBFCA – Planning Team

Name	Position/Title	How Participated
Michael Bessette, P.E.	Executive Director	Planning Team Meetings; Annex Development and Review; Final Draft and Public Draft reviews for the overall planning process.
Chris Fritz	Director of Engineering	Planning Team Meetings; Annex Development and Review; Final Draft and Public Draft reviews for the overall planning process.

H.3 Agency Profile

The Agency profile for the SBFCA is detailed in the following sections. Figure H-1 displays a map and the location of the Agency within Sutter County.

Figure H-1 SBFCA



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

H.3.1. Overview and Background

The Sutter Butte Flood Control Agency (SBFCA) is a joint powers agency formed in 2007 by the Counties of Butte and Sutter, the Cities of Biggs, Gridley, Live Oak and Yuba City, and Levee Districts 1 and 9. The agency has the authority to finance and construct regional levee improvements. It is governed by a 13-member Board comprised of elected officials from the cities, counties and levee districts. The Agency's Boundaries encompass 34,200 properties in Butte and Sutter Counties.

The Sutter-Butte Basin (Basin) covers 300 square miles bordered by the Cherokee Canal to the north, the Sutter Buttes to the west, the Sutter Bypass to the southwest and the 44-mile long Feather River to the east. The Basin is home to 95,000 residents and encompasses $7 billion of damageable assets (as estimated by the U.S. Army Corps of Engineers, or USACE, in 2014). The region has sustained numerous floods, including the 1955 levee failure on the Feather River, which resulted in the deaths of at least 38 people. The personal safety and economic stability of large segments of the population are reliant on flood management systems that, until recent efforts, did not begin to meet modern engineering standards. Numerous projects and programs have been implemented in the Basin over the years to reduce flood risk. The Sutter Butte Flood Control Agency (SBFCA) leads the planning and implementation efforts in the Basin to reduce the risk of catastrophic, riverine flooding.

H.4 Hazard Identification

SBFCA identified the hazards that affect the Agency and summarized their location, extent, frequency of occurrence, potential magnitude, and significance specific to Agency (see Table H-2).

Table H-2 SBFCA—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Highly Likely	Limited	Medium	Medium
Climate Change	Extensive	Likely	Limited	Medium	–
Dam Failure	Extensive	Occasional	Catastrophic	High	Medium
Drought & Water Shortage	Extensive	Likely	Limited	Medium	High
Earthquake	Extensive	Unlikely	Catastrophic	Medium	Low
Floods: 1%/0.2% annual chance	Extensive	Likely	Critical	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Limited	Medium	Medium
Levee Failure	Significant	Occasional	Catastrophic	High	Limited
Pandemic	Extensive	Likely	Critical	High	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Limited	Medium	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Medium	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Limited	Medium	Medium
Wildfire	Significant	Highly Likely	Critical	Medium	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

H.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile the Agency's hazards and assess the Agency's vulnerability separate from that of the Sutter County Planning Area as a whole, which has already been assessed in Sections 4.2 Hazard Profiles and 4.3 Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Sutter County Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the Agency is included in this Annex. This vulnerability assessment analyzes the property and other assets at risk to hazards ranked of medium or high significance specific to the Agency. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

H.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section H.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table H-2) affects the Agency and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Sutter County Planning Area.

H.5.2. Vulnerability Assessment and Assets at Risk

This section identifies the Agency's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within the Agency.

Assets at Risk and Critical Facilities

This section considers the SBFCA's assets at risk, with a focus on key Agency assets such as critical facilities, infrastructure, and other Agency assets and their values. With respect to Agency assets, the majority of these assets are considered critical facilities as defined for this LHMP Update. Critical facilities are defined for this Plan as:

> ***Any facility, including without limitation, a structure, infrastructure, property, equipment or service, that if adversely affected during a hazard event may result in severe consequences to public health and safety or interrupt essential services and operations for the community at any time before, during and after the hazard event.***

SBFCA does not own physical property. The Agency owns office and other equipment needed to perform their role in the County. As such, the Agency has no assets at risk.

Natural Resources

SBFCA has a variety of natural resources of value to the Agency. These natural resources parallel that of southern Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Historic and Cultural Resources

SBFCA has a variety of historic and cultural resources of value to the Agency. These historic and cultural resources parallel that of southern Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Growth and Development Trends

General growth in the Agency parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Future Development

The Agency owns no physical structures, and has no plans to build in the future. The Agency has no control over future development in areas the Agency provides levee improvements in. Future development in these areas parallels that of southern portion of Sutter County. More general information on growth and development in Sutter County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sutter County Vulnerability and Assets at Risk of the Base Plan.

H.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table H-2 as high or medium significance hazards. Impacts of past events and vulnerability of the Agency to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the Agency to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.

- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, critical facilities and infrastructure, populations at risk, and future development.

Aquatic Invasive Species

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

The introduction of nonnative species into coastal marine and estuarine waters can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability.

Boats discharge ballast water that has been obtained from waters throughout the state, country, or the world. This water might include non-native organisms, untreated sewage, and other contaminants. Once introduced, invasive species are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and wreaking economic havoc. Examples include the zebra mussel infestation in the Great Lakes and the propagation of water hyacinth in the California Delta. Both the zebra mussel and the quagga mussel are concerns for California and Sutter County. These mussels have not affected the waters in Sutter County yet, but are still a cause for concern.

Some of California's most serious weed problems occur in waterways, lakes and streams. The aquatic plant hydrilla is considered one of the most serious aquatic weed problems in the world and the California Department of Food and Agriculture (CDFA) maintains an intensive program to survey and eradicate this aquatic weed pest. It can quickly take over lakes and streams, crowding out native animals and plants and blocking hydroelectric plants, while impeding water flow and delivery. Its rapid growth and ease of spread by boats makes it critical to detect early and eradicate.

The effects of nonnative fish on native fish are generally in the form of predation and competition for food and breeding sites. There are also several non-fish, nonnative invasive species found in aquatic natural communities that can damage such communities. The introduced bullfrog is an important riparian invasive in the plan area. Many varieties of non-native aquatic weeds compete for the entire water column and shoreline in Sutter County, crowding out native species and degrading the aquatic and riparian habitat. The main concern for SBFCA is the growth of Primrose.

Location and Extent

All freshwater lakes, streams, and rivers are potentially at risk from aquatic invasive species. There is no established scale for these invasive species. Magnitude is measured by the presence and counts of aquatic invasive species in waterways in Sutter County. Speed of onset of these invasive species is short, as it only takes a careless boater or visitor to the area to accidentally introduce an invasive species. However, the duration is long as once established they can take years to eradicate, if at all.

Past Occurrences

There are no past occurrences with aquatic invasive species in the planning area.

Vulnerability to and Impacts from Invasive Aquatics

The introduction of invasive species into rivers and lakes can cause significant and enduring economic and environmental impacts. One of the most widespread mechanisms by which introductions occur is through transport of ballast water in boats. Ballast water is taken on and released by a vessel during cargo loading and discharging operations to maintain the vessel's trim and stability. Ships ballast water obtained from some other foreign location (outside the County) can include non-native organisms, untreated sewage, and other contaminants. Once introduced, NAS are likely to become a permanent part of an ecosystem and may flourish, creating environmental imbalances and economic havoc.

Aquatic invasive species can jeopardize and damage any part of the entire system ranging from human economy dependent infrastructure to natural aquatic, riparian and wetland habitat. Entire watersheds can be affected when an aggressive invasive species infests the rivers, shorelines, tributaries, drainage, irrigation and domestic delivery systems. Impacts to the Agency are mostly related to water recreation activities that may be hampered by these invasive species.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future. The Agency plans to work with DWR and grant programs to remove and prevent against invasive species where possible.

Climate Change

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Climate change adaptation is a key priority of the State of California. The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by

as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing. In Sutter County and the Agency, the HMPC noted that each year it seems to get a bit warmer each year. It was also noted that 2017 and 2019 were both some of the wettest and hottest years on record. Climate change is more specific to hydraulics and hydrology of the water as long as reservoirs are able to manage the discharges in a high water year. During the past 5 years, there were some increases to projected flows due to climate change and the Agency has taken those into consideration. As part of the 2022 Central Valley Flood Protection Plan update those flows will be evaluated again.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the Agency, Sutter County, and State of California. There is no scale to measure the extent of climate change. Climate change exacerbates other hazards, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known, but is feared to be tens to hundreds of years.

Past Occurrences

Climate change has never been directly linked to any declared disasters. While the Agency noted that climate change is of concern, no specific impacts of climate change could be recalled. The Agency and HMPC members noted that the strength of storms does seem to be increasing and the temperatures seem to be getting hotter.

Vulnerability to and Impacts from Climate Change

The California Adaptation Planning Guide (APG) prepared by California OES and CNRA was developed to provide guidance and support for local governments and regional collaboratives to address the unavoidable consequences of climate change. California's APG: Understanding Regional Characteristics has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. Sutter County falls within the North Sierra Region characterized as a sparsely settled mountainous region where the region's economy is primarily tourism-based. The region is rich in natural resources, biodiversity, and is the source for the majority of water used by the state. This information can be used to guide climate adaptation planning in the Agency and Sutter County Planning Area.

The California APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Sutter County Planning Area is part of:

- Temperature increases
- Decreased precipitation
- Reduced snowpack

- Reduced tourism
- Ecosystem change
- Sensitive species stress
- Increased wildfire
- Increased or decreased flows depending on water year
- More intense shorter duration weather events

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future. Future development of Agency facilities is unlikely to be affected by climate change.

Dam Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–Extremely High

Hazard Profile and Problem Description

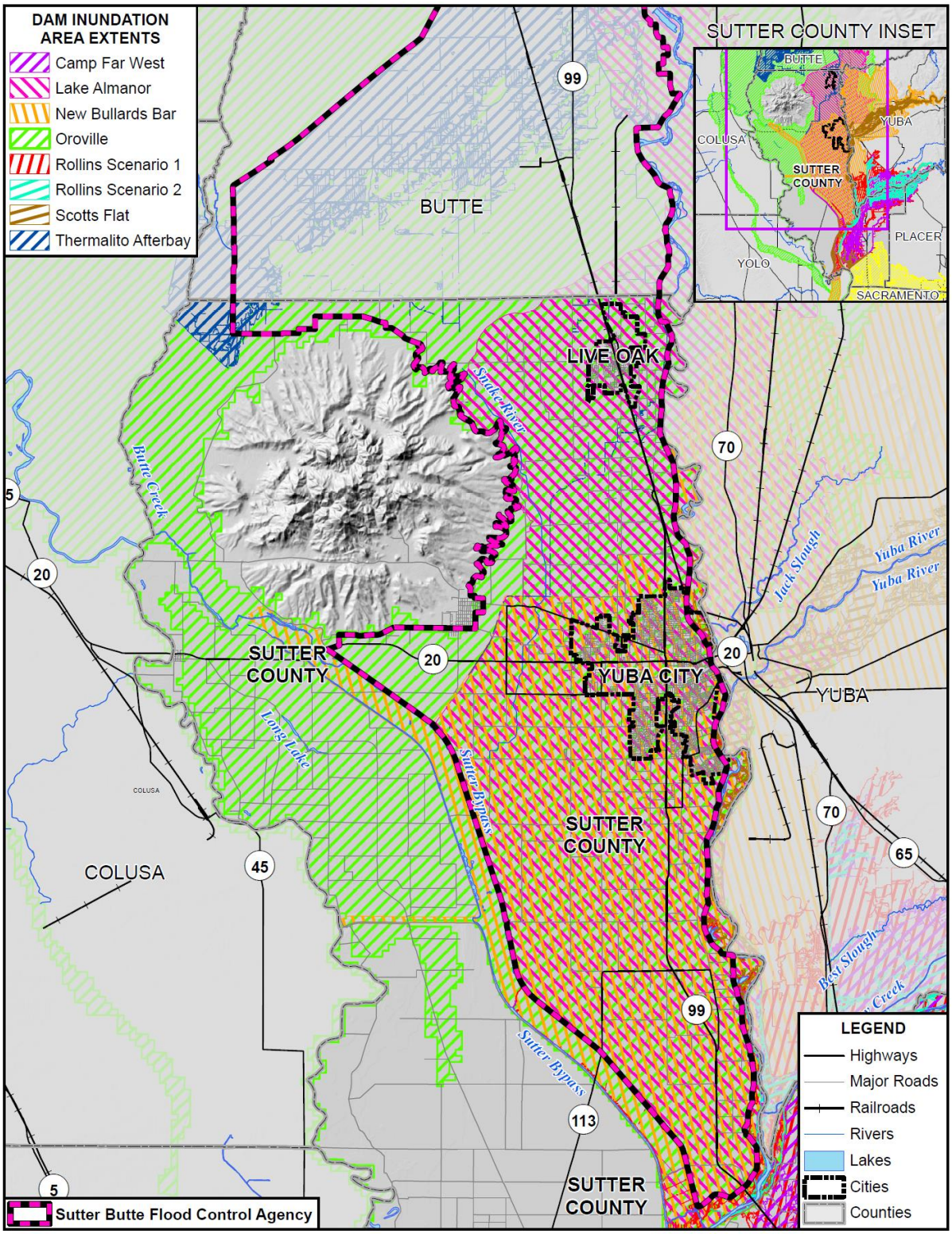
Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, Cal DWR Division of Safety of Dams (DOSD) assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.2.10 of the Base Plan.

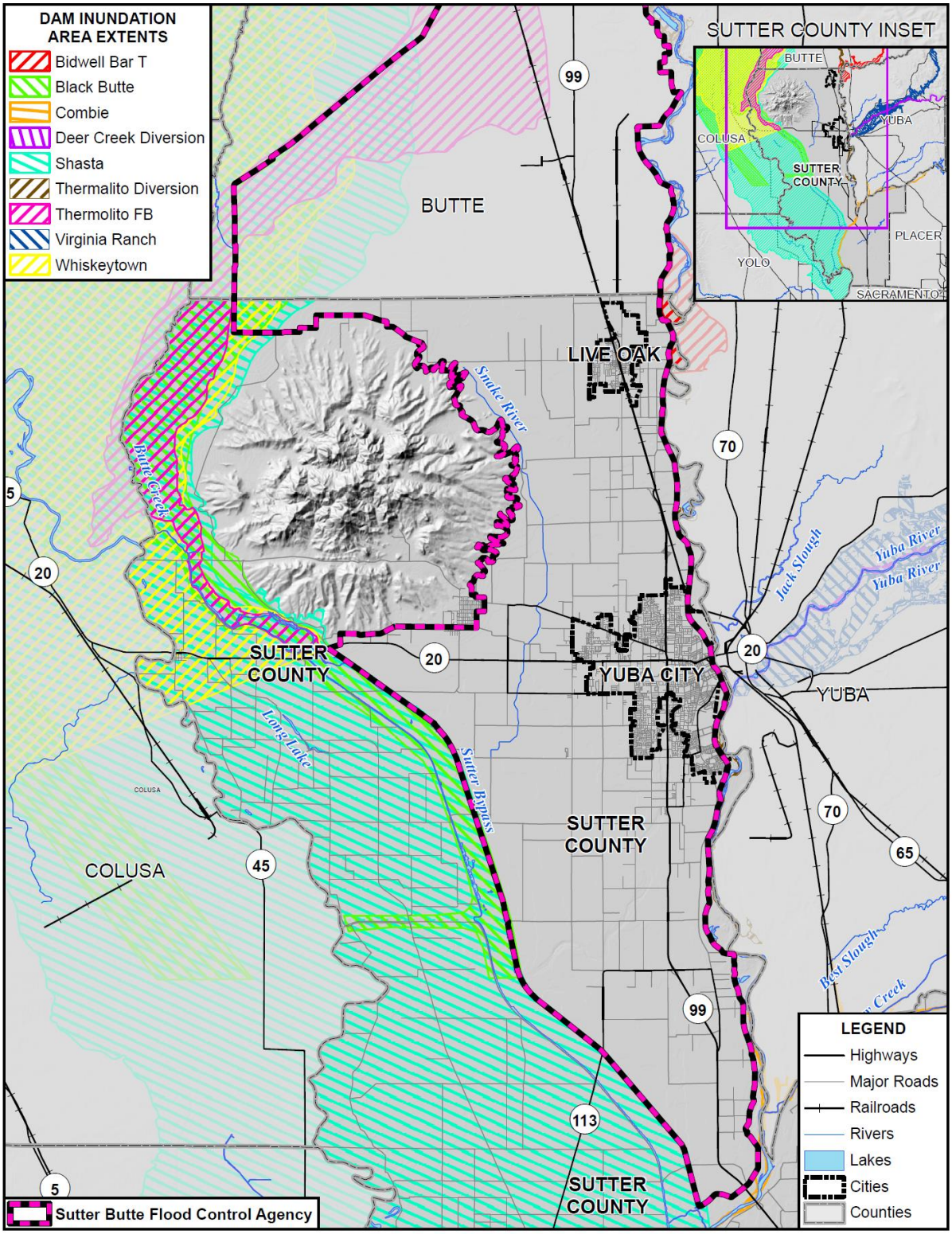
While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The Agency would be affected for as long as the flood waters from the dam failure took to drain downstream.

Figure H-2 SBFCA – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Figure H-3 SBFCA – High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident. This can be seen on Table H-3.

Table H-3 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

Impacts to SBFCA from the Oroville Spillway Disaster are as follows:

- Levee erosion at Levee District 1
- Sediment impacts
- Rapid drawdown and sloughing of banks into the Feather River along the system

The Oroville Spillways Emergency in February 2017 required a strong response from the Agency. SBFCA built several miles of emergency seepage berms north of Laurel Avenue, and implemented a 3-mile long emergency levee repair project with the installation of a slurry cutoff wall in Yuba City. FEMA provided approximately $3.5 million in disaster assistance to SBFCA after the event for the berm installations and the State funded the levee repair project with $25 million.

The Agency noted no other dam failure occurrences that have affected the Agency.

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the Agency from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant.

The Oroville Dam and the New Bullards Bar Dam are the primary dams of concern to the Agency. Both of these dams contribute flows into the Feather River.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Drought & Water Shortage

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects. Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue and is critical for agriculture, manufacturing, tourism, recreation, and commercial and domestic use. As the population in the area continues to grow, so will the demand for water.

Location and Extent

Drought and water shortage are regional phenomenon. The whole of the County, as well as the whole of the Agency, is at risk. The US Drought Monitor categorizes drought conditions with the following scale:

- None
- D0 – Abnormally dry
- D1 – Moderate Drought
- D2 – Severe Drought
- D3 – Extreme drought
- D4 – Exceptional drought

Drought has a slow speed of onset and a variable duration. Drought can last for a short period of time, which does not usually affect water shortages and for longer periods. Should a drought last for a long period of time, water shortage becomes a larger issue. Current drought conditions in the Agency and the County are shown in Section 4.2.11 of the Base Plan.

Past Occurrences

Since drought is a regional phenomenon, past occurrences of drought for the Agency are the same as those for the County and includes 5 multi-year droughts over an 85-year period. Details on past drought occurrences can be found in Section 4.2.11 of the Base Plan.

Vulnerability to and Impacts from Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the Agency, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Earthquake

Likelihood of Future Occurrence–Unlikely
Vulnerability–Medium

Hazard Profile and Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction.

Location and Extent

Since earthquakes are regional events, the whole of the Agency is at risk to earthquake. SBFCA and the surrounding area are relatively free from significant seismic and geologic hazards. There are no known or inferred active faults within the Agency.

The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales, as discussed in Section 4.2.12 of the Base Plan. The faults identified in Sutter County include the Quaternary Faults, located in the northern section of the County within the Sutter Buttes, and the Pre Quaternary Fault, located in the southeastern corner of the Planning Area, just east of where Highway 70 enters into the County. Both faults are listed as inactive faults, but have the potential for seismic activity.

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. The Agency is located in an area where few earthquakes of significant magnitude occur, so both magnitude and intensity of earthquakes are expected to remain low. Seismic shaking maps for the area show Sutter County and the Agency fall within a low to moderate shake risk.

Past Occurrences

The Agency noted no past occurrences of earthquakes or that affected the Agency in any meaningful way.

Vulnerability to and Impacts from Earthquake

The combination of plate tectonics and associated California coastal mountain range building geology generates earthquake as a result of the periodic release of tectonic stresses. Sutter County's mountainous terrain lies in the center of the North American and Pacific tectonic plate activity. There have been earthquakes as a result of this activity in the historic past, and there will continue to be earthquakes in the future of the California north coastal mountain region.

Fault ruptures itself contributes very little to damage unless the structure or system element crosses the active fault; however, liquefaction can occur further from the source of the earthquake. In general, newer construction is more earthquake resistant than older construction due to enforcement of improved building codes. Manufactured housing is very susceptible to damage because their foundation systems are rarely braced for earthquake motions. Locally generated earthquake motions and associated liquefaction, even from very moderate events, tend to be more damaging to smaller buildings, especially those constructed of unreinforced masonry (URM) and soft story buildings.

The Uniform Building Code (UBC) identifies four seismic zones in the United States. The zones are numbered one through four, with Zone 4 representing the highest level of seismic hazard. The UBC establishes more stringent construction standards for areas within Zones 3 and 4. All of California lies within either Zone 3 or Zone 4. The SBFCA is within the less hazardous Zone 3.

Impacts from earthquake in the Agency will vary depending on the fault that the earthquake occurs on, the depth of the earthquake strike, and the intensity of shaking. Large events could cause damages to infrastructure, critical facilities, residential and commercial properties, and possible injuries or loss of life.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

This hazard analyzes the FEMA Q3/DFIRM 1%, 0.5%, and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the Agency, and have caused damages in the past.

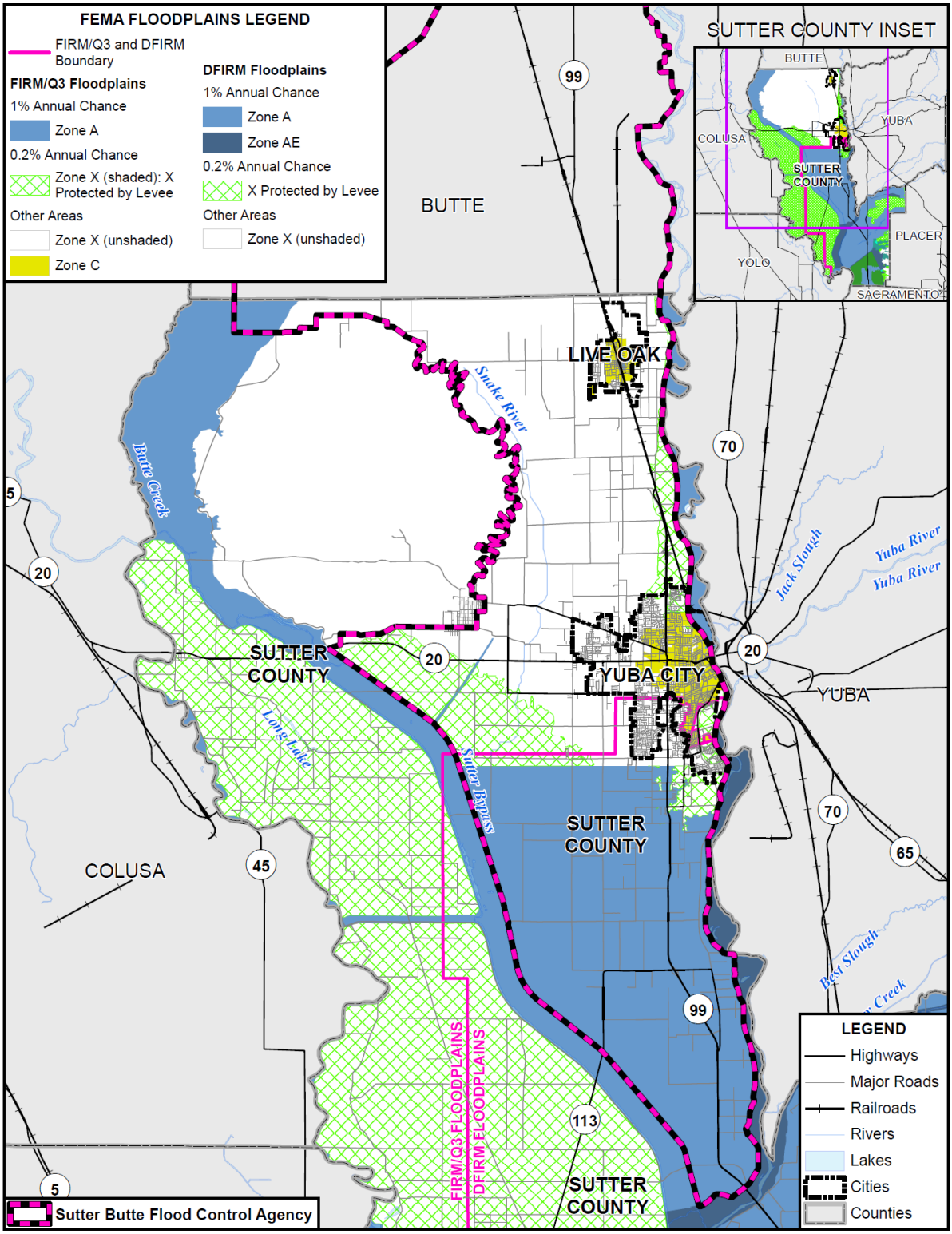
Flooding is a significant problem in Sutter County and the Agency. Historically, the Agency has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1%, 0.5%, and 0.2% annual chance floodplains and in other localized areas.

As previously described in Section 4.2.13 of the Base Plan, the Sutter County Planning Area and the SBFCA have been subject to historical flooding. SBFCA is traversed by several stream systems and is at risk to the 1%, 0.5%, and 0.2% flood.

Location and Extent

The SBFCA has areas located in the 1%, 0.5%, and 0.2% annual chance floodplain. This is seen in Figure H-4.

Figure H-4 SBFCA – FEMA Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Table H-4 details the Q3/DFIRM mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the Agency.

Table H-4 SBFCA– Q3/DFIRM Flood Hazard Zones

Flood Zone	Description	Present in SBFCA Boundaries
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	X
AE	1% annual chance flood: Base flood elevations provided	X
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	X
X (unshaded)	No flood hazard	X
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	X
AE	100-year Flood: Base flood elevations provided	
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	
X (unshaded)	No flood hazard	X
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	X

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the Agency vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the Agency tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the Agency tends to have a shorter speed of onset, due to the amount of water that flows through the Agency.

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table H-5. These events also likely affected the Agency to some degree.

Table H-5 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

The following occurred due to flooding for the Agency:

- 2017 Seepage in southern portion of the SBFCA basin and in the Sutter Bypass
- 2017 Erosion to the Feather River West Levee
- 2019 Sutter Bypass seepage long duration as water stayed high for a long period of time.

Vulnerability to and Impacts from Flood

Floods have been a part of the Agency's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Flooding occurs in areas other than the FEMA mapped 1% and 0.2% annual chance floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate

maintenance. Localized, stormwater flooding occurs throughout the County during the rainy season from November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration.

Location and Extent

The SBFCA is subject to localized flooding throughout the Agency. Flood extents are usually measured in areas affected, velocity of flooding, and depths of flooding. Expected flood depths in the Agency vary by location. Flood durations in the Agency tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Localized flooding in the Agency tends to have a shorter speed of onset, especially when antecedent rainfall has soaked the ground and reduced its capacity to absorb additional moisture.

Past Occurrences

The Agency noted that everything that is adjacent to the levees is vulnerable from underseepage and through seepage due to riverine flooding.

Vulnerability to and Impacts from Localized Flooding

Historically, much of the growth in the Agency and County has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff.

Primary concerns associated with stormwater flooding include impacts to infrastructure that provides a means of ingress and egress throughout the community. Ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Objects can also be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt services. Standing water can cause damage to crops, roads, and foundations. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Levee Failure

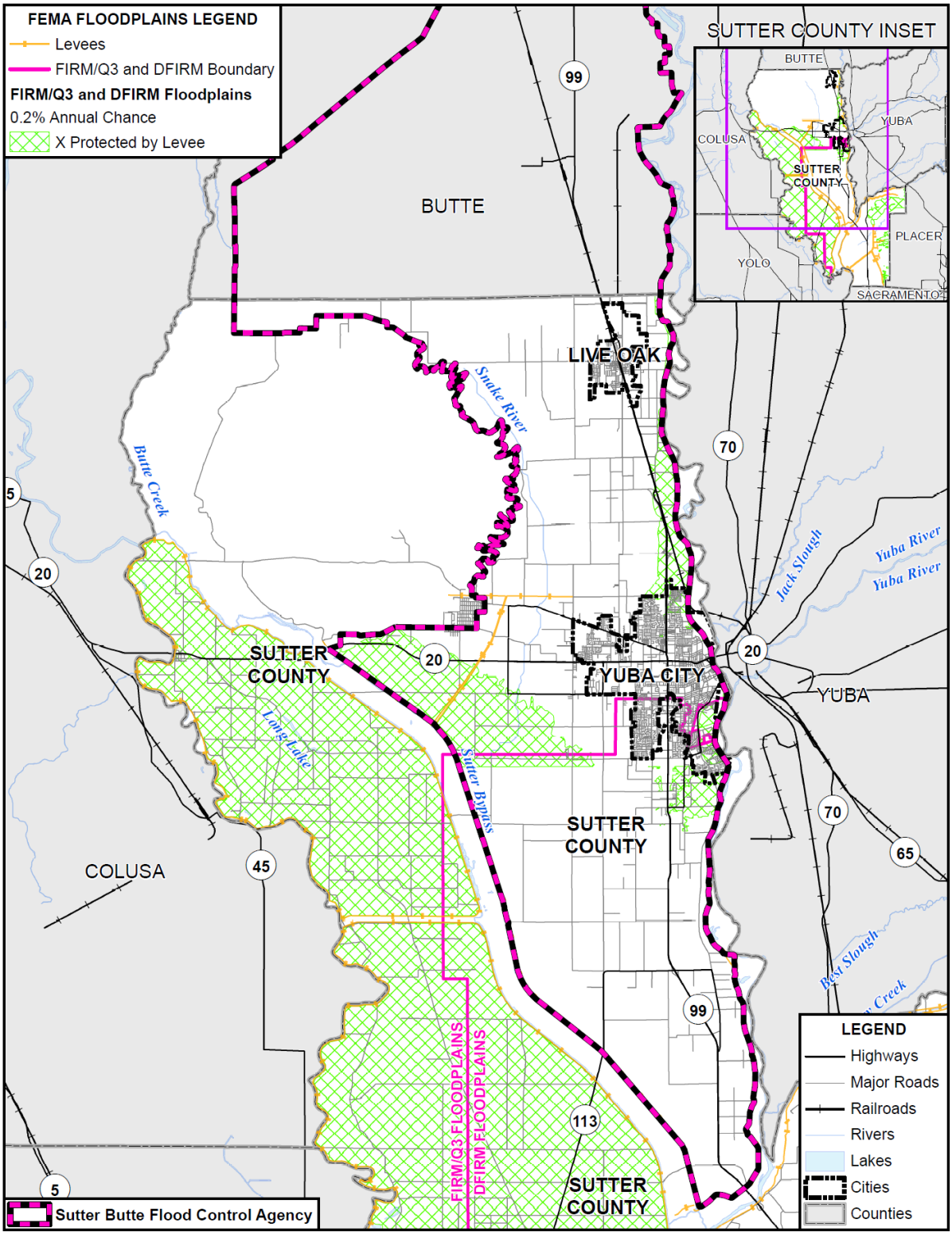
Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure. Levees in the SBFCA are shown on Figure H-5.

Figure H-5 SBFCA – Levees and Q3/DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Location and Extent

There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the Agency are not known. The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. The HMPC noted that when northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees.

Past Occurrences

The Agency Planning Team noted no past occurrences of levee failures.

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Pandemic

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

According to the World Health Organization (WHO), a disease epidemic occurs when there are more cases of that disease than normal. A pandemic is a worldwide epidemic of a disease. A pandemic may occur when a new virus appears against which the human population has no immunity. It is important to realize that this LHMP Update does not examine pandemic contingency plans, but instead focuses on examining the risk of a normal hazard occurrence.

A pandemic occurs when a new virus emerges for which people have little or no immunity, and for which there is no vaccine. This disease spreads easily person-to-person, causes serious illness, and can sweep across the country and around the world in a very short time. The U.S. Centers for Disease Control and Prevention has been working closely with other countries and the World Health Organization to strengthen systems to detect outbreaks of that might cause a pandemic and to assist with pandemic planning and preparation. An especially severe a pandemic could lead to high levels of illness, death, social disruption, and economic loss.

Location and Extent

During a pandemic, the whole of the Agency, County, and surrounding region is at risk, as pandemic is a regional, national, or international event. The speed of onset of pandemic is usually short, while the duration is variable, but can last for more than a year as shown in the 1918/1919 Spanish Flu. There is no scientific scale to measure the magnitude of pandemic. Pandemics are usually measured in numbers affected by the pandemic, and by number who die from complications from the pandemic.

Past Occurrences

There has been one state and federal disaster declaration due to pandemic, as shown in Table H-6.

Table H-6 Sutter County – State and Federal Pandemic Disaster Declarations 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Pandemic	1	2020	1	2020

Source: Cal OES, FEMA

The 20th century saw three outbreaks of pandemic flu.

- The **1918-1919 Influenza Pandemic (H1N1)**
- The **February 1957-1958 Influenza Pandemic (H2N2)**
- The **1968 Influenza Pandemic (H3N2)**

To date, the 21st century has seen two acknowledged pandemics.

- **2009 Swine Flu (H1N1**)
- **2019/2020 COVID 19**

Vulnerability to and Impacts from Pandemic

Pandemic has and will continue to have impacts on human health in the region. A pandemic occurs when a new virus emerges for which there is little or no immunity in the human population; the virus causes serious illness and spreads easily from person-to-person worldwide. There are several strategies that public health officials can use to combat pandemic flu. Constant surveillance regarding current pandemic, use of infection control techniques, and administration of vaccines once they become available. Citizens can help prevent spread of pandemic flu by staying home, or "self-quarantining," if they suspect they are infected. Pandemic does not affect the buildings, critical facilities, and infrastructure in the Agency. Pandemic can

have varying levels of impact to the citizens of the Agency and greater County, depending on the nature of the pandemic.

Impacts could range from school and business closings to the interruption of basic services such as public transportation, health care, and the delivery of food and essential medicines. Hospitalizations and deaths can occur, especially to the elderly or those with pre-existing underlying conditions. As seen with Covid-19, multiple businesses were forced to close temporarily (some permanently) an unemployment rose significantly. Supply chains for food can be interrupted. Prisons may need to release prisoners to comply with social distance standards.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

Future development is not expected to be significantly impacted by this hazard, though population growth in the Agency could increase exposure to pandemic flu, and increase the ability of each disease to be transmitted among the population of the Agency.

Severe Weather: Extreme Cold and Freeze

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

According to the National Weather Service), extreme cold often accompanies a winter storm or is left in its wake. Winter snowstorms can include heavy snow, ice, blizzard conditions, and cold temperatures. Freezing temperatures can also occur without the accompanying winter storm.

Location and Extent

Extreme cold and freeze are regional issues, meaning the entire Agency is at risk to cold weather and freeze events. While there is no scale (i.e. Richter, Enhanced Fujita) to measure the effects of extreme cold and freeze, temperature data from the County from the WRCC indicates that there are 21.8 days that fall below 32°F in western Sutter County. Freeze has a slow onset and can generally be predicted in advance for the County. Freeze events can last for hours (in a cold overnight), or for days to weeks at a time. It is rare for snow to fall in the Agency, and even rarer that snow accumulates in the Agency. Snowfall has an onset that is similar to freeze.

Past Occurrences

There has been one federal and one state disaster declaration for freeze. This can be seen in Table H-7.

Table H-7 Sutter County – State and Federal Freeze Disaster Declarations 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Freeze	1	1990	1	1990

Source: Cal OES, FEMA

The Agency noted that freeze and winter storm is a regional phenomenon; events that affected the lower elevations of the County also affected the Agency. Those past occurrences were shown in the Base Plan in Section 4.2.5.

Vulnerability to and Impacts from Severe Weather: Freeze and Winter Storms

The Agency experiences temperatures below 32 degrees during the winter months. The temperature moves to the teens in rather extreme situations. Freeze can cause injury or loss of life to residents of the Agency. While it is rare for buildings to be affected directly by freeze, damages to pipes that feed building can be damaged during periods of extreme cold. Construction crews may have to halt work in the most extreme cases. Construction on levee structures may have been halted during extreme weather conditions for the safety of construction crews and other essential staffing onsite.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Severe Weather: Extreme Heat

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

According to FEMA, extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. Heat kills by taxing the human body beyond its abilities. In extreme heat and high humidity, evaporation is slowed, and the body must work extra hard to maintain a normal temperature." Most heat disorders occur because the victim has been overexposed to heat or has over-exercised for his or her age and physical condition. Older adults, young children, and those who are sick or overweight are more likely to succumb to extreme heat.

In addition to the risks faced by citizens of the Agency, there are risk to the built environment from extreme heat. While extreme heat on its own does not usually affect structure, extreme heat during times of drought can cause wildfire risk to heighten. Extreme heat and high winds can cause Public Safety Power Shutdowns (PSPS) events, causing issues to buildings in the Agency.

Location and Extent

Heat is a regional phenomenon and affects the whole of the Agency. Heat emergencies are often slower to develop, taking several days of continuous, oppressive heat before a significant or quantifiable impact is seen. Heat waves do not strike victims immediately, but rather their cumulative effects slowly affect vulnerable populations and communities. Heat waves do not generally cause damage or elicit the immediate response of floods, fires, earthquakes, or other more "typical" disaster scenarios.

The NWS has in place a system to initiate alert procedures (advisories or warnings) when extreme heat is expected to have a significant impact on public safety. The expected severity of the heat determines whether advisories or warnings are issued. The NWS HeatRisk forecast provides a quick view of heat risk potential over the upcoming seven days. The heat risk is portrayed in a numeric (0-4) and color (green/yellow/orange/red/magenta) scale which is similar in approach to the Air Quality Index (AQI) or the UV Index. This can be seen in Section 4.2.2 of the Base Plan.

Past Occurrences

The Agency Planning Team note that since extreme heat is a regional phenomenon, events that affected the County also affected the Agency. Those past occurrences were shown in the Base Plan in Section 4.2.2.

During the summer months the construction crews will follow OSHA requirements during heat events.

Vulnerability to and Impacts from Extreme Heat

The Agency experiences temperatures in excess of 100°F during the summer and fall months. The temperature moves to 105-115°F in rather extreme situations. During these times, drought conditions may worsen. Also, PSPS events may occur during these times as well. Health impacts are the primary concern with this hazard, though economic impacts are also an issue.

Days of extreme heat have been known to result in medical emergencies, and unpredictable human behavior. Periods of extended heat and dryness (droughts) can have major economic, agricultural, and water resources impacts. Extreme heat can also dry out vegetations, making it more vulnerable to wildfire ignitions. During periods of extreme heat (with high winds), PG&E can institute the Public Safety Power Shutoff (PSPS). Construction on levee structures may have been halted during extreme weather conditions for the safety of construction crews and other essential staffing onsite

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Severe Weather: Heavy Rains and Storms (Hail, Lightning)

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Storms in the Agency occur annually and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the Agency falls mainly in the fall, winter, and spring months.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the Agency. All portions of the Agency are at risk to heavy rains. Most of the severe rains occur during the fall, winter, and spring months. There is no scale by which heavy rains and severe storms are measured. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Duration of severe storms in California, Sutter County, and the Agency can range from minutes to hours to days. Information on precipitation extremes can be found in Section 4.2.3 of the Base Plan.

Past Occurrences

According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the Agency. This is the cause of many of the federal disaster declarations related to flooding.

Vulnerability to and Impacts from Heavy Rain and Storms

Heavy rain and severe storms are the most frequent type of severe weather occurrences in the Agency. These events can cause localized flooding. Elongated events, or events that occur during times where the ground is already saturated can cause 1% and 0.2% annual chance flooding. Wind often accompanies these storms and has caused damage in the past. Hail and lightning are rare in the Agency.

Actual damage associated with the effects of severe weather include impacts to property, critical facilities (such as utilities), and life safety. Heavy rains and storms often result in localized flooding creating significant issues. Roads can become impassable and ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Floodwaters and downed trees can break utilities and interrupt services. Construction on levee structures may have been halted during extreme weather conditions for the safety of construction crews and other essential staffing onsite

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

Wildfire

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

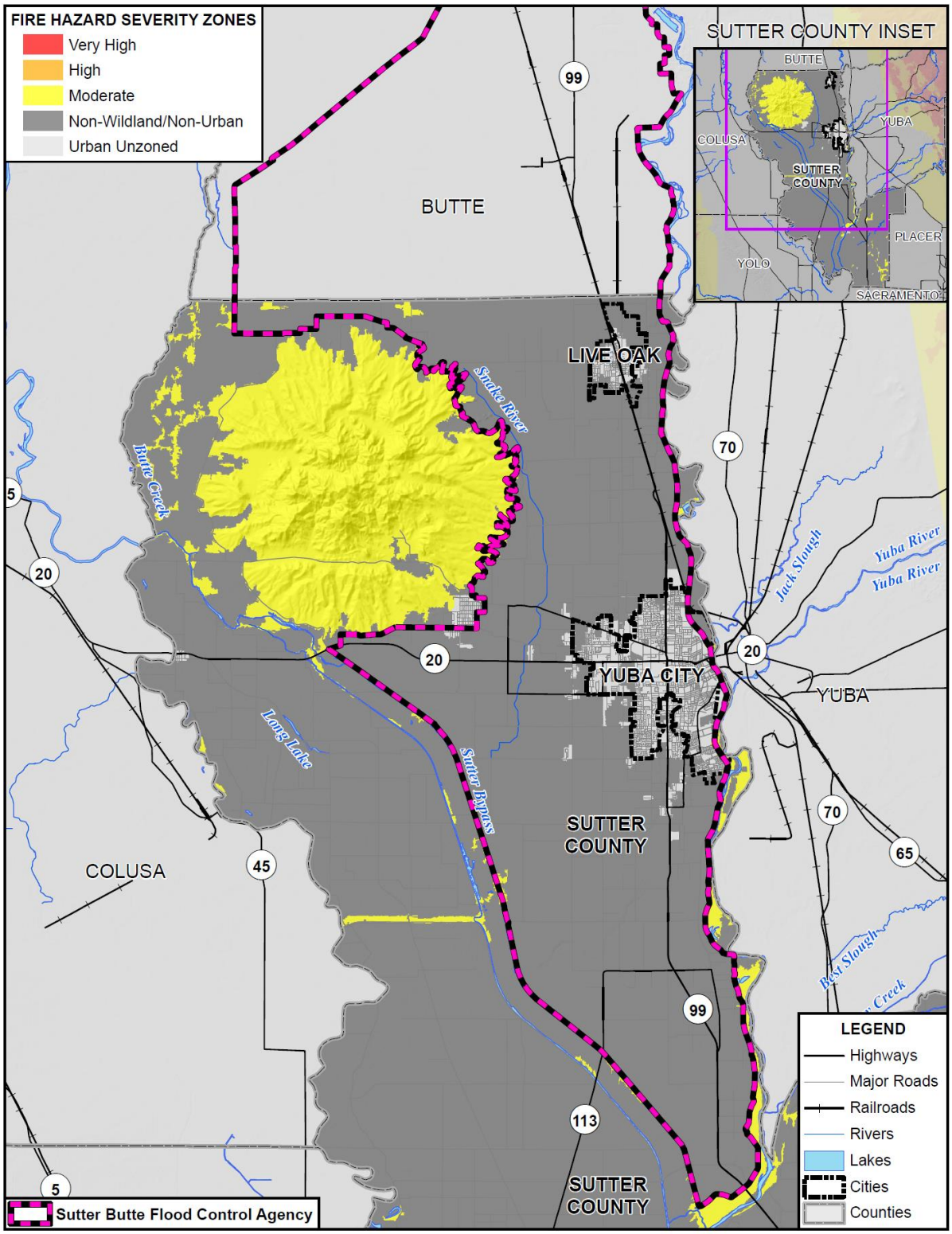
Hazard Profile and Problem Description

Wildland fire and the risk of a conflagration is an ongoing concern for the SBFCA. Throughout California, communities are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire control practices have affected the natural cycle of the ecosystem. Wildland fires affect grass, forest, and brushlands, as well as any structures located within them. Where there is human access to wildland areas the risk of fire increases due to a greater chance for human carelessness and historical fire management practices. Historically, the fire season extends from early spring through late fall of each year during the hotter, dryer months; however, in recent years, the risk of wildfire has become a year around concern. Fire conditions arise from a combination of high temperatures, low moisture content in the air and fuel, accumulation of vegetation, and high winds. While wildfire risk has predominantly been associated with more remote forested areas and wildland urban interface (WUI) areas, significant wildfires can also occur in more populated, urban areas.

Location and Extent

Wildfire can affect all areas of the Agency. CAL FIRE has estimated that the risk varies across the Agency and has created maps showing risk variance. Following the methodology described in Section 4.3.16 of the Base Plan, wildfire maps for the SBFCA were created. Figure H-6 shows the CAL FIRE FHSZ in the Agency. As shown on the maps, fire hazard severity zones within the Agency range from low to moderate.

Figure H-6 SBFCA – Fire Hazard Severity Zones



Data Source: CAL FIRE (Draft 9/2007 - c51fhszl06_1), Sutter County GIS, Cal-Atlas; Map Date: 8/25/2020.

Wildfires tend to be measured in structure damages, injuries, and loss of life as well as on acres burned. Fires can have a quick speed of onset, especially during periods of drought or during hot dry summer months. Fires can burn for a short period of time, or may have durations lasting for a week or more.

Past Occurrences

There have been no state and federal disaster declarations for Sutter County from wildfire.

Vulnerability to and Impacts from Wildfire

The wildfire hazard is one of the highest priority hazards in the County and Agency, and is the hazard with the greatest potential for catastrophic loss. High fuel loads in the County and Cities, along with geographical and topographical features, create the potential for both natural and human-caused fires that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. The more urbanized areas within the County are not immune from fire. The dry vegetation and hot and sometimes windy weather, combined with continued growth in the WUI areas, results in an increase in the number of ignitions. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire. As development continues throughout the County and Agency, especially in these interface areas, the risk and vulnerability to wildfires will likely increase.

Potential impacts from wildfire include loss of life and injuries; damage to structures and other improvements, natural and cultural resources, croplands, and timber; and loss of recreational opportunities. Wildfires can cause short-term and long-term disruption to the Agency. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the Agency by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading water quality. Fires can also affect air quality in the Agency; smoke and air pollution from wildfires can be a severe health hazard.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of buildings and infrastructure. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Schools and businesses can be forced to close for extended periods of time. Recently, the threat of wildfire, combined with the potential for high winds, heat, and low humidity, has caused PG&E to initiate PSPSs which can also significantly impact a community through loss of services, business closures, and other impacts associated with loss of power for an extended period. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides, and erosion during the rainy season.

Runoff and debris flow from fires in the river bottoms; more material and debris following wildfire years.

Assets at Risk

As previously stated, the Agency owns no physical structures. Therefore, there are no Agency assets at risk to this hazard.

Future Development

The Agency owns no physical structures, and has no plans to build in the future.

H.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

H.6.1. Regulatory Mitigation Capabilities

Table H-8 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the SBFCA.

Table H-8 SBFCA Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan		
Capital Improvements Plan		
Economic Development Plan		
Local Emergency Operations Plan	Y	2015 Flood Safety Plan
Continuity of Operations Plan	Y	Used during pandemic
Transportation Plan		
Stormwater Management Plan/Program		
Engineering Studies for Streams	Y	
Community Wildfire Protection Plan	N	
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)	Y	SBFCA Strategic Plan
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code		Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score		Score:
Fire department ISO rating:		Rating:
Site plan review requirements	Y	SBFCA is a reviewing party for development plans when projects are close to levee structures

Land Use Planning and Ordinances	Y/N	Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?
Zoning ordinance		
Subdivision ordinance		
Floodplain ordinance		
Natural hazard specific ordinance (stormwater, steep slope, wildfire)		
Flood insurance rate maps	Y	SBFCA works with FEMA on new FIRMS based on new levee improvements
Elevation Certificates		
Acquisition of land for open space and public recreation uses		
Erosion or sediment control program	Y	SBFCA levee certification process includes erosion analysis and sediment is evaluated.
Other		
How can these capabilities be expanded and improved to reduce risk?		
More funding for the Agency to conduct activities noted.		

Source: SBFCA

H.6.2. Administrative/Technical Mitigation Capabilities

Table H-9 identifies the Agency department(s) responsible for activities related to mitigation and loss prevention in SBFCA.

Table H-9 SBFCA's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission	N	SBFCA works closely with the Planning Commissions in the planning area on projects that will affect them.
Mitigation Planning Committee	Y	SBFCA has an internal mitigation review team and works with its various partners such as Levee Districts, Cities and County.
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)	N	SBFCA works closely with the Levee Districts on their maintenance programs.
Mutual aid agreements	N	
Other	Y	SBFCA is working with the Feather River Region to provide technical support and information in events
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official	N	SBFCA works closely with the Building Officials within the planning area.
Floodplain Administrator	N	SBFCA works closely with the Floodplain Administrators within the Planning Area.

Emergency Manager	N	SBFCA works closely with the Sutter County OEM.
Community Planner	Y	SBFCA contracts out to accomplish this function.
Civil Engineer	Y	The Executive Director for SBFCA is a Professional Engineer.
GIS Coordinator	Y	SBFCA contracts out to accomplish this function.
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)	N	SBFCA utilizes the Sutter County Sutter Alert program and is programed into the system.
Hazard data and information	Y	SBFCA is comprised of hazard data and information in many documents including this Annex.
Grant writing	Y	PBI through contract (Agency Engineer)
Hazus analysis	N	
Other		
How can these capabilities be expanded and improved to reduce risk?		
These capabilities can be expanded and improved with additional annual funding opportunities to either contract some of these administrative and technical duties out or additional staffing for the agency could be an option.		

Source: SBFCA

H.6.3. Fiscal Mitigation Capabilities

Table H-10 identifies financial tools or resources that the Agency could potentially use to help fund mitigation activities.

Table H-10 SBFCA's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding		
Authority to levy taxes for specific purposes	Y	Assessment District approved in 2010 used for CIP funding
Fees for water, sewer, gas, or electric services		
Impact fees for new development	Y	Working with Yuba City to collect fees
Storm water utility fee		
Incur debt through general obligation bonds and/or special tax bonds	Y	Bonds
Incur debt through private activities		
Community Development Block Grant		
Other federal funding programs	Y	
State funding programs	Y	Prop 1E, 1 68
Other		
How can these capabilities be expanded and improved to reduce risk?		

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
These capabilities can be expanded and improved with additional annual funding opportunities to either contract some of these fiscal duties out or additional staffing for the agency could be an option.		

Source: SBFCA

H.6.4. Mitigation Education, Outreach, and Partnerships

Table H-11 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table H-11 SBFCA's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Y	Annual partnership with Sutter County during Flood Preparedness month in October.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Y	Annual partnership with Sutter County during Flood Preparedness month in October.
Natural disaster or safety related school programs	N	n/a
StormReady certification	Y	Sutter County is a Storm Ready Community, SBFCA is a part of that program with Sutter County.
Firewise Communities certification	N	n/a
Public-private partnership initiatives addressing disaster-related issues	Y	Annual partnership with Sutter County during Flood Preparedness month in October.
Other		
How can these capabilities be expanded and improved to reduce risk?		
These capabilities can be expanded and improved with additional annual funding opportunities.		

Source: SBFCA

H.6.5. Other Mitigation Efforts

The Agency has many other completed or ongoing mitigation efforts that include the following:

Feather River West Levee Project

The Sutter Butte Flood Control Agency is repairing 44 miles of levees from Thermalito Afterbay south to the Sutter Bypass. The goal of the project is to reduce flood risk and eventually remove more than 34,000 properties from FEMA Special Flood Hazard Areas. Levee repairs are being completed in two separate projects (see below).

The repairs are needed because levees along the west bank of the Feather River suffer from potential underseepage and through-seepage. Similar problems caused major levee failures in Yuba City in 1955 and Yuba County in 1986 and 1997.

In general, the Feather River levees will be made stronger by building deep cutoff walls (also known as slurry walls) and seepage berms. These levee improvements block or slow the flow of water through and underneath the levees. Not all 44 miles of levees will need each of these improvements. More than 80 percent of the repairs will involve the construction of slurry walls, some as deep as 130 feet. In a few select areas, seepage berms were constructed on the land side of the levee.

The levee improvement program is expected to:

- Increase public safety by providing 200-year flood protection to Biggs, Gridley, Live Oak, and most of Yuba City, and improve flood protection for the less populated areas south of Yuba City.
- Save property owners tens of millions each year in mandatory flood insurance costs by delaying or preventing FEMA floodplain mapping.
- Allow cities and counties the freedom to implement general plans, which will soon be severely restricted for any urban or urbanizing community without 200-year flood protection. This would not apply to rural communities (areas with fewer than 10,000 residents).
- Maintain the rights of property owners to make substantial improvements to property without new state or federal land use restrictions.
- Sustain and grow the local economy by creating construction jobs, protecting property values, and allowing for responsible residential, commercial and industrial development.

Levee repairs will be completed in two separate phases:

- The Feather River West Levee Project I included work from Thermalito Afterbay to Star Bend, just south of Yuba City, and was completed at the end of 2017 (includes emergency repairs to 2.9 miles of levee adjacent to Yuba City).
- Project II will include the area south of Star Bend to the confluence of the Feather River and the Sutter Bypass. Project II work includes the Laurel Avenue Repair Project, which was completed in 2017, and the USACE's Sutter Basin Project (Cypress Avenue to Tudor Road) which will begin construction in May 2019.

Project Cost

The most recent cost estimate – $378 million – reflects the combined costs of the Feather River West Levee Project I, which is nearly completed, and Project II work. This estimate will continue to be refined as the projects move toward completion. To date, the State is expected to pay as much as 78 percent of the costs for Project I. Property assessment revenues (approved by property owners in June 2010) will be used to pay the remaining share. As of January 2019, the State has committed $226.8 million toward the design and construction of Project I. In addition, the State committed up to $4.2 million for emergency measures to address flooding in February 2017. SBFCA recently completed Laurel Avenue Repair Project at a cost of $11.15 million with the State funding $9.5 million of these costs. In addition, SBFCA has secured State and Federal Funding for the Sutter Basin Levee Improvement Project (Feather River West Levee between Cypress and Tudor). The Total Project is expected to cost $77 million with the Federal Government funding approximately $50 million and the State funding approximately $18.9 million. Assessment revenues will fund the remainder.

Oroville Wildlife Area Flood Risk Reduction Project

SBFCA is entering the second year of construction of the Oroville Wildlife Area Flood Stage Reduction (FSR) Project, which is located between the Thermalito Afterbay and State Route (SR) 70 in Butte County. The OWA FSR Project is a multi-benefit project featuring flood control, ecosystem restoration and recreation improvements. When high flows occur in the Feather River, water is diverted from the main channel into the OWA via an existing system of inflow and outflow weirs. The OWA FSR Project will augment the existing system of inflow and outflow weirs to safely divert additional floodwaters through the OWA and reduce flood stages within the main channel. The improvements will reduce flood stages, improve State Water Project operations, reconnect the Feather River to its historic floodplain, provide more frequently inundated floodplain rearing habitat for juvenile salmonids, and improve drainage and fish stranding conditions. The project also incorporates invasive species removal, new riparian restoration plantings, and construction of new recreational footbridges and grading work to provide improved river access, public parking, and site access improvements. Work was completed in 2019. Current restoration monitoring, major construction completed.

Sutter Basin Flood Risk Management Project

In May 2019, repairs will begin on the US Army Corps of Engineers' (USACE) Sutter Basin Project, which involves repairs to nearly five miles of critically deficient Feather River west levee between Tudor Road and Cypress Avenue in south Sutter County. Repairs will include the installation of cutoff walls as deep as 140 feet into the existing levee. Construction is expected to last two construction seasons and is being managed by the USACE.

In advance of the federal portion of the project, SBFCA completed repairs on 36 miles of Feather River west levee from Thermalito Afterbay south to Star Bend (locally known as the Feather River West Levee Project 1), along with nearly 1 mile adjacent to Laurel Avenue. Preceding that work, Levee District 1 constructed a new .63 mile-long setback levee at Star Bend. The Sutter Basin Project will augment these repairs by tying into the Star Bend Setback in the north and the Laurel Avenue repair in the south. Notably, the project will replace a temporary seepage berm north of Laurel Avenue that SBFCA constructed as an emergency repair following the early 2017 storms and Oroville Spillway incident.

Funding for the $77 million project is largely made possible through an appropriation in the USACE's 2018 Work Plan. That document authorized a 65 percent federal cost share for the project, up to a maximum of $50 million. The remaining 35 percent cost share is to be split between the state and SBFCA, with the state paying up to 70 percent of that 35 percent.

Star Bend Setback Levee and Habitat Enhancement Project

The Star Bend Setback Levee was constructed in 2009 by Levee District 1 in advance of SBFCA's flood risk reduction projects. The 3,300 foot-long levee, which provides both flood risk reduction and environmental benefits, was later integrated into SBFCA's Feather River West Levee Project 1. The levee begins at the intersection of Star Bend Road and the Feather River levee (Levee Mile 4.50) and continues south to the approximate intersection of Tudor Road and the Feather River levee (Levee Mile 3.75). It was designed to provide 200-year flood protection. Levee project has been completed and the habitat

enhancement is a mitigation site for the valley elderberry bush, longhorn beetle is still in process (conservation easement and management plan and company in place to manage long-term).

Feather River Regional Floodplain Management Planning

The Sutter Butte Flood Control Agency is partnering with Three Rivers Levee Improvement Authority (TRLIA), Yuba Water Agency, Marysville Levee Commission, and Reclamation District 1001 on an update to the Feather River Regional Flood Management Plan (RFMP). In addition to these primary partner agencies representatives of several key local levee maintaining agencies, including Levee District 1 and 9 in Sutter County, are involved. TRLIA has been identified as the lead agency for the State contract and will work in close conjunction with these partner agencies and other stakeholders to advance the flood management priorities of the Region while at the same time collaborating with the State as they develop the 2022 Central Valley Flood Protection Plan (CVFPP) Update.

With adoption of the CVFPP 2017 Update, regional flood management planning efforts will now shift to supporting Plan implementation. One key issue identified in the 2017 CVFPP update was the need for adequate operations, maintenance, repair, rehabilitation & replacement (OMRR&R) of State Plan of Flood Control (SPFC) facilities. The State has begun making significant investments in the SPFC with general funds and bond funding, including programs like the Deferred Maintenance (DMP) and Flood Maintenance Assistance (FMAP) programs. The active participation of the Region will be key in directing these investments to the Feather River Region and ensuring that these investments occur efficiently and maximize flood risk reduction benefits.

The RFMP will help advance the necessary planning efforts that are needed for addressing critical repairs along the Sutter Bypass East Levee. Additionally, there is an opportunity as part of the RFMP to implement the Feather River Corridor Management Plan to support long-term OMRR&R of the channels in ways that improve and promote ecosystem benefits. The Region has also started developing a Corridor Management Plan along the Bear River and has an opportunity to complete similar plans on the Cherokee Canal and Yuba River. Additional efforts will include advancing options for more efficient Regional flood management governance and improvements to emergency operations and response activities in the region. This project is ongoing.

Sediment Removal Project

In February of 2020, Sutter Butte Flood Control Agency (SBFCA) received a $5M grant from the California Natural Resources Agency (CNRA) under the California River Parkways Grant Program – Proposition 68 to restore access at three boat ramps located along the Feather River. The work includes the removal of sediment at the Yuba City and Star Bend boat ramp locations, and removal of sediment and invasive species at the Live Oak boat ramp location. SBFCA will be taking the lead on the project work at the Yuba City and Live Oak sites, and Yuba County will be taking the lead on the project at Star Bend.

2017 Emergency Repairs – Yuba City

In early 2017, a 2.9 mile segment of levee adjacent to the City's urban center (from approximately Gilsizer Slough south to Whiteaker Hall) showed signs of severe distress – such as seepage, sink holes and boils, and waterside erosion during winter/spring storm events and in the days following the Oroville spillway

failure. Local agencies and the State averted potential disaster by aggressive flood fighting over a period of several weeks.

SBFCA had no plans to repair this stretch of levee, because the US Army Corps of Engineers had previously installed a slurry wall within it (2000). However, the poor performance of the slurry wall led SBFCA and the State to plan an emergency repair for completion before the next flood season. The US Army Corps of Engineers and the Central Valley Flood Protection Board expedited the approval of permits required for the project, allowing construction to begin August 2, 2017. Given the scope and scale of the repairs, construction will be completed by December 1, which is one month after the start of flood season.

The majority of the $28.5 million project is being paid for by the California Department of Water Resources

Small Communities Flood Risk Reduction Feasibility Studies

On behalf of Sutter County, SBFCA is conducting two separate Small Communities Flood Risk Reduction Feasibility Studies, one for the Tudor area in south Sutter County, and the other for the town of Sutter. Which are protected by the Sutter Bypass East Levee. The studies will include a summary of known flooding issues and problems with the existing flood management systems. Ultimately, the studies will determine a preferred flood risk reduction solution, to include potential funding sources to pay for implementation. The feasibility studies are fully funded under the CA DWR's Small Community Flood Risk Reduction Program.

Sutter Butte Flood Control Agency: Flood Safety Plan (2015)

This document is the Sutter Butte Flood Control Agency's (SBFCA) Flood Safety Plan. It: (1) enhances the ongoing flood emergency response planning and preparedness activities of SBFCA and its constituent agencies; and (2) satisfies the requirements of California Water Code Section (WC Sec.) 9650, as amended by Assembly Bill (AB) 156 (2007).

This Flood Safety Plan describes SBFCA's planned response to large-scale regional flood emergencies caused by levee failure or dam failure. This type of flood event is referred to as a "flood emergency" in the remainder of this Flood Safety Plan. The plan reflects the implementation of the California Standardized Emergency Management System (SEMS). When used in conjunction with the California Emergency Plan and other local emergency plans, it will facilitate multi-agency and multi-jurisdictional coordination among SBFCA, its constituent agencies, and state agencies in flood emergency operations.

Sutter Basin Feasibility Study Floodplain Management Plan (2013)

This Floodplain Management Plan (FMP) has been developed for the Sutter Butte Flood Control Agency (SBFCA) as an in-kind contribution to the US Army Corps of Engineers (USACE) Sutter Basin Pilot Feasibility Study (SBFS). The primary focus of this FMP is to identify potential measures, practices, and policies which will reduce the impact of future residual flooding, help preserve levels of protection provided by the SBFS project, and preserve and enhance natural floodplain values. SBFCA is the local sponsor, and is responsible for verifying implementation of this FMP by its member agencies.

H.7 Mitigation Strategy

H.7.1. Mitigation Goals and Objectives

The SBFCA adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

H.7.2. Mitigation Actions

The planning team for the SBFCA identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Aquatic Invasive Species
- Climate Change
- Dam Failure
- Drought & Water Shortage
- Earthquake
- Floods: 1%/0.2% annual chance
- Floods: Localized Stormwater
- Levee Failure
- Pandemic
- Severe Weather: Extreme Cold and Freeze
- Severe Weather: Extreme Heat
- Severe Weather: Heavy Rains and Storms
- Wildfire

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement.

Multi-Hazard Actions

Action 1. Sediment and Invasive Species Removal

Hazards Addressed: Floods: 1%/0.2% annual chance; Levee Failure; Aquatic Invasive Species; Climate Change

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Sutter Bypass cannot convey its design flow at the design flood stage primarily due to excessive sedimentation and vegetation growth. The Department of Water Resources' (DWR) 2016 Flood System Status Report also found that not all Sutter Bypass levees meet freeboard requirements, that levee seepage is "particularly prevalent along the Sutter Bypass", and that the Bypass has inadequate channel conveyance capacity to convey intended flood flows. If sediment and vegetation management practices within the Feather River and Sutter Bypass do not change and necessary levee repairs are not implemented, the flood conveyance capacity of the bypass will decrease, the integrity of the existing levees will be degraded, and the flood system's resiliency will be diminished, resulting in increased flood risk and reduced public safety. Sediment and invasive species buildup in portions of the Feather River and Sutter Bypass, exacerbated by the Oroville Dam Spillway incident of 2017, has also created dangerous conditions for recreational boating users, made some boat launch facilities unusable, and has hampered public safety as it has affected emergency vessel launching capabilities.

Project Description: Remove sediment, vegetation, and invasive species within portions of the Feather River and Sutter Bypass.

Other Alternatives: N/A

Existing Planning Mechanism(s) through which Action Will Be Implemented: Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and the Sutter Bypass Comprehensive Management Plan

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $25,000,000

Benefits (Losses Avoided): Protect 95,000 people and $7 billion in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 2. Lower Feather River West Levee Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance, Floods: Localized stormwater flooding

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Lower Feather River West Levee, between the Highway 99 Bridge and confluence with the Sutter Bypass, is unimproved and does not meet current standards. This section of levee is susceptible to through and under-seepage.

Project Description: Levee improvements would consist of the installation of a seepage barrier cutoff wall, levee geometry improvements, and encroachments compliance work.

Other Alternatives: Installation of a seepage berm instead of a cutoff wall

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Feather River West Levee Project

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $25,000,000

Benefits (Losses Avoided): Protects thousands of people and hundreds of millions of dollars in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 3. Oroville Wildlife Area Multi-Benefit Improvements

Hazards Addressed: Aquatic Invasive Species, Climate Change, Floods: 1%/0.2% annual chance, Severe Weather: Heavy Rains and Storms, Extreme Heat, Extreme Cold and Freeze, Levee Failure, Drought and Water Shortage, Wildfire

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Oroville Wildlife Area (OWA) is a 12,000-acre State Wildlife Area located downstream from Oroville Dam. The area largely consists of remnant cobble and mine tailings that have separated the floodplain from the main channel of the Feather River. In addition, the area suffered further ecological damage from borrow pit operations necessary for the construction of Oroville Dam that began in 1963. To this day, the existing tailing piles and elevated berms continue to prevent flow into the overbanks of the Feather River, substantially diminishing fish and avian habitat and exacerbating flooding issues. The OWA is also heavily impacted by the presence of aquatic invasive species.

Project Description: Multi-benefit improvements will enhance and augment the many hydraulic, ecological, flood management, and recreational benefits to other OWA units as well as the larger river corridor.

Other Alternatives: N/A

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Feather River Regional Plan, Sutter Butte Flood Control Agency Strategic Plan

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $50,000,000

Benefits (Losses Avoided): The project features flood control, flood maintenance, improved sediment control, floodplain connectivity, ecological habitat, and recreational benefits.

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 4. Sutter Bypass East Levee Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Sutter Bypass functions as the central backbone of the Sacramento River Flood Control Project. The Bypass conveys overflow flood waters away from the Sacramento River at a capacity substantially greater than the river, and in doing so, protects vital infrastructure of statewide importance, thousands of acres of agricultural lands, which play a key role in California's economy. However, a 2013 hydraulic analysis found that the Sutter Bypass cannot convey its design flow at the design flood stage primarily due to excessive sedimentation and vegetation growth. The Department of Water Resources' (DWR) 2016 Flood System Status Report also found that not all Sutter Bypass levees meet freeboard requirements, that levee seepage is "particularly prevalent along the Sutter Bypass", and that the Bypass has inadequate channel conveyance capacity to convey intended flood flows. If sediment and vegetation management practices within the Sutter Bypass do not change and necessary levee repairs are not implemented, the flood conveyance capacity of the bypass will decrease, the integrity of the existing levees will be degraded, and the flood system's resiliency will be diminished, resulting in increased flood risk and reduced public safety.

Project Description: Levee improvements would consist of the installation of a seepage barrier cutoff wall.

Other Alternatives: Installation of a seepage berm instead of a cutoff wall

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Sutter Bypass Comprehensive Management Plan

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $200,000,000

Benefits (Losses Avoided): Protects thousands of people and hundreds of millions of dollars in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 5. Feather River and Sutter Bypass Erosion Repairs

Hazards Addressed: Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The levees along the Feather River and Sutter Bypass, which protect the Sutter-Butte basin from flooding, suffer from erosion following high water events.

Project Description: Erosion repairs will be implemented to address levee deficiencies and to ensure the reliability of the levee system.

Other Alternatives: N/A

Existing Planning Mechanism(s) through which Action Will Be Implemented: Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Feather River West Levee Project

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $35,000,000

Benefits (Losses Avoided): Protect 95,000 people and $7 billion in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 6. Sutter Bypass Multi-Benefit Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance, Aquatic Invasive Species, Climate Change

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Sutter Bypass is part of the State Plan of Flood Control System and performs many functions including flood risk reduction, environmental preservation, ecosystem enhancement, open space preservation, and agricultural opportunities. Improvement projects including one or more of these important functions provides benefits to the entire system.

Project Description: Multi-benefit improvements would consist of levee improvements (geotechnical, structural), sediment removal, invasive species removal, vegetation management, and environmental enhancements.

Other Alternatives: N/A

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Feather River Regional Plan, Sutter Butte Flood Control Agency Strategic Plan

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $50,000,000

Benefits (Losses Avoided): Protect 10,000 people and $2 billion in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 7. Levee Penetration and Encroachments Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The levees along the Feather River and Sutter Bypass which protect the Sutter-Butte basin from flooding contain hundreds of levee penetrations (pipes, structures) and encroachments. Many of these penetrations/encroachments have not yet been improved to current standards and could fail, which could result in levee failure.

Project Description: Levee penetration/encroachments improvements would consist of the repair or replacement of the penetrations, and possibly the modification or relocation of the encroachments to comply with current levee design standards.

Other Alternatives: Removal of the penetration or encroachment

Existing Planning Mechanism(s) through which Action Will Be Implemented: Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Feather River West Levee Project

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $2,000,000

Benefits (Losses Avoided): Protect 95,000 people and $7 billion in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 8. Dam Failure Risk Reduction

Hazards Addressed: Dam Failure, Levee Failure, Floods: 1%/0.2% annual chance

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Oroville Dam and the New Bullards Bar Dam are the primary dams of concern to the Agency. Both of these dams contribute flows into the Feather River. Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the Agency from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant.

Project Description: Project 1: Mass evacuation in advance of a dam failure would be the primary mitigation and would rely on coordinated communication with the dam owner(s) and local emergency response and public safety managers. Coordinated communication would stem from Emergency Response Training and plan preparation. Project 2: Recovery after the dam failure would consist of repairs to the flood protection system (levees, pump stations), dewatering of the floodplain, and infrastructure reconstruction.

Other Alternatives: N/A

Existing Planning Mechanism(s) through which Action Will Be Implemented: Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Flood Safety Plan

Responsible Agency/ Department/Partners: State of California, Yuba Water Agency, Sutter and Butte County, Sutter Butte Flood Control Agency

Cost Estimate: $250,000 - $150,000,000

Benefits (Losses Avoided): Protect 95,000 people and $7 billion in damageable assets

Potential Funding: FEMA, USACE, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 9. Earthquake Risk Reduction

Hazards Addressed: Earthquake, Levee Failure, Floods: 1%/0.2% annual chance

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, hazmat incidents, fires, avalanches, and landslides.

Project Description: Levee damage repairs would consist of regrading of failed levees, installation of new levee embankment material, levee geometry improvements, and encroachments repair work.

Other Alternatives: Installation of a new levee

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Feather River West Levee Project

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $10,000,000

Benefits (Losses Avoided): Protects 95,000 people and $7.1 billion in damageable assets

Potential Funding: FEMA, USACE, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 10. Levee Penetration and Encroachments Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The levees along the Feather River and Sutter Bypass which protect the Sutter-Butte basin from flooding contain hundreds of levee penetrations (pipes, structures) and encroachments. Many of these penetrations/encroachments have not yet been improved to current standards and could fail, which could result in levee failure.

Project Description: Levee penetration/encroachments improvements would consist of the repair or replacement of the penetrations, and possibly the modification or relocation of the encroachments to comply with current levee design standards.

Other Alternatives: Removal of the penetration or encroachment

Existing Planning Mechanism(s) through which Action Will Be Implemented: Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Feather River West Levee Project

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $2,000,000

Benefits (Losses Avoided): Protect 95,000 people and $7 billion in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 11. Lower Feather River West Levee Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance

Goals Addressed: 1, 2, 3, 4, 5

Issue Issue/Background: The Lower Feather River West Levee, between the Highway 99 Bridge and confluence with the Sutter Bypass, is unimproved and does not meet current standards. This section of levee is susceptible to through and under-seepage.

Project Description: Levee improvements would consist of the installation of a seepage barrier cutoff wall, levee geometry improvements, and encroachments compliance work.

Other Alternatives: Installation of a seepage berm instead of a cutoff wall

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Feather River West Levee Project

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $25,000,000

Benefits (Losses Avoided): Protects thousands of people and hundreds of millions of dollars in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

Action 12. Sutter Bypass East Levee Improvements

Hazards Addressed: Levee Failure, Floods: 1%/0.2% annual chance

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The Sutter Bypass functions as the central backbone of the Sacramento River Flood Control Project. The Bypass conveys overflow flood waters away from the Sacramento River at a capacity substantially greater than the river, and in doing so, protects vital infrastructure of statewide importance, thousands of acres of agricultural lands, which play a key role in California's economy. However, a 2013 hydraulic analysis found that the Sutter Bypass cannot convey its design flow at the design flood stage primarily due to excessive sedimentation and vegetation growth. The Department of Water Resources' (DWR) 2016 Flood System Status Report also found that not all Sutter Bypass levees meet freeboard requirements, that levee seepage is "particularly prevalent along the Sutter Bypass", and that the Bypass has inadequate channel conveyance capacity to convey intended flood flows. If sediment and vegetation management practices within the Sutter Bypass do not change and necessary levee repairs are not implemented, the flood conveyance capacity of the bypass will decrease, the integrity of the existing levees will be degraded, and the flood system's resiliency will be diminished, resulting in increased flood risk and reduced public safety.

Project Description: Levee improvements would consist of the installation of a seepage barrier cutoff wall.

Other Alternatives: Installation of a seepage berm instead of a cutoff wall

Existing Planning Mechanism(s) through which Action Will Be Implemented: Central Valley Flood Protection Plan, Feather River Regional Flood Management Plan, Sutter Butte Flood Control Agency Strategic Plan and Sutter Bypass Comprehensive Management Plan

Responsible Agency/ Department/Partners: Sutter Butte Flood Control Agency

Cost Estimate: $200,000,000

Benefits (Losses Avoided): Protects thousands of people and hundreds of millions of dollars in damageable assets

Potential Funding: FEMA, State, Local and Private Grant funding

Timeline: When funding is available

Project Priority (H, M, L): High

LOGO

Annex I Levee District 9

I.1 Introduction

This Annex details the hazard mitigation planning elements specific to Levee District 9 (LD 9 or District), a new participating jurisdiction to the 2021 Sutter County Local Hazard Mitigation Plan (LHMP) Update. This Annex is not intended to be a standalone document, but appends to and supplements the information contained in the Base Plan document. As such, all sections of the Base Plan, including the planning process and other procedural requirements apply to and were met by the District. This Annex provides additional information specific to LD 9, with a focus on providing additional details on the risk assessment and mitigation strategy for this District.

I.2 Planning Process

As described above, the District followed the planning process detailed in Chapter 3 of the Base Plan. In addition to providing representation on the Sutter County Hazard Mitigation Planning Committee (HMPC), the District formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table I-1. Additional details on plan participation and District representatives are included in Appendix A. INSERT NAMES OF WHO PARTICIPATED AND HOW

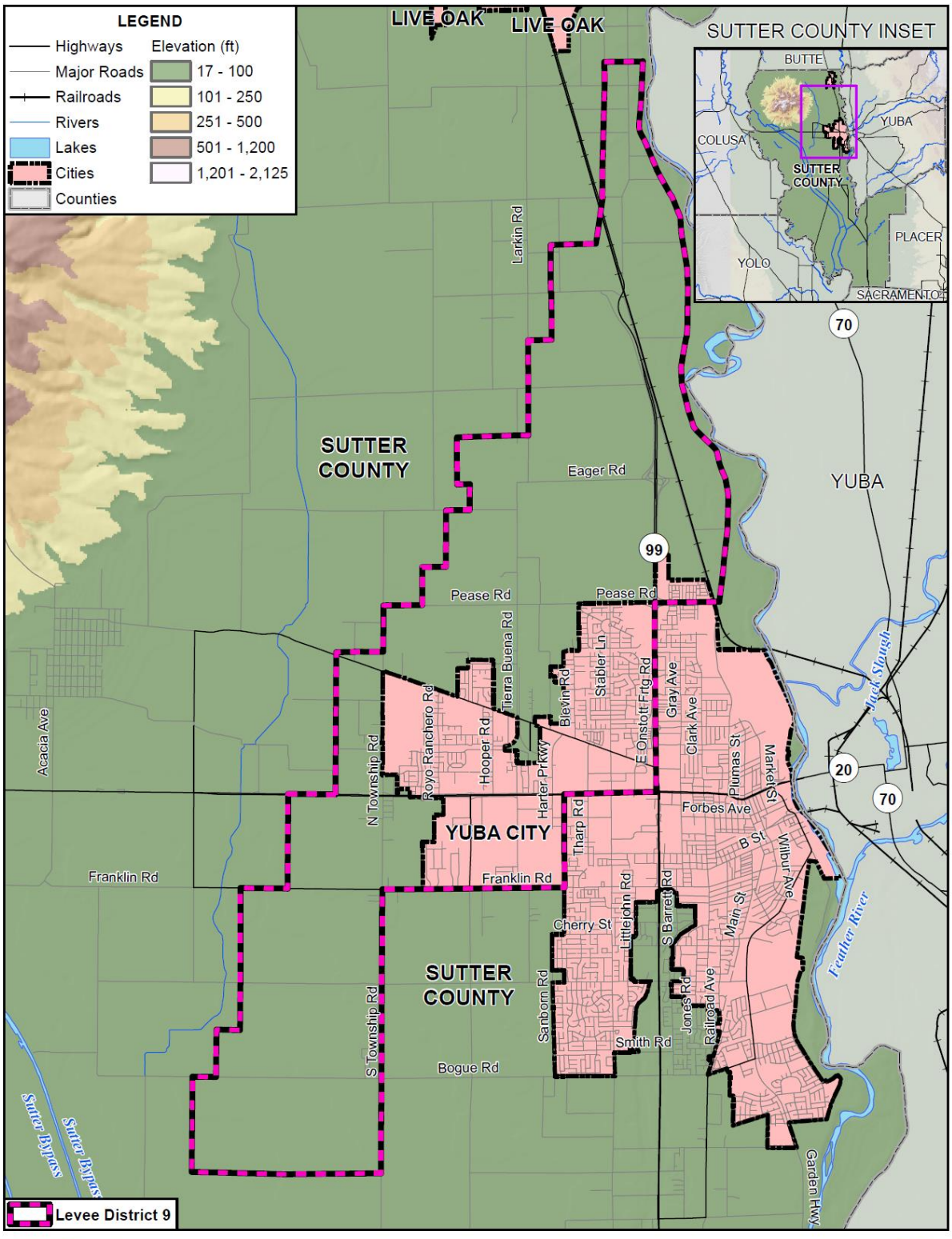
Table I-1 LD 9 – Planning Team

Name	Position/Title	How Participated

I.3 District Profile

The District profile for the LD 9 is detailed in the following sections. Figure I-1 displays a map and the location of the District within Sutter County.

Figure I-1 LD 9



Data Source: Sutter County GIS, Cal-Atlas; Map Date: 4/5/2021.

I.3.1. Overview and Background

CAN YOU PROVIDE A BACKGROUND OF THE DISTRICT? MILES OF LEVEES? OPERATIONS, ORIGIN? BUDGET? STAFF?

I.4 Hazard Identification

LD 9 identified the hazards that affect the District and summarized their location, extent, frequency of occurrence, potential magnitude, and significance specific to District (see Table I-2).

Table I-2 LD 9—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Highly Likely	Limited	Low	Medium
Climate Change	Extensive	Likely	Limited	Low	–
Dam Failure	Extensive	Occasional	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Limited	Low	High
Earthquake	Extensive	Unlikely	Catastrophic	Low	Low
Floods: 1%/0.2% annual chance	Extensive	Likely	Critical	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Limited	Medium	Medium
Levee Failure	Significant	Occasional	Catastrophic	High	Medium
Pandemic	Extensive	Likely	Critical	Low	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Limited	Low	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Low	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Limited	Low	Medium
Severe Weather: High Winds and Tornadoes	Extensive	Highly Likely	Limited	Low	High
Wildfire	Significant	Highly Likely	Critical	Low	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

I.5 Hazard Profile and Vulnerability Assessment

The intent of this section is to profile the District's hazards and assess the District's vulnerability separate from that of the Planning Area as a whole, which has already been assessed in Section 4.3 Hazard Profiles and Vulnerability Assessment in the Base Plan. The hazard profiles in the Base Plan discuss overall impacts to the Planning Area and describes the hazard problem description, hazard location and extent, magnitude/severity, previous occurrences of hazard events and the likelihood of future occurrences. Hazard profile information specific to the District is included in this Annex. This vulnerability assessment analyzes the property and other assets at risk to hazards ranked of medium or high significance specific to the District. For more information about how hazards affect the County as a whole, see Chapter 4 Risk Assessment in the Base Plan.

I.5.1. Hazard Profiles

Each hazard vulnerability assessment in Section I.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table I-2) affects the District and includes information on past hazard occurrences and the likelihood of future hazard occurrence. The intent of this section is to provide jurisdictional specific information on hazards and further describes how the hazards and risks differ across the Planning Area.

I.5.2. Vulnerability Assessment and Assets at Risk

This section identifies the District's total assets at risk, including values at risk, populations at risk, critical facilities and infrastructure, natural resources, and historic and cultural resources. Growth and development trends are also presented for the community. This data is not hazard specific, but is representative of total assets at risk within the community.

Assets at Risk and Critical Facilities

This section considers the LD 9's assets at risk, with a focus on key District assets such as critical facilities, infrastructure, and other District assets and their values. With respect to District assets, the majority of these assets are considered critical facilities as defined for this Plan. Critical facilities are defined for this Plan as:

CF DEFINITION

Table I-3 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. LD 9's physical assets, valued at over $X million, consist of the buildings and infrastructure to support the District's operations. FILL OUT TABLE WITH DISTRICT ASSETS. MAKE SURE TO FILL OUT THE FINAL COLUMN

Table I-3 LD 9 Critical Facilities, Infrastructure, and Other District Assets

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
Total		**$ 0**	

Source: PID

Natural Resources

LD 9 has a variety of natural resources of value to the District. These natural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan. DOES THE DISTRICT HAVE ANY UNIQUE NATURAL RESOURCES TO CONSIDER?

Historic and Cultural Resources

LD 9 has a variety of historic and cultural resources of value to the District. These historic and cultural resources parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan. DOES THE DISTRICT HAVE ANY UNIQUE HISTORICAL RESOURCES TO CONSIDER?

Growth and Development Trends

General growth in the District parallels that of Sutter County as a whole. Information can be found in Section 4.3.1 of the Base Plan. ANYTHING FOR THE DISTRICT TO ADD? IS THERE GROWTH OCCURRING?

Future Development

The District has no control over future development in areas the District provides water in. DOES THE DISTRICT HAVE ANY PLANS FOR DEVELOPMENT OF NEW DISTRICT FACILITIES OR IMPROVEMENTS TO EXISTING DISTRICT FACILITIES ? Future development in these areas parallels that of Sutter County. More general information on growth and development in Sutter County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sutter County Vulnerability and Assets at Risk of the Base Plan.

I.5.3. Vulnerability to Specific Hazards

This section provides the vulnerability assessment, including any quantifiable loss estimates, for those hazards identified above in Table I-2 as high or medium significance hazards. Impacts of past events and

vulnerability of the District to specific hazards are further discussed below (see Section 4.1 Hazard Identification in the Base Plan for more detailed information about these hazards and their impacts on the Sutter County Planning Area). Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

An estimate of the vulnerability of the District to each identified priority hazard, in addition to the estimate of likelihood of future occurrence, is provided in each of the hazard-specific sections that follow. Vulnerability is measured in general, qualitative terms and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential. It is categorized into the following classifications:

- **Extremely Low**—The occurrence and potential cost of damage to life and property is very minimal to nonexistent.
- **Low**—Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**—Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**—Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have occurred in the past.
- **Extremely High**—Very widespread with catastrophic impact.

Depending on the hazard and availability of data for analysis, this hazard specific vulnerability assessment also includes information on values at risk, critical facilities and infrastructure, populations at risk, and future development.

Dam Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–Extremely High

Hazard Profile and Problem Description

Dams are manmade structures built for a variety of uses including flood protection, power generation, agriculture, water supply, and recreation. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. For example, a dam may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If prolonged periods of rainfall and flooding occur that exceed the design requirements, that structure may be overtopped or fail. Overtopping is the primary cause of earthen dam failure in the United States.

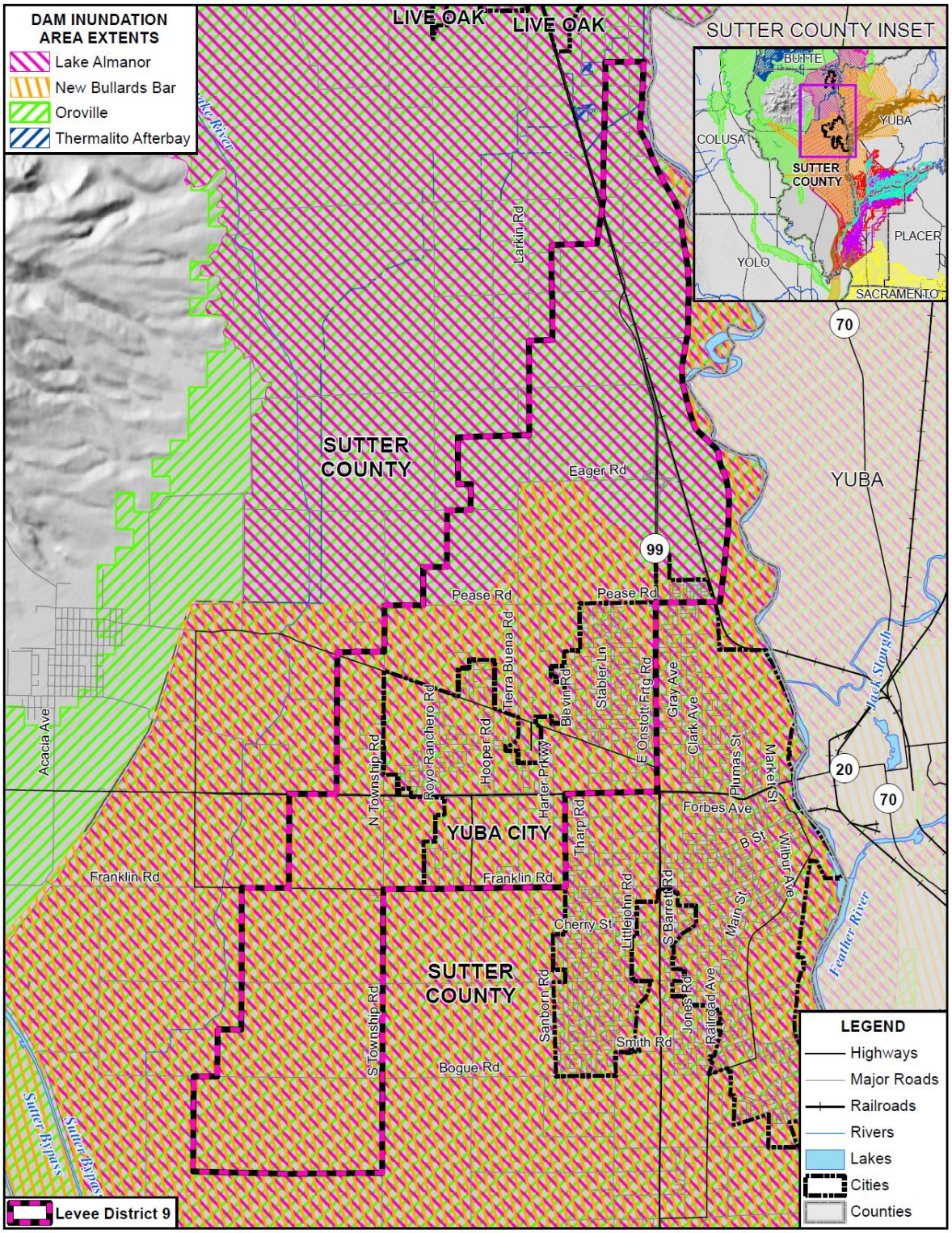
Location and Extent

Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an earthquake. There is no scale with which to measure dam failure. However, Cal DWR Division of Safety of Dams (DOSD)

assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.2.10 of the Base Plan.

While a dam may fill slowly with runoff from winter storms, a dam break has a very quick speed of onset. The duration of dam failure is generally not long – only as long as it takes to empty the reservoir of water the dam held back. The District would be affected for as long as the flood waters from the dam failure took to drain downstream. Figure I-2 shows the extremely high hazard dam inundation area that intersect LD9. No high hazard dam inundation areas intersect LD 9.

Figure I-2 LD 9 – Extremely High Hazard Dam Inundation Areas



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sutter County GIS, Cal-Atlas;
Map Date: 4/5/2021.

Past Occurrences

There has been one federal disaster declaration for dam failure in the County for the 2017 Oroville Spillway Incident. This can be seen on Table I-4.

Table I-4 Sutter County – State and Federal Disaster Declarations Summary 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Dam Failure	0	–	1	2017

Source: Cal OES, FEMA

OROVILLE IMPACTS TO DISTRICT? WERE THERE DAMAGES? MUTUAL AID?

The District noted no other dam failure occurrences that have affected the District. TRUE?

Vulnerability to and Impacts from Dam Failure

Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding. Impacts to the District from a dam failure flood include loss of life and injury, flooding and damage to property and structures, damage to critical facilities and infrastructure, loss of natural resources, and all other flood related impacts. Additionally, mass evacuations and associated economic losses can also be significant. CAN THE DISTRICT PROVIDE SPECIFIC IMPACTS TO THE LEVEES FROM A POSSIBLE DAM FAILURE?

Assets at Risk

WHAT DISTRICT ASSETS (FROM Table I-3) ARE AT RISK FROM THIS HAZARD?

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. LD 9 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD 9 facilities is properly sited and constructed.

Flood: 1%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

This hazard analyzes the FEMA DFIRM 1% and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the District, and have caused damages in the past. Flooding is a significant problem in Sutter County and the District. Historically, the District has been at risk to flooding primarily during the winter and spring months when river systems in the County swell with heavy rainfall and snowmelt runoff. Normally, storm floodwaters are kept within defined limits by a variety of storm

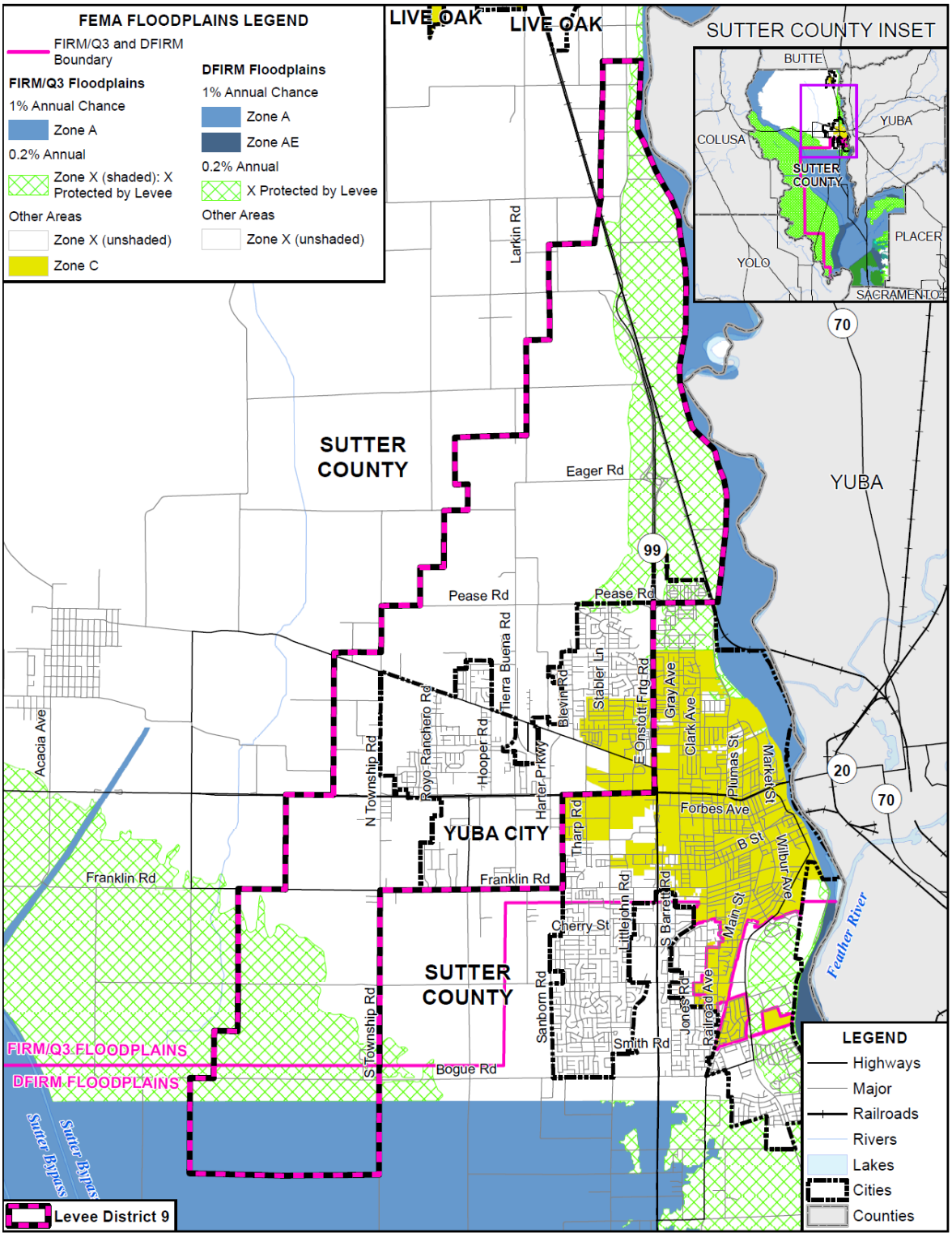
drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage.

As previously described in Section 4.2.13 of the Base Plan, the Sutter County Planning Area and the LD 9 have been subject to historical flooding. LD 9 is traversed by several stream systems and is at risk to the 1% and 0.2% flood.

Location and Extent

The LD 9 has areas located in the 1% and 0.2% annual chance floodplain. This is seen in Figure I-3.

Figure I-3 LD 9 – FEMA DFIRM Flood Zones



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas;
Map Date: 4/5/2021.

Table I-5 details the DFIRM AND Q3 mapped flood zones within the 1% annual chance flood zone as well as other flood zones located within the District.

Table I-5 LD 9– DFIRM Flood Hazard Zones

Flood Zone	Description	Present in District
DFIRM Flood Zones		
A	1% annual chance flood: No base flood elevations provided	X
AE	1% annual chance flood: Base flood elevations provided	
AH	1% annual chance flood: shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone.	
AO	1% annual chance flooding: sheet flow areas. BFEs derived from detailed hydraulic analyses are shown in this zone.	
Shaded X	500-year Flood: The areas between the limits of the 1% annual chance flood and the 0.2-percent-annual-chance (or 500-year) flood	
X Protected by Levee	Areas protected by levees from 1% annual chance flood event. Levee protection places these areas in the 0.2% annual chance flood zone.	X
X (unshaded)	No flood hazard	X
Q3 Flood Zones		
A	100-year Flood: No base flood elevations provided	X
AE	100-year Flood: Base flood elevations provided	
AH	100-year Flood: Shallow flooding, base flood depths provided	
AO	100-year Flood: Sheet flow areas, base flood depths provided	
A99	To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.	
X (shaded)	500-year Flood: Areas protected by levees from 1% annual chance	X
X (unshaded)	No flood hazard	X
Zone C	Areas of minimal flood hazard (from old paper maps). No base flood elevations provided.	X

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the District vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the District tends to have a shorter speed of onset, due to the amount of water that flows through the District.

Past Occurrences

A list of state and federal disaster declarations for Sutter County from flooding is shown on Table I-6. These events also likely affected the District to some degree.

Table I-6 Sutter County – State and Federal Disaster Declarations from Flood 1950-2020

Disaster Type	Federal Declarations		State Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	20	1950, 1955, 1957, 1958 (twice), 1959, 1962, 1963, 1964, 1970, 1972, 1973, 1983, 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	15	1955, 1958, 1962, 1964, 1970, 1983, 1986, 1995 (twice), 1997, 1998, 2005/2006, 2008, 2017 (twice)

Source: Cal OES, FEMA

The District noted that there were some damages sustained in the early 2017 high water event. A high-water event in January and February of 2017 were caused due to atmospheric rivers compounded with high reservoir releases from Oroville Dam (failing spillway) impacted systems along the Feather River, Sutter Bypass, and Sacramento River. Water logging of orchards adjacent to the Feather River (e.g. walnut) occurred. There were impacts to the agriculture sector; evacuation closed businesses. Roads in the District were closed due to flooding or evacuation routing; schools were closed during the evacuation. The District had some erosion and seepage issues. Local and federal declarations for eligible applicants for Disasters DR-4301, DR-4308. CA DWR addressed sites they deemed "serious." USACE PL84-99 assisted levee maintaining agencies that were eligible under this program (including eligibility via a Letter of Intent).

Vulnerability to and Impacts from Flood

Floods have been a part of the District's historical past and will continue to be so in the future. During winter months, long periods of precipitation and the timing of that precipitation are critical in determining the threat of flood, and these characteristics further dictate the potential for widespread structural and property damages. Predominantly, the effects of flooding are generally confined to areas near the waterways of the County. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat. This threatens structures in the floodplain. Structures can also be damaged from trees falling as a result of water-saturated soils. Electrical power outages happen, and the interruption of power causes major problems. Loss of power is usually a precursor to closure of governmental offices and community businesses. Roads can be damaged and closed, causing safety and evacuation issues. People may be swept away in floodwaters, causing injuries or deaths.

Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Floods can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Floods can be extremely dangerous, and even six inches of moving water can knock over a person given a strong current. During a flood, people can also suffer heart attacks or electrocution due to electrical equipment short outs. Floodwaters can transport large objects downstream which can damage or remove stationary structures. Ground saturation can result in instability, collapse, or other damage. Objects can also be buried or destroyed through sediment deposition. Floodwaters can also break utility lines and interrupt services. Standing water can cause damage to crops, roads, foundations, and electrical circuits. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, loss of environmental resources, and economic impacts.

CAN THE DISTRICT PROVIDE SPECIFIC ISSUES/CONCERNS TO THE DISTRICT RELATED TO LARGE FLOOD EVENTS?

Assets at Risk

WHAT DISTRICT ASSETS (FROM Table I-3) ARE AT RISK FROM THIS HAZARD?

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. LD 9 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD 9 facilities is properly sited and constructed.

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Flooding occurs in areas other than the FEMA mapped 1% and 0.2% annual chance floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate maintenance. Localized, stormwater flooding occurs throughout the County during the rainy season from November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration.

Location and Extent

LD 9 is subject to localized flooding throughout the District. Flood extents are usually measured in areas affected, velocity of flooding, and depths of flooding. Expected flood depths in the District vary by location. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Localized flooding in the District tends to have a shorter speed of onset, especially when antecedent rainfall has soaked the ground and reduced its capacity to absorb additional moisture.

The District tracks localized flooding areas. Affected localized flood areas identified by LD 9 are summarized in Table I-7. FILL OUT TABLE

Table I-7 LD 9 – List of Localized Flooding Problem Areas

Area Name	Flooding	Pavement Deterioration	Washout	High Water	Landslide/ Mudslide	Debris	Downed Trees

Area Name	Flooding	Pavement Deterioration	Washout	High Water	Landslide/ Mudslide	Debris	Downed Trees

Source: LD 9

Past Occurrences

The District noted the following past occurrences of localized flooding:

- INSERT

Vulnerability to and Impacts from Localized Flooding

Historically, much of the growth in the District and County has occurred adjacent to streams, resulting in significant damages to property, and losses from disruption of community activities when the streams overflow. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff.

Primary concerns associated with stormwater flooding include impacts to infrastructure that provides a means of ingress and egress throughout the community. Ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Objects can also be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt services. Standing water can cause damage to crops, roads, and foundations. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards. CAN THE DISTRICT PROVIDE A THEIR IMPACTS/CONCERNS ASSOCIATED WITH LOCALIZED FLOODING?

Assets at Risk

WHAT DISTRICT ASSETS (FROM Table I-3) ARE AT RISK FROM THIS HAZARD?

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. LD 9 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD 9 facilities is properly sited and constructed.

Levee Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–High

Hazard Profile and Problem Description

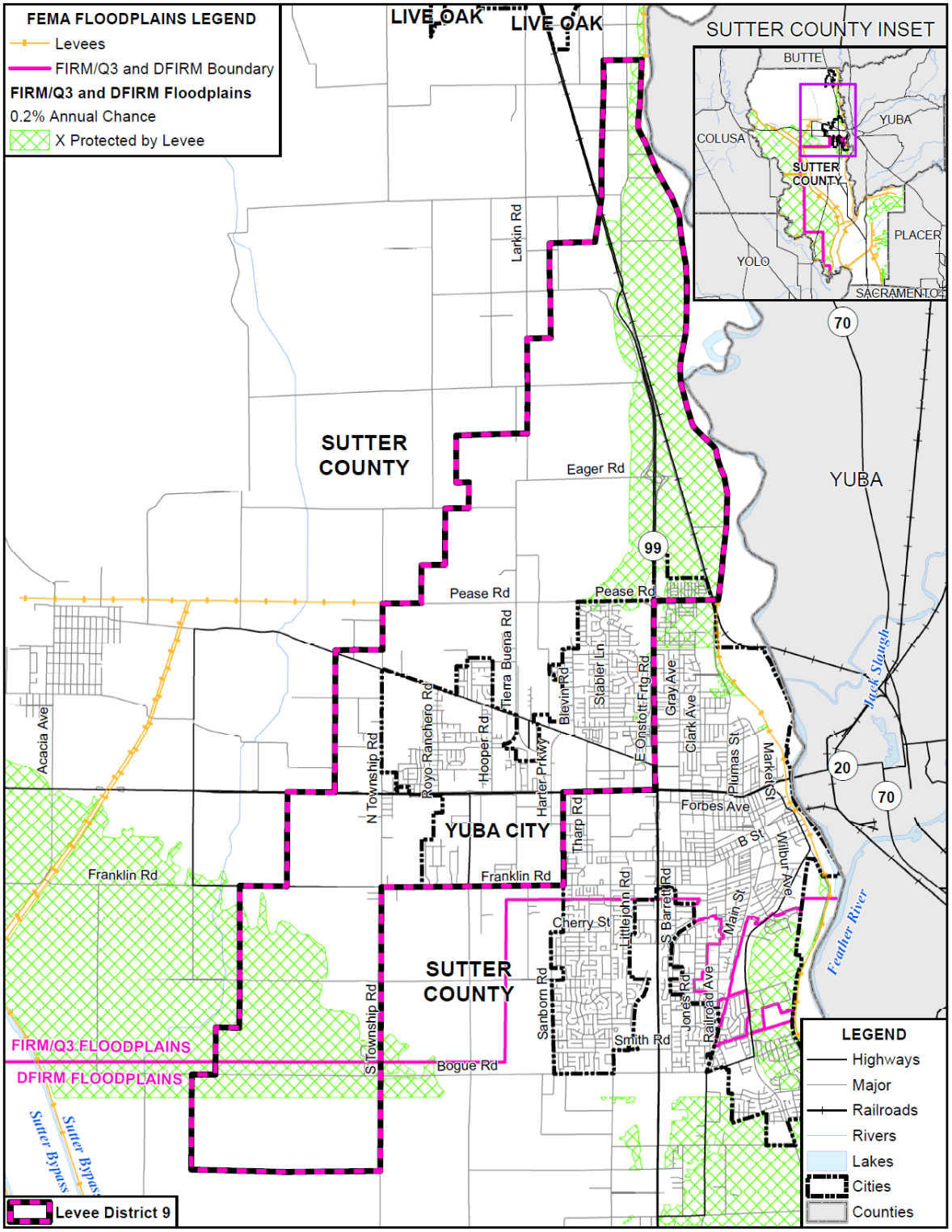
A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be natural or man-made.

Levees provide strong flood protection, but they are not failsafe. Levees are designed to protect against a specific flood level and could be overtopped during severe weather events or dam failure. For example, levees can be certified to provide protection against the 1% annual chance flood. Levees reduce, not eliminate, the risk to individuals and structures located behind them. A levee system failure or overtopping can create severe flooding and high water velocities. Levee failure can occur through overtopping or from seepage issues resulting from burrowing rodents, general erosion, excessive vegetation and root systems and other factors that compromise the integrity of the levee. No levee provides protection from events for which it was not designed, and proper operation and maintenance are necessary to reduce the probability of failure.

Location and Extent

There is not a scientific scale or measurement system in place for levee failure. Expected flood depths from a levee failure in the District are not known. The speed of onset is slow as the river rises, but if a levee fails the warning times are generally short for those in the inundation area. The duration of levee failure risk times can be hours to weeks, depending on the river flows that the levee holds back. The HMPC noted that when northern California reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees. Levee protected areas in the District are shown on Figure I-4. CAN THE DISTRICT PROVIDE A MAP OF THE DISTRICT LEVEES AND PROVIDE INFORMATION ON THE CURRENT LOP? IT WOULD ALSO BE HELPFUL TO KNOW WHAT LEVEE IMPROVEMENT PROJECTS ARE ONGOING AND WHAT LOP WILL EVENTUALLY BE IN PLACE.

Figure I-4 LD 9 – Levee Protected Areas



Data Source: Sutter County Flood Data (FIRM/Q3 4/5/1988 and DFIRM 6/16/2015), Sutter County GIS, Cal-Atlas;
Map Date: 4/5/2021.

Past Occurrences

HAS THE DISTRICT EVER EXPERIENCED ANY LEVEE FAILURES? INCLUDE INFORMATION ON DATES, DAMAGES, ETC. INCLUDE A NARRATIVE HERE ON OTHER TYPES OF PAST LEVEE ISSUES OR NEAR LEVEE FAILURE EVENTS.

Vulnerability to and Impacts from Levee Failure

A levee failure can range from a small, uncontrolled release to a catastrophic failure. Levee failure flooding can occur as the result of prolonged rainfall and flooding. The primary danger associated with levee failure is the high velocity flooding of those properties outside and downstream of the breach.

Should a levee fail, some or all of the area protected by the levees would be at risk to flooding. Impacts from a levee failure include property damage, critical facility damage, and life safety issues. Business and economic losses could be large as facilities could be flooded and services interrupted. School and road closures could occur. Road closures would impede both evacuation routes and ability of first responders to quickly respond to calls for aid. Other problems connected with levee failure flooding include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

CAN THE DISTRICT PROVIDE SPECIFIC VULNERABILITES AND IMPACTS TO DISTRICT FACILITIES ASSOCIATED WITH A LEVEE FAILURE. ALSO INCLUDE INFORMATION ON ISSUES/CONCERNS SUCH AS EROSION, RODENTS, SEEPAGE, ETC?

Assets at Risk

WHAT DISTRICT ASSETS (FROM Table I-3) ARE AT RISK FROM THIS HAZARD?

Future Development

General growth and development in the Sutter County Planning Area is under the purview of the County and Cities. LD 9 will continue to work with Sutter County and Yuba City in the future to ensure that any future development of LD 9 facilities is properly sited and constructed.

I.6 Capability Assessment

Capabilities are the programs and policies currently in use to reduce hazard impacts or that could be used to implement hazard mitigation activities. This capabilities assessment is divided into five sections: regulatory mitigation capabilities, administrative and technical mitigation capabilities, fiscal mitigation capabilities, mitigation education, outreach, and partnerships, and other mitigation efforts.

I.6.1. Regulatory Mitigation Capabilities

Table I-8 lists regulatory mitigation capabilities, including planning and land management tools, typically used by local jurisdictions to implement hazard mitigation activities and indicates those that are in place in the LD 9. FILL OUT TABLE. MUCH WILL NOT APPLY TO THE DISTRICT. JUST FILL OUT THE AREAS THAT DO. MAKE SURE TO FILL OUT THE LAST CELL.

Table I-8 LD 9 Regulatory Mitigation Capabilities

Plans	Y/N Year	Does the plan/program address hazards? Does the plan identify projects to include in the mitigation strategy? Can the plan be used to implement mitigation actions?
Comprehensive/Master Plan/General Plan		
Capital Improvements Plan		
Economic Development Plan		
Local Emergency Operations Plan		
Continuity of Operations Plan		
Transportation Plan		
Stormwater Management Plan/Program		
Engineering Studies for Streams		
Community Wildfire Protection Plan		
Other special plans (e.g., brownfields redevelopment, disaster recovery, coastal zone management, climate change adaptation)		
Building Code, Permitting, and Inspections	**Y/N**	**Are codes adequately enforced?**
Building Code		Version/Year:
Building Code Effectiveness Grading Schedule (BCEGS) Score		Score:
Fire department ISO rating:		Rating:
Site plan review requirements		
Land Use Planning and Ordinances	**Y/N**	**Is the ordinance an effective measure for reducing hazard impacts? Is the ordinance adequately administered and enforced?**
Zoning ordinance		
Subdivision ordinance		
Floodplain ordinance		
Natural hazard specific ordinance (stormwater, steep slope, wildfire)		
Flood insurance rate maps		
Elevation Certificates		
Acquisition of land for open space and public recreation uses		
Erosion or sediment control program		
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: LD 9

ANY MITIGATION RELATED PLANS? CAN WE GET COPIES?

I.6.2. Administrative/Technical Mitigation Capabilities

Table I-9 identifies the District department(s) responsible for activities related to mitigation and loss prevention in LD 9. FILL OUT TABLE. MUCH WILL NOT APPLY TO THE DISTRICT. JUST FILL OUT THE AREAS THAT DO. MAKE SURE TO FILL OUT THE LAST CELL.

Table I-9 LD 9's Administrative and Technical Mitigation Capabilities

Administration	Y/N	Describe capability Is coordination effective?
Planning Commission		
Mitigation Planning Committee		
Maintenance programs to reduce risk (e.g., tree trimming, clearing drainage systems)		
Mutual aid agreements		
Other		
Staff	**Y/N FT/PT**	**Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?**
Chief Building Official		
Floodplain Administrator		
Emergency Manager		
Community Planner		
Civil Engineer		
GIS Coordinator		
Other		
Technical		
Warning systems/services (Reverse 911, outdoor warning signals)		
Hazard data and information		
Grant writing		
Hazus analysis		
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: LD 9

I.6.3. Fiscal Mitigation Capabilities

Table I-10 identifies financial tools or resources that the District could potentially use to help fund mitigation activities. FILL OUT TABLE. MUCH WILL NOT APPLY TO THE DISTRICT. JUST FILL OUT THE AREAS THAT DO. MAKE SURE TO FILL OUT THE LAST CELL.

Table I-10 LD 9's Fiscal Mitigation Capabilities

Funding Resource	Access/ Eligibility (Y/N)	Has the funding resource been used in past and for what type of activities? Could the resource be used to fund future mitigation actions?
Capital improvements project funding		
Authority to levy taxes for specific purposes		
Fees for water, sewer, gas, or electric services		
Impact fees for new development		
Storm water utility fee		
Incur debt through general obligation bonds and/or special tax bonds		
Incur debt through private activities		
Community Development Block Grant		
Other federal funding programs		
State funding programs		
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: LD 9

I.6.4. Mitigation Education, Outreach, and Partnerships

Table I-11 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information. FILL OUT TABLE. MUCH WILL NOT APPLY TO THE DISTRICT. JUST FILL OUT THE AREAS THAT DO. MAKE SURE TO FILL OUT THE LAST CELL.

Table I-11 LD 9's Mitigation Education, Outreach, and Partnerships

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.		

Program/Organization	Yes/No	Describe program/organization and how relates to disaster resilience and mitigation. Could the program/organization help implement future mitigation activities?
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)		
Natural disaster or safety related school programs		
StormReady certification		
Firewise Communities certification		
Public-private partnership initiatives addressing disaster-related issues		
Other		
How can these capabilities be expanded and improved to reduce risk?		
PROVIDE SPECIFIC DETAILS OF AREAS FOR IMPROVEMENT OF THESE TYPES OF CAPABILITIES AND HOW/WHY IT WILL HELP THE DISTRICT		

Source: LD 9

I.6.5. Other Mitigation Efforts

The District has many other completed or ongoing mitigation efforts that include the following:

- ANYTHING NOT CAPTURED ABOVE? PROVIDE A LIST OF MITIGATION PROJECTS/ACTIVITIES IMPLEMENTED BY THE DISTRICT, INCLUDE INFORMATION ON ANNUAL O&M EFFORTS.

I.7 Mitigation Strategy

I.7.1. Mitigation Goals and Objectives

The LD 9 adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

I.7.2. Mitigation Actions

The planning team for the LD 9 identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Dam Failure
- Floods: 1%/0.2% annual chance
- Levee Failure

It should be noted that many of the projects submitted by each jurisdiction in Table 5-4 in the Base Plan benefit all jurisdictions whether or not they are the lead agency. Further, many of these mitigation efforts are collaborative efforts among multiple local, state, and federal agencies. In addition, the countywide public outreach action, as well as many of the emergency services actions, apply to all hazards regardless of hazard priority. Collectively, this multi-jurisdictional mitigation strategy includes only those actions and projects which reflect the actual priorities and capacity of each jurisdiction to implement over the next 5-years covered by this plan. It should further be noted, that although a jurisdiction may not have specific projects identified for each priority hazard for the five year coverage of this planning process, each jurisdiction has focused on identifying those projects which are realistic and reasonable for them to implement and would like to preserve their hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement.

Multi-Hazard Actions

Action 1. Access Control

Hazards Addressed: Dam Failure, Flood: 1%/0.5%/0.2% Annual Chance, Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: The LD1 and LD9 levee segments along the west bank of the Feather River protect a large portion of Sutter County's population, including City of Live Oak and the City of Yuba City, as well as high-value agricultural land.

Unauthorized camping on and near levees, ramps, maintenance roads, channel bank, etc. make it a significant challenge for Levee District personnel to perform critical maintenance activities (as required by the USACE and DWR), levee patrols, emergency flood fight activity, repairs, etc. In addition, unauthorized pedestrian and vehicle access damage the levee slopes that require significant resources for the Districts' to address. This is often compounded with the additional challenge of physically accessing the sites due uncontrolled unauthorized citizen and camping access blocking access to levee sites.

The compounded effects of uncontrolled access could leave the levee and it's system features vulnerable to more damage under highwater conditions, extended dry periods, and (if left unattended) potentially compromise the integrity of the levee.

Project Description: The project proposes to further characterize the best method(s) to control access to, on, and within the levee, ramps, maintenance roads, etc. This could include but is not limited to: additional gates, fencing, signage, partnerships with local enforcement agencies, etc.

Other Alternatives: Fencing place at the toe of the levee

Existing Planning Mechanism(s) through which Action Will Be Implemented: District currently budgets an amount each to address this issue. Current budget only allows for approximately 1 mile per year. Total levee miles are 22.36

Responsible Agency/ Department/Partners: Sutter County, City of Yuba City Levee District No.1 of Sutter County, Levee District No.9

Cost Estimate: $2 million

Benefits (Losses Avoided): Comprising the integrity of the levee which in protects 78,000 people and 10 billion in assets.

Potential Funding: Potential cost share with Levee Districts

Timeline: 2-3 years

Project Priority (H, M, L): High

Action 2. Erosion Mitigation at Levee District 9

Hazards Addressed: Dam Failure, Flood: 1%/0.5%/0.2% Annual Chance, Levee Failure

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Various locations, not already addressed by recent improvements, impacting the LD9 levee are susceptible to erosion at locations where the river takes an abrupt turn during high water events in the Feather River. In particular, eddies (turning or spinning water at a location) remove channel material and are within the levee prism. Additional sites may be revealed as a result of future high-water events.

Erosion is caused by forces induced by the high flow of water within a river or channel that cause embankment material to shear off. These sites are generally worse at locations where the river makes an abrupt turn or bend. These flows can erode a channel bank and approach the levee, or undermine other flood control structures and cause them to cave into the water. Bank caving or stream bank erosion can be a very serious threat to the stability of the levee. At these specific locations, the river or stream bank erosion has been observed to be moving in the direction of a levee, making fortification of the embankment and levee a need. Because erosion occur underwaters, levee patrols are often unable to see new issue developing or worsening, making it a challenge to respond to erosion during a flood event. Often is not truly seen until after sloughing occurs or waters recede. Therefore, implementing mitigation measures ahead of a flood is critical.

If erosion ultimately causes a levee failure at the project sites (immediately upstream of the City of Yuba City), floodwaters would flow southwest and impact the City of Yuba City, then impound against the levee along the Sutter Bypass or south end of the Feather River, and could produce flood depths exceeding 15-ft.

Project Description: The project seeks to reduce the threat of levee damage and potential failure induced by erosive forces. Fortification of the embankment and LD9 levees along the Feather River serves to protect critical evacuation and emergency transport routes, life, and property in Sutter County, Yuba City, and the City of Live Oak.

The project proposes to further characterize the erosion issue and implement the best erosion mitigation strategy. This includes fortifying the levees by scarifying the material and backfilling with higher quality, compacted, levee material. Since erosion is typically a reoccurring issue, the project should also include reseeding the levee slopes, and installing rock slope protection along the channel embankment. In extreme cases, where erosion persists this may also consider a setback levee.

Other Alternatives: None

Existing Planning Mechanism(s) through which Action Will Be Implemented: System Wide Improvement Framework under the USACE's PL 84-99 program (if eligible), ongoing maintenance, and emergency response

Responsible Agency/ Department/Partners: Levee District 9 / Sutter Butter Flood Control Agency

Cost Estimate: $ 30M

Benefits (Losses Avoided):

Potential Funding: FEMA grant program (HMGP, BRIC, etc.), State DWR programs such as Flood System Repair Program (FSRP)

Timeline: 36 months

Project Priority (H, M, L): High

Appendix A Planning Process

TO BE COMPLETED AT END OF PROCESS

A.1 Sutter County Step 1: Organize to Prepare a Plan

A.2 Sutter County Step 2: Involve the Public

A.3 Sutter County Step 3: Coordinate

A.4 Meeting Handouts

Appendix B References

DOUBLE CHECK ANNEX REFERENCES AT END

2013 Sutter County LHMP

2013-2021 Sutter County Housing Element

2018 State of California Hazard Mitigation Plan

ArkStorm at Tahoe - Stakeholder Perspectives on Vulnerabilities and Preparedness for an Extreme Storm Event in the Greater Lake Tahoe, Reno and Carson City Region. 2014.

Bureau of Land Management

CA DWR Best Available Maps

CA DWR Division of Safety of Dams

CA DWR Special Populations and Disadvantaged Community Mapping

Cal Adapt – Extended Drought Scenarios

CAL FIRE GIS datasets

Cal OES

Cal-Adapt

Cal-Adapt – Annual Average of Acres Burned

Cal-Adapt – Number of Extreme Heat Days by Year

Cal-Adapt – Precipitation: Decadal Averages Map

CalAtlas

California Adaptation Planning Guide

California Climate Adaptation Strategy (CAS) – 2014

California Department of Finance

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California Department of Fish and Game

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California Department of Water Resources (CA DWR) Division of Safety of Dams

California Department of Water Resources Best Available Maps

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California Office of Emergency Services – Dam Inundation Data

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California's Drought of 2007-2009, An Overview. State of California Natural Resources Agency, California Department of Water Resources.

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Climate Change and Health Profile Report – Sutter County

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County staff

Existing plans and studies

FEMA

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FEMA's HAZUS-MH 4.2 GIS-based inventory data

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HMPC input

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IPCC Fifth Assessment Synthesis Report (2014)

Kenward, Alyson PhD, Adams-Smith, Dennis, and Raja, Urooj. Wildfires and Air Pollution – The Hidden Health Hazards of Climate Change. Climate Central. 2013.

Levees in History: The Levee Challenge. Dr. Gerald E. Galloway, Jr., P.E., Ph.D., Water Policy Collaborative, University of Maryland, Visiting Scholar, USACE, IWR.

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Multi-Hazard Identification and Risk Assessment, FEMA 1997

National Drought Mitigation Center

National Drought Mitigation Center – Drought Impact Reporter

National Integrated Drought Information System

National Levee Database

National Institute of Building Science Multi-Hazard Mitigation Council 2019 Report

National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) Storm Events Database

National Oceanic and Atmospheric Administration's National Climatic Data Center

National Weather Service

Natural Resource and Conservation Service

NOAA Storm Prediction Center

Pacific Gas and Electric Company

Personal interviews with planning team members and staff from the County

Proceedings of the National Academy of Sciences

Public Health Alliance of Southern California

Public Policy Institute of California

Science Magazine

State of California Department of Conservation

State of California Department of Conservation Farmland Mapping and Monitoring Program

Statewide GIS datasets from other agencies such as Cal OES, FEMA, USGS, CGS, Cal Atlas, and others

Sutter County 2020 Assessor/Parcel Data

Sutter County 2030 General Plan Land Use Element

Sutter County Climate Action Plan – 2010

Sutter County Economic Development Department

Sutter County General Plan (2011)

Sutter County General Plan Technical Background Report (2008)

Sutter County GIS

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U.S. Census Bureau 2010 Household Population Estimates

U.S. Fish and Wildlife Service

U.S. Fish and Wildlife Service's National Wetlands Inventory maps

U.S. Forest Service GIS datasets

U.S. Geological Survey

U.S. Occupational Safety and Health Administration

United States Geological Survey Open File Report 2015-3009

University of California

US Army Corps of Engineers

US Census Bureau

US Department of Agriculture

US Farm Service Agency

US Fish and Wildlife Service

US Fish and Wildlife Service

USDA Forest Service Region 5

USGS Bulletin 1847

USGS National Earthquake Information Center

USGS Publication 2014-3120

Vaisala National Lightning Detection Network

Western Regional Climate Center

World Health Organization

Written descriptions of inventory and risks provided by Sutter County

Appendix C Mitigation Strategy

Sutter County
Local Hazard Mitigation Plan Update
HMPC Meetings #3 & 4 - Mitigation Strategy
January 13 & 20, 2021

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AGENDA

Sutter County
Local Hazard Mitigation Plan (LHMP) Update
HMPC Meetings #3 & #4 - Mitigation Strategy
January 13 & 20, 2021

HMPC Meeting #3:

1. Introductions
2. Status of the DMA Planning Process
3. Risk Assessment and Annex Status
4. Develop Plan Goals and Objectives
5. Introduction to Day 2: Mitigation Alternatives/Actions/Projects

HMPC Meeting #4:

1. Introductions
2. Review Mitigation Selection Criteria
3. Identify and discuss Mitigation Alternatives/Actions/Projects
4. Prioritize Mitigation Projects
5. Review of Schedule/Data Needs

Mitigation Strategy Meetings
January 13 & 20, 2021
Day 1

Sutter County Hazard Identification & Profiles

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Aquatic Invasive Species	Limited	Highly Likely	Limited	Low	Low
Climate Change	Extensive	Likely	Limited	Medium	--
Dam Failure	Extensive	Occasional	Critical	High	Medium
Drought & Water shortage	Extensive	Likely	Limited	High	High
Earthquake	Extensive	Unlikely	Catastrophic	Medium	Low
Floods: 1%/0.5%/0.2% annual chance	Extensive	Likely	Critical	High	Medium
Floods: Localized Stormwater	Significant	Highly Likely	Limited	Medium	Medium
Levee Failure	Significant	Occasional	Catastrophic	Medium	Medium
Pandemic	Extensive	Likely	Critical	High	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Limited	Medium	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Medium	High
Severe Weather: Heavy Rains and Storms	Extensive	Highly Likely	Limited	Medium	Medium
Wildfire	Significant	Highly Likely	Critical	Medium	High

Geographic Extent
Limited: Less than 10% of planning area
Significant: 10-50% of planning area
Extensive: 50-100% of planning area

Likelihood of Future Occurrences
Highly Likely: Near 100% chance of occurrence in next year, or happens every year.
Likely: Between 10 and 100% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
Occasional: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
Unlikely: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Magnitude/Severity
Catastrophic—More than 50 percent of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths
Critical—25-50 percent of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability
Limited—10-25 percent of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability
Negligible—Less than 10 percent of property severely damaged, shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid

Significance
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Climate Change Influence
Low: minimal potential impact
Medium: moderate potential impact
High: widespread potential impact

Risk Assessment Methodology

Calculating Likelihood of Future Occurrence

The frequency of past events is used in this section to gauge the likelihood of future occurrences. Based on historical data, the likelihood of future occurrence is categorized into one of the following classifications:

- **Highly Likely**: Near 100% chance of occurrence in next year, or happens every year.
- **Likely**: Between 10 and 90% chance of occurrence in next year, or has a recurrence interval of 10 years or less.
- **Occasional**: Between 1 and 10% chance of occurrence in the next year, or has a recurrence interval of 11 to 100 years.
- **Unlikely**: Less than 1% chance of occurrence in next 100 years, or has a recurrence interval of greater than every 100 years.

Calculating Vulnerability

Vulnerability is measured in general, qualitative terms, and is a summary of the potential impact based on past occurrences, spatial extent, and damage and casualty potential:

- **Extremely Low**: The occurrence and potential cost of damage to life and property is very minimal to non-existent.
- **Low**: Minimal potential impact. The occurrence and potential cost of damage to life and property is minimal.
- **Medium**: Moderate potential impact. This ranking carries a moderate threat level to the general population and/or built environment. Here the potential damage is more isolated and less costly than a more widespread disaster.
- **High**: Widespread potential impact. This ranking carries a high threat to the general population and/or built environment. The potential for damage is widespread. Hazards in this category may have already occurred in the past.
- **Extremely High**: Very widespread and catastrophic impact.

Defining Significance (Priority) of a Hazard

Defining the significance or priority of a hazard to a community is based on a subjective analysis of several factors. This analysis is used to focus and prioritize hazards and associated mitigation measures for the plan. These factors include the following:

- **Past Occurrences**: Frequency, extent, and magnitude of historic hazard events.
- **Likelihood of Future Occurrences**: Based on past hazard events.
- **Ability to Reduce Losses through Implementation of Mitigation Measures**: This looks at both the ability to mitigate the risk of future occurrences as well as the ability to mitigate the vulnerability of a community to a given hazard event.

Risk Assessment Summary: Sutter County Planning Area

Aquatic Invasive Species

- Sutter County is surrounded by waterways, which create the environment for a variety of plant and animal species, including those considered invasive to the area.
- Species of concern include: Water Primrose is currently the biggest concern. SBFCA received $5M grant for sediment and invasive species removal at several County boat ramps (Yuba City, Star Bend, Live Oak).
- OTHERS? CAN THE COUNTY PROVIDE INFORMATION ON OTHER PAST OCCURRENCES OR SPECIFIC AREAS/CONCERNS/ISSUES? WHAT ARE THE BIGGEST PROBLEMS?
- Likelihood of Future Occurrence: Highly Likely
- Vulnerability: Medium
- Non-Priority Hazard

Climate Change

- The 2018 State of California Multi-Hazard Mitigation Plan stated that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the state's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and both snowmelt and rainwater running off sooner in the year. Climate Change has the potential to alter the nature and frequency of most hazards.
- CAN THE COUNTY PROVIDE INFORMATION ON EVIDENCE OF PAST OCCURRENCES OR SPECIFIC CONCERNS/ISSUES?
- Likelihood of Future Occurrence: Likely
- Vulnerability: Medium
- Priority Hazard

Dam Failure

- According to data provided by DSOD, Cal OES, and National Performance of Dam's data, there is 1 Low hazard dam in Sutter County: Steidlmayer #3. Additionally, there are 8 Extremely High and 9 High Hazard dams outside of the County that have some part of their inundation areas intersecting County parcels.
- The most significant dams of concern include the Extremely High and High Hazard where loss of life is possible.
- With the exception of the Oroville incident, here have been no past dam failure events or issues of concern that would affect Sutter County. Oroville spillway incident combined with seasonal rains impacted various areas along the levees with seepage issues, boils, waterside erosion issues. OTHER ISSUES/CONCERNS FROM A DAM FAILURE?
- Likelihood of Future Occurrence: Occasional
- Vulnerability: Extremely High
- Priority Hazard

Drought and Water Shortage

- Historical drought data for the Sutter County Planning Area and region indicate there have been 5 significant droughts in the last 84 years.
- Since 2012, snowpack levels in California had dropped dramatically. 2015 estimates place snowpack at 5 percent of normal levels. However, snowpack levels increased in 2016 and in 2017 snowpack levels were the highest they've been in 22 years. But then back down again in early 2018, only to be back up again in late 2018/2019. 2019/2020 was experiencing a fair amount of rain early on, but limited as we go in to 2021.
- 2 state (1977, 2014) disaster declarations and 1 federal declaration (1977) for Sutter County since 1950. 13 USDA disaster declarations for drought 2012 – 2020. There have been 29 NCDC drought events in Sutter County, all related to events in the 2014 to 2016 drought.
- Water supply throughout the County is based on both ground and surface water supplies. However, as water supply is reduced such as during periods of drought, water supply is further compounded in the County by others with more senior water rights.
- OTHER KEY ISSUES?
- Likelihood of Future Occurrence: Drought - Likely/Water supply - Occasional
- Vulnerability: High
- Priority Hazard

Earthquake

- Sutter County is located in a relatively aseismic area with respect to other more seismically active areas in California. The faults identified in Sutter County include the Quaternary Faults, located in the northern section of the County within the Sutter Buttes, and the Pre Quaternary Fault, located in the southeastern corner of the Planning Area, just east of where Highway 70 enters in to the County. Both faults are listed as non active faults, but still have the potential for seismic activity.
- The USGS National Seismic Hazard Maps provides acceleration and probabilities for various time periods. Sutter County falls within an area of mostly low to moderate seismic risk.
- USGS identified 40, 5.0 or greater earthquakes have occurred within 90 miles of Yuba City. County residents noted past felt occurrences associated with the 1975 and 1989 earthquakes occurring elsewhere. No URM inventories, but Yuba City does have vulnerable buildings in historic areas.
- Seismic studies for area levees show that the County isn't significantly vulnerable to earthquake; expecting some settlement and some repairs to area levees
- OTHER KEY ISSUES?
- Likelihood of Future Occurrence: Unlikely – large, damaging earthquake; Occasional – minor earthquake
- Vulnerability: High
- Priority Hazard

Flood Hazards

1%/0.5%/0.2% Annual Chance

- Historically, portions of Sutter County have always been at risk to flooding because of its annual percentage of rainfall in the winter and the number of watercourses that surround/traverse the County.

- Flood hazard is complicated in the County. The flood hazard is based on both 1988 FIRM and 2015 DFIRM data; levee improvement projects are underway. Local flood areas have been mapped to guide development in the Special Flood Hazard Areas until the levee projects and updated FEMA mapping catch up.
- 20 state and 15 federal declarations from 1950-present were for heavy rains and flooding. 23 NCDC Flood Events.
- REVIEW RISK ASSESSMENT AND ADD INFORMATION ON MAJOR FLOOD EVENTS.
- Likelihood of Future Occurrence: 1%-Occasional; 0.5% and 0.2%-Unlikely
- Vulnerability: High
- Priority Hazard

Localized/Stormwater flooding

- Significant localized flood history in the County – occurs annually
- REVIEW RISK ASSESSMENT AND ADD ANY INFORMATION ON SIGNIFICANT FLOOD EVENTS/ISSUES/AREAS.
- Likelihood of Future Occurrence: Highly Likely
- Vulnerability: Medium
- Priority Hazard

Levee Failure

- A series of levees surround Sutter County; with many levee improvement/certification projects in-process.
- No disaster declarations associated with levee failures; the NCDC does not identify any levee failure
- ONGOING MAINTENANCE ISSUES INCLUDE SEEPAGE, BOILS, SINK HOLES, RODENTS, WAVE ACTION, WATERSIDE EROSION. AN EMERGENCY REPAIR WAS CONDUCTED POST OROVILLE SPILLWAY INCIDENT WITH INCREASED FLOWS/SEASONAL RAINS
- WHAT ARE THE BIGGEST LEVEE ISSUES MOVING FORWARD?
- Likelihood of Future Occurrence: Unlikely/Occasional
- Vulnerability: Extremely High
- Priority Hazard

Pandemic

- The 20th Century had 3 Pandemics (WHO): 1918-1919 Influenza Pandemic (H1N1),1957-1958 Influenza Pandemic (H2N2), and the 1968 Influenza Pandemic (H3N2). The 21st Century had 2 Pandemics (WHO): 2009 Swine Flu (H1N1) and 2020 Covid-19.
- One 2020 federal declaration for Covid-19; the NCDC does not track pandemics.
- County workforce has been significantly impacted
- PRIMARY ISSUES/CONCERNS?
- Likelihood of Future Occurrence: Likely
- Vulnerability: High
- Priority Hazard

Severe Weather

Extreme Cold and Freeze

- Annual occurrences of cold temperatures. The lowest recorded daily extreme was -9°F in January 1907. In a typical year, minimum temperatures fall below 32°F on 18.3 days in Sutter, with 0 days falling below 0°.
- The County has no state or federal disaster declarations for extreme cold and freeze, and no USDA declarations for freeze since 2007. NCDC identified 26 extreme cold or freeze events.
- PRIMARY ISSUES/CONCERNS?
- Likelihood of Future Occurrence: Highly Likely
- Vulnerability: Medium
- Priority Hazard

Extreme Heat

- Annual occurrences of hot temperatures. The highest recorded daily extreme was 118°F in July 1905 in Sutter. In a typical year, maximum temperatures exceed 90°F on 91.5 days in Sutter.
- No state or federal disaster declarations. No USDA declarations since 2012. 45 extreme heat events (NCDC) since 1950.
- PRIMARY ISSUES/ CONCERNS?
- Likelihood of Future Occurrence: Highly Likely
- Vulnerability: Medium
- Priority Hazard?

Heavy rains and storms (Hail, Lightning, Wind)

- Significant County history: annual occurrences; Severe storms/heavy rains are the primary cause of most major flooding
- There have been 15 federal and 20 state declarations since 1950 for flooding, including heavy rains and storms. Since 2012, there have been 3 USDA declarations related to heavy rains.
- The NCDC data recorded 4 hail, 4 rain, 72 wind, and 0 lightning events for Sutter County since 1950, for a total of 81 NCDC events.
- PRIMARY ISSUES/CONCERNS.
- Likelihood of Future Occurrence: Highly Likely
- Vulnerability: Medium
- Priority Hazard

Wildfire

- Wildfires occur on an annual basis in the Sutter County Planning Area.
- Any ignition has the potential to become an out of control wildfire. However, the County surrounded by levees and fuels comprised predominantly of grasses, has a limited vulnerability to wildfire.
- No state or federal disaster declarations for Wildfire since 1950. No USDA declarations since 2012.
- Cal Fire database lists 17 notable fires ranging from 77 to 2,745 acres in size.
- 10 NCDC wildfire events since 1993.
- Sutter County is a Tier 1 for PSPS; unlikely to be impacted moving forward

- Camp Fire and North Complex fire – 2 of the most significant impacting Sutter – smoke/air quality
- WHAT ARE THE COUTIES BIGGEST ISSUES/CONCERNS?
- Likelihood of Future Occurrence: Highly Likely
- Vulnerability: High
- Priority Hazard

Sutter County Priority Hazards

- Climate Change
- Dam Failure
- Drought & Water Shortage
- Earthquake
- Flood: 1%/0.2% annual chance
- Flood: Localized/Stormwater
- Levee Failure
- Pandemic
- Severe Weather: Extreme Cold and Freeze
- Severe Weather: Extreme Heat
- Severe Weather: Heavy Rains and Storms (wind, hail, lightning)
- Wildfire

Non-Priority Hazards:

- Aquatic Invasive Species

Jurisdiction: _____

Priority Hazards???

- Aquatic Invasive Species
- Climate Change
- Dam Failure
- Drought & Water Shortage
- Earthquake
- Flood: 1%/0.2% annual chance
- Flood: Localized/Stormwater
- Levee Failure
- Pandemic
- Severe Weather: Extreme Cold and Freeze
- Severe Weather: Extreme Heat
- Severe Weather: Heavy Rains and Storms (wind, hail, lightning)
- Wildfire

Data Needs

Review of Key Items to date:

- Hazard-specific data
    - Hazard ID tables
    - Historic Hazard Worksheets or list of past hazard occurrences and impacts to each jurisdiction
        - Old participating jurisdictions – need past occurrences/hazard history since 2013
        - New participating jurisdictions –significant hazard occurrences - back 50 years or so
- Risk Assessment Worksheets (County)
- Data on future development areas (County/Cities)
- Updated critical facility layer (County)
- Review and input on Jurisdictional Annexes (due by 1/8)

Other Data Items:

- Logos for each participating jurisdiction
- Photos, Photos, Photos
- 2013 Mitigation Action Update Worksheet (Table and Text)
- List of Mitigation Actions for each participating jurisdiction for each Priority Hazard for next meeting – January 20

Mitigation Strategy: Goals

The most important element of the LHMP is the resulting mitigation strategy which serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy is comprised of three components:

6. Mitigation Goals
7. Mitigation Actions
8. Action (Implementation) Plan

Mitigation Goals

Up to now, the HMPC has been involved in collecting and providing data for the Sutter County Local Hazard Mitigation Plan Update. From this information, a Risk Assessment has been developed that describes the risk and vulnerability of the Sutter County Planning Area to identified hazards and includes an assessment of the area's current capabilities for countering these threats through existing policies, regulations, programs, and projects.

This analysis identifies areas where improvements could or should be made. Formulating Goals will lead us to incorporating these improvements into the Mitigation Strategy portion of the LHMP. Our planning goals should provide direction for what loss reduction activities can be undertaken to make the planning area and participating jurisdictions more disaster resistant.

Mitigation Goals are general guidelines that represent the community's vision for reducing or avoiding losses from identified hazards. Goals are stated without regard for achievement, that is, implementation, cost, schedule, and means are not considered. ***Goals are public policy statements that:***

- **Represent basic desires of the jurisdiction;**
- **Encompass all aspects of planning area, public and private;**
- **Are nonspecific, in that they refer to the quality (not the quantity) of the outcome;**
- **Are future-oriented, in that they are achievable in the future; and**
- **Are time-independent, in that they are not scheduled events.**

While goals are not specific (quantitative), they should not be so general as to be meaningless or unachievable.

Goals statements will form the basis for objectives. They should be stated in such a way as to develop one or more objectives related to each goal.

The key point in writing goals is to remember that they must deal with results, not the activities that produce those results.

Finally, before we formulate our goals, we should discuss other planning area goals from other regional/county/city programs and priorities. This keeps us from "reinventing the wheel," as well as being consistent with Multi-Objective Management --- or "MOM" --- where communities strive for efficiency by combining projects/needs that are similar in nature or location. Utilizing "MOM" effectively can result in

identifying multiple sources of funding that can be "packaged" and broadening the supporting constituency base by including "outcomes" desired by various stakeholder groups.

Types/Sources of other area mitigation plans and programs include:

- General Plans
- Stormwater Program and Plans
- Flood/Watershed Management Plans and Studies
- Drought Plans, Integrated Regional Water Management Plan
- Community Wildfire Protection Plans
- Strategic Fire Plans
- Dam Emergency Action Plans
- Emergency Operations Plans
- Climate Adaptation Plans
- Other?

Sample Goals from other Plans

Goals from the 2018 California State Hazard Mitigation Plan

1. Significantly reduce life loss and injuries.

2. Minimize damage to structures and property, as well as minimizing interruption of essential services and activities.

3. Protect the environment.

4. Promote community resilience through integration of hazard mitigation with public policy and standard business practices.

*Goals from the Sutter County General Plan Public Health and **Safety Element, 2011***

Land Use Element

GOAL:	**Goal LU-1 Promote the efficient and sensitive use of lands to protect and enhance Sutter County's quality of life and meet the needs of existing and future residents and businesses.**
Objective:	Identification of Floodplains. Identify the unincorporated areas of Sutter County that are subject to flooding, and evaluate and regulate development within these areas according to state and federal regulations to minimize the loss of life and damage to property caused by potential flood events.
Objective:	Climate Action Plan. Require new development to demonstrate consistency with the County's Climate Action Plan to reduce greenhouse gas emissions.

Agriculture Element

GOAL:	GOAL AG 3 Protect the natural resources needed to ensure that agriculture remains an essential and sustainable part of Sutter County's future.
Objective:	Efficient Water Management. Support the efficient management and use of agricultural water resources where economically feasible to support agriculture.
Objective:	Water Conservation and Recycling. Support the efforts of the multiple water agencies operating in Sutter County to adopt water conservation practices and explore the feasibility of water recycling for agriculture.
Objective:	Water Quality and Quantity. Support efforts to maintain water resource quality and quantity for the irrigation of productive farmland.
Objective:	Water Use Reduction. Implement, as appropriate, reduction measures in the Climate Action Plan targeted to manage agricultural water use. Such measures may include encouraging agricultural water users to conserve water, and providing information on technologies that reduce agricultural water use.
Objective:	Groundwater Resources. Support the efforts of the local water agencies to promote groundwater recharge, conjunctive use, conservation of significant recharge areas, and other activities to protect and manage Sutter County's groundwater resources.

Infrastructure Element

GOAL:	GOAL I 1 Ensure the availability of an adequate, reliable, and safe potable water supply for current and future County residents, businesses, and other water users.
Objective:	Improve Water Availability. Support the creation of new water projects in appropriate locations that improve water availability for urban, rural, and agricultural water uses in Sutter County, including recycled water projects.
Objective:	Water Conservation. Support water conservation programs that increase water use efficiency, and provide incentives for adoption of water-efficiency measures.

GOAL:	GOAL I 3 Ensure stormwater runoff is collected and conveyed safely and efficiently.
Objective:	Availability. Require new development to study, coordinate, and plan the provision of stormwater services to support the new development and demonstrate the availability of long-term, safe, and reliable stormwater collection, and conveyance.
Objective:	Infrastructure Planning. Establish stormwater collection master plans for areas served, or to be served, by County-owned or County-operated stormwater systems. Ensure that the required infrastructure is successfully planned and designed.
Objective:	New Development. Require new development to provide stormwater systems supporting the development based on the following guidelines for stormwater collection and conveyance
Objective:	Mitigation of Stormwater Flows. Require new development to adequately mitigate increases in stormwater flow rates and volume.

Public Services Element

GOAL:	GOAL PS 2 Protect life and property from the risk of fire, and provide for coordinated emergency medical services.
Objective:	Coordinated Operations. Coordinate operations between County Service Areas, independent Fire Protection Districts, and neighboring fire service agencies to ensure optimum fire protection and efficient use of all fire suppression resources.
Objective:	New Fire Stations. Ensure that new fire stations are located strategically throughout the County to provide optimal response times to all areas.
Objective:	Adequate Fire Flows. Incorporate fire flow requirements into new development design consistent with the California Fire Code and other applicable requirements based on County fire prevention standards.

GOAL:	GOAL PS 3 Minimize risk to life and property resulting from wildland fire hazards.
Objective:	Development Limitation. Limit development in areas of extreme, very high, and high wildfire risk.
Objective:	Defensible Space. Require new and/or existing development to establish adequate defensible space by providing clearance around structures, and using fire-resistant landscaping and roofing materials.
Objective:	Private Properties. Require private property owners to remove excessive/overgrown vegetation and rubbish to prevent and minimize fire risks.
Objective:	Wildfire Management Plan. Require new large-scale development projects (i.e., Specific Plans, Rural Planned Communities) to prepare and implement a County approved wildfire management plan incorporating fire protection measures for developing properties adjacent to undeveloped lands. The wildfire management plan shall be consistent with any adopted Countywide plan and/or regulations in effect at the time of the project's approval.

Environmental Resources Element

GOAL:	GOAL ER 2 Conserve, protect, and enhance Sutter County's significant natural wetland and riparian habitats.
Objective:	No Net Loss. Require new development to ensure no net loss of state and federally regulated wetlands, other waters of the United States (including creeks, rivers, ponds, marshes, vernal pools, and other seasonal wetlands), and associated functions and values through a combination of avoidance, restoration, and compensation.
Objective:	Resource Conservation District. Encourage and support the Sutter County Resource Conservation District's programs that facilitate preservation and restoration of natural wetland environments as long as these programs do not significantly affect Sutter County agricultural lands and flood control operations.
Objective:	Minimize Surface Runoff. Minimize direct discharge of surface runoff into wetland areas and design new development in such a manner that pollutants and siltation will not significantly affect jurisdictional wetlands.
Objective:	Wetland Mitigation Banks. Encourage the creation and use of regional wetland mitigation banks to the extent that they do not conflict with Sutter County agricultural lands and flood control operations.

GOAL:	GOAL ER 6 Preserve and protect the County's surface water and groundwater resources.
Objective:	Integrated Water Management Programs. Integrate water management programs that emphasize multiple benefits and balance the needs of agricultural, rural, and urban users.
Objective:	Surface Water Resources. Protect the surface water resources in the County including the Sacramento, Feather and Bear Rivers and their significant tributaries.
Objective:	Groundwater Sustainability. Protect the sustainability of groundwater resources.
Objective:	Groundwater Recharge Areas. Require new development to preserve areas that provide important groundwater recharge, stormwater management, and water quality benefits such as undeveloped open spaces, natural habitat, riparian corridors, wetlands, and natural drainage areas.
Objective:	Water Use Reduction. Implement, as appropriate, the reduction measures in the Climate Action Plan targeted to reduce water use. Such measures may include: adopting a per capita water use reduction goal; implementing a water conservation and efficiency program; providing incentives for new development to reduce potable water use; installing water meters for uses not using wells; encouraging water suppliers to adopt a water conservation pricing schedule; encouraging upgrades in water efficiency; providing training and education on water efficiency; and increasing recycled water use.

Public Health & Safety Element

GOAL:	GOAL PHS 1 Minimize the potential for loss of life, personal injury, and property damage associated with floods.
Objective:	NFIP. Continue to participate in the National Flood Insurance Program and the Community Rating System.
Objective:	Minimize Risk of Flood Damage. Require a minimum of 100- year flood protection and regulate development in accordance with local, state, and federal requirements to avoid or minimize the risk of flood damage.
Objective:	Flood Protection for New Development. Require new development in urban and/or urbanizing areas to provide 200-year flood protection within 3 years of adoption of the Central Valley Flood Protection Plan in accordance with state regulations, and require new development outside urban or urbanizing areas to provide 100-year flood protection in accordance with federal regulations.
Objective:	Development in Dam Inundation Areas. Require new development located in dam inundation areas to consider the risks from dam failure.
Objective:	Essential Facilities. Require that new essential public facilities (e.g., hospitals, health care facilities, emergency shelters, fire stations, etc.) be located, when feasible, outside of flood hazard zones, as defined by FEMA, or designed to maintain the structural and operational integrity of the facility during flooding events.

GOAL:	GOAL PHS 2 Minimize the risk of personal injury and property damage due to geologic and seismic hazards and adverse soil conditions.
Objective:	Review Standards. Review and enforce seismic and geologic safety standards and require the use of best management practices in site design and building construction methods.
Objective:	Minimize Exposure to Geologic Hazards. Minimize development in areas where geologic hazards exist from landslides and erosion.

GOAL:	GOAL PHS 2 Minimize the risk of personal injury and property damage due to geologic and seismic hazards and adverse soil conditions.
Objective:	Site-Specific Geotechnical Analysis. Require the preparation of a County approved site-specific geotechnical analysis prior to approval of development in areas where the potential for geologic or seismic hazards exists (e.g., ground shaking, landslides, liquefaction, expansive soils, steep slopes, subsidence, and erosion) and incorporate recommended project features to avoid or minimize the identified hazards.
Objective:	Essential Facilities. Promote the upgrade, retrofitting, and/or relocation of existing essential facilities (e.g., hospitals, schools, law enforcement and fire stations, etc.) that do not meet current building code standards and are within areas susceptible to seismic or geologic hazards.

GOAL:	GOAL PHS 4 Respond appropriately, effectively, and efficiently to natural and human-made emergencies and disasters.
Objective:	Emergency Operation Plans. Continue to implement and regularly update countywide emergency operation plans to reduce or eliminate long-term risk to life and property from natural or human-made emergencies and disasters.
Objective:	Evacuation Routes. Regularly review established evacuation routes to ensure emergency access to and from all parts of the County.
Objective:	Emergency Access. Require minimum road and driveway widths and clearances around structures consistent with established requirements in order to ensure emergency access.
Objective:	Emergency and Disaster Preparedness Training. Coordinate with local and regional agencies to regularly conduct emergency and disaster preparedness training to test operational and emergency plans.
Objective:	StormReady Program. Continue to be a member of the StormReady Program ensuring a higher level of community awareness to minimize the loss of life and property from severe weather.
Objective:	Coordination. Continue to be responsible for planning, preparedness, emergency response, and recovery activities associated with natural and human-made disasters. Provide communication and coordination between local and federal agencies, medical facilities, schools, local radio stations, and special needs service providers.
Objective:	Public Education. Support public education and awareness regarding emergency response and disaster preparedness.

Sutter County 2013 LHMP Update (This is what we are updating)

Goal 1: Minimize risk and vulnerability of the community to hazards and reduce damages and protect lives, properties, and public health in Sutter County

- Minimize economic and resource impact
- Minimize impact to both existing and future development
- Prevent and reduce flood-related losses
- Improve integrity of levees
- Prevent and reduce agricultural losses

Goal 2: Provide protection for critical facilities, infrastructure, utilities, and services from hazard impacts.

- Update and maintain list of critical facilities: Essential Services, At-Risk Populations, Hazardous Materials Facilities
- Protect evacuation routes

Goal 3: Improve community awareness, education, and preparedness for hazards that threaten our communities

- Enhance public outreach, education and preparedness program to include all hazards of concern
- Increase public knowledge about the risk and vulnerability to identified hazards and recommended responses to disaster events
- Increase public communications to keep the public well informed prior to, during and after a disaster event, including information regarding evacuation and sheltering options
- Provide planning and coordination for "At-Risk" populations
- Increase public's awareness and involvement in communities' mitigation projects

Goal 4: Increase communities' ability to be prepared for, respond to, and recover from a disaster event

- Improve interagency (local, state, federal) emergency coordination and communication to ensure effective community preparedness, response and recovery
- Enhance the use of shared resources/Develop a strong mutual aid support system
- Create and maintain a fully functional, interoperable radio and communication system
- Improve interoperable communication with non-public safety and private partners

Goal 5: Enhance collaboration and coordination of disaster-related plans with local, state, and federal agencies and private partners

- Protect and maintain continuity of operations

Goal 6: Maintain FEMA Eligibility/Position the communities for grant funding.

Miscellaneous Goal Statements

- Minimize risk and vulnerability from natural hazards
- Increase communities' awareness of vulnerability to hazards
- Increase the use of shared resources
- Improve communities' capabilities to mitigate losses
- Maintain coordination of disaster plans with changing DHS/FEMA needs
- Maintain FEMA eligibility/position jurisdictions for grant funding
- Maintain/enhance the flood mitigation program to provide 200/500-year flood protection
- Maintain current service levels
- Provide protection for existing buildings from hazards
- Provide protection for future development from hazards
- Provide protection for natural and cultural resources from hazard impacts
- Provide protection for people's lives from hazards
- Provide protection for public health
- Provide protection for critical services (fire, police, etc.) from hazard impacts
- Provide protection for critical lifeline utilities from hazard impacts
- Reduce exposure to hazard related losses
- Reduce the number of emergency incidents
- Make better use of technology

General Recommendation for Categories of Goals

- Reduce Losses/Protection of Life, Property, Public Health, and the Environment from all Hazards
- Reduce Losses/Protection of Critical Facilities and Infrastructure from all Hazards
- Public Education
- Increase County Capabilities to all Hazards
- Any Hazard-specific goals

Goals Development

The purpose of goal's development is to reach a consensus on Plan goals. Provided above are example goals for this LHMP. You may reword these or develop your own.

Each person should provide either via chat (on this zoom call) or email to Jeanine.foster@fostermorrison.com: Two (2) goals they would like to see included for this 2021 Sutter County LHMP Update. (Please submit by Friday, January 22nd)

When collated, we will combine and rework them into 4-6 goals for this LHMP Update and send them out to the HMPC for further review and refinement.

Mitigation Strategy Meetings
January 13 & 20, 2021
Day 2

Mitigation Strategy: Actions

Mitigation Actions are specific projects and activities that help achieve the goals and accomplish risk reduction in the community.

Categories of Mitigation Measures

PREVENTION: Preventive measures are designed to keep the problem from occurring or getting worse. Their objective is to ensure that future development is not exposed to damage and does not increase damage to other properties.

- Planning
- Zoning
- Open Space Preservation
- Land Development Regulations
  - ✓ Subdivision regulations
  - ✓ Building Codes
    - Fire-Wise Construction
  - ✓ Floodplain development regulations
  - ✓ Geologic Hazard Areas development regulations (for roads too!)
- Storm Water Management
- Fuels Management, Fire-Breaks

EMERGENCY SERVICES: protect people during and after a disaster. A good emergency services program addresses all hazards. Measures include:

- Warning (flooding, tornadoes, winter storms, geologic hazards, fire)
  - ✓ NOAA Weather Radio
  - ✓ Sirens
  - ✓ "Reverse 911" (Emergency Notification System)
- Emergency Response
  - ✓ Evacuation & Sheltering
  - ✓ Communications
  - ✓ Emergency Planning
    - Activating the EOC (emergency management)
    - Closing streets or bridges (police or public works)
    - Shutting off power to threatened areas (utility company)
    - Holding/releasing children at school (school district)
    - Ordering an evacuation (mayor)
    - Opening emergency shelters (Red Cross)
    - Monitoring water levels (engineering)
    - Security and other protection measures (police)
- Critical Facilities Protection (Buildings or locations vital to the response and recovery effort, such as police/fire stations, hospitals, sewage treatment plants/lift stations, power substations)

- ✓ Buildings or locations that, if damaged, would create secondary disasters, such as hazardous materials facilities and nursing homes
- ✓ Lifeline Utilities Protection

➢ Post-Disaster Mitigation

➢ Building Inspections
- ✓ ID mitigation opportunities & funding before reconstruction

PROPERTY PROTECTION: Property protection measures are used to modify buildings subject to damage rather than to keep the hazard away. A community may find these to be inexpensive measures because often they are implemented by or cost-shared with property owners. Many of the measures do not affect the appearance or use of a building, which makes them particularly appropriate for historical sites and landmarks.

➢ Retrofitting/disaster proofing
- ✓ Floods
  - Wet/Dry floodproofing (barriers, shields, backflow valves)
  - Relocation/Elevation
  - Acquisition
  - Retrofitting
- ✓ High Winds/Tornadoes
  - Safe Rooms
  - Securing roofs and foundations with fasteners and tie-downs
  - Strengthening garage doors and other large openings
- ✓ Winter Storms
  - Immediate snow/ice removal from roofs, tree limbs
  - "Living" snow fences
- ✓ Geologic Hazards (Landslides, earthquakes, sinkholes)
  - Anchoring, bracing, shear walls
  - Dewatering sites, agricultural practices
  - Catch basins
- ✓ Drought
  - Improve water supply (transport/storage/conservation)
  - Remove moisture competitive plants (Tamarisk/Salt Cedar)
  - Water Restrictions/Water Saver Sprinklers/Appliances
  - Grazing on CRP lands (no overgrazing-see Noxious Weeds)
  - Create incentives to consolidate/connect water services
  - Recycled wastewater on golf courses
- ✓ Wildfire, Grassfires
  - Replacing building components with fireproof materials
  - Roofing, screening
  - Create "Defensible Space"
  - Installing spark arrestors
  - Fuels Modification

- ✓ Noxious Weeds/Insects
  - Mowing
  - Spraying
  - Replacement planting
  - Stop overgrazing
  - Introduce natural predators
- Insurance

NATURAL RESOURCE PROTECTION: Natural resource protection activities are generally aimed at preserving (or in some cases restoring) natural areas. In so doing, these activities enable the naturally beneficial functions of floodplains and watersheds to be better realized. These natural and beneficial floodplain functions include the following:

- storage of floodwaters
- absorption of flood energy
- reduction in flood scour
- infiltration that absorbs overland flood flow
- groundwater recharge
- removal/filtering of excess nutrients, pollutants, and sediments from floodwaters
- habitat for flora and fauna
- recreational and aesthetic opportunities

Methods of protecting natural resources include:

- Wetlands Protection
- Riparian Area/Habitat Protection/Threatened-Endangered Species
- Erosion & Sediment Control
- Best Management Practices

Best management practices ("BMPs") are measures that reduce nonpoint source pollutants that enter the waterways. Nonpoint source pollutants come from non-specific locations. Examples of nonpoint source pollutants are lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces and industrial areas and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground's surface by stormwater and flushed into receiving storm sewers, ditches and streams. BMPs can be implemented during construction and as part of a project's design to permanently address nonpoint source pollutants. There are three general categories of BMPs:

9. Avoidance: setting construction projects back from the stream.
10. Reduction: Preventing runoff that conveys sediment and other water-borne pollutants, such as planting proper vegetation and conservation tillage.
11. Cleanse: Stopping pollutants after they are en route to a stream, such as using grass drainageways that filter the water and retention and detention basins that let pollutants settle to the bottom before they are drained

- Dumping Regulations
- Set-back regulations/buffers

- Fuels Management
- Water Use Restrictions
- Landscape Management
- Weather Modification

STRUCTURAL: Projects that have traditionally been used by communities to control flows and water surface elevations. Structural projects keep flood waters away from an area. They are usually designed by engineers and managed or maintained by public works staff. These measures are popular with many because they "stop" flooding problems. However, structural projects have several important shortcomings that need to be kept in mind when considering them for flood hazard mitigation:

- They are expensive, sometimes requiring capital bond issues and/or cost sharing with Federal agencies, such as the U.S. Army Corps of Engineers or the Natural Resources Conservation Service.
- They disturb the land and disrupt natural water flows, often destroying habitats or requiring Environmental Assessments.
- They are built to a certain flood protection level that can be exceeded by a larger flood, causing extensive damage.
- They can create a false sense of security when people protected by a structure believe that no flood can ever reach them.
- They require regular maintenance to ensure that they continue to provide their design protection level.

Structural measures include:

- Detention/Retention structures
- Erosion and Sediment Control
- Basins/Low-head Weirs
- Channel Modifications
- Culvert resizing/replacement/Maintenance
- Levees and Floodwalls
- Anchoring, grading, debris basins (for landslides)
- Fencing (for snow, sand, wind)
- Drainage System Maintenance
- Reservoirs (for flood control, water storage, recreation, agriculture)
- Diversions
- Storm Sewers

PUBLIC INFORMATION: A successful hazard mitigation program involves both the public and private sectors. Public information activities advise property owners, renters, businesses, and local officials about hazards and ways to protect people and property from these hazards. These activities can motivate people to take protection

- Hazard Maps and Data
- Outreach Projects (mailings, media, web, speakers, displays)
- Library Resources
- Real Estate Disclosure
- Environmental Education

Mitigation Measures from 2013 Sutter County LHMP (This is what we are updating)

Mitigation Action	Complete	Ongoing	Not Started	Project in LHMP Update
Multi-Jurisdictional Actions				
Enhance Public Awareness of the Effects of Natural Hazards and Public Understanding of Disaster Preparedness				
Planned Multi-Hazard CRS Outreach Projects				
Implementation of CRS Activities				
Review and Amend Flood Damage Prevention Ordinance, as Appropriate				
Evaluate the Development and Implementation of County-Wide Stormwater Management Ordinance				
Prepare Post-Disaster Guidance Materials				
Feather River Regional Flood Management Plan				
Feather River West Levee Rehabilitation Project				
River Level Gauge System				
Sutter Basin Feasibility Study				
Sutter County Actions				
Flood System Repair Program				
Robbins Wastewater Plant - Backup Power Source				
Live Oak Canal - Improvement Project				
Gilsizer Slough - Master Drainage Study				
Robbins Wastewater Plant - Water Meters & Mains				
NIXLE Text Notification System				
Robbins Wastewater Plant - Water Treatment Plant				
City of Live Oak Actions				
Eliminate Local Flooding Areas at the Six Locations Identified in the Master Drainage Study				
Hwy 99 Improvements				
EOC Equipment and Supplies				
Blackboard Connect Upgrades and Maintenance				
Backup Power to Critical Facilities				
Well, Holding Tank, Water Treatment Equipment with Associated Water lines and Water Main Upgrade				
City of Yuba City Actions				
Project Improvements to Decrease Localized Flooding				
Enhance Current Rapid Notify System to Include Cell Phone Enhancements				
Feather River Habitat Restoration				

Mitigation Action	Complete	Ongoing	Not Started	Project in LHMP Update
Fifth Street Bridge Replacement				
Gilsizer Slough Weir at Bogue Road				
Interactive Critical Facility Data Management				
Low Lift Pump Station Security Improvements				
Hazard Preparedness Public Outreach				
Relocation of Treated Wastewater Effluent Diffuser Line				
Response Logistics Planning				
200-Year Flood Protection for Sphere of Influence Area				
Alternative Methods to Dispose of Treated Wastewater Effluent				
Establish Backup Power Sources for Critical Facilities within Yuba City				
Yuba City Urban Area Emergency Operations Center				
Gilsizer Drainage District Actions				
Master Drainage Study and Improvements to Meet 200-YR Flood Protection				
Revetment of Slough Channel				
Levee District 1 Actions				
Bank Erosion Repairs				
Reclamation District 70 Actions				
Alternative Power Source at Pumping Station				
Levee/Erosion Repair				
Coordination with State DWR Flood Emergency Response Project				
Reclamation District 1001 Actions				
Flood System Repair Project #1				
Flood System Repair Project #2				
Flood System Repair Project #3				
Flood System Repair Project #4				
Flood System Repair Project #5				
Flood System Repair Project #6				
Flood System Repair Project #7				
Flood System Repair Project #8				
Alternative Power Source at Pump House				
Flood Emergency Response Project				
Reclamation District 1500 Actions				
Alternative Power Source at Karnak Pump Station				

Mitigation Action	Complete	Ongoing	Not Started	Project in LHMP Update
Reclamation District 1660 Actions				
Levee Repair				
Alternative Power Source at Pump Station				
Coordination with State DWR Flood Emergency Response Project				

Mitigation Strategy: Action Plan

The mitigation action plan describes how the mitigation actions will be implemented, including how those actions will be prioritized, administered, and incorporated into the community's existing planning mechanism. Each participating jurisdiction must have a mitigation action(s) and an action plan specific to that jurisdiction and its priority hazards and vulnerabilities.

Mitigation Criteria

For use in selecting and prioritizing Proposed Mitigation Measures

1. STAPLEE

Social: Does the measure treat people fairly? (different groups, different generations)

- Community Acceptance
- Effect on Segment of Population
- Social Benefits

Technical: Will it work? (Does it solve the problem? Is it feasible?)

- Technical Feasibility
- Reduce Community Risk
- Long Term Solution/Sustainable
- Secondary Impacts

Administrative: Do you have the capacity to implement & manage project?

- Staffing
- Funding Allocated
- Maintenance/Operations

Political: Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support?

- Political Support
- Local Champion
- Public Support
- Achieves Multiple Objectives
- Supported by a broad array of Stakeholders

Legal: Does your organization have the authority to implement? Is it legal? Are there liability implications?

- Existing Local Authority
- State Authority
- Potential Legal Challenges

Economic: Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development?

- Benefit of Action
- Cost of Action
- Cost Effective/Economic Benefits
- Economically Viable
- Outside Funding Required

Environmental: Does it comply with Environmental regulations?

- Effect on Land/Water
- Effect on Endangered Species
- Effect on Cultural Resources
- Effect on Hazmat sites
- Consistent with Community Environmental Goals
- Consistent with Environmental Laws
- Environmental Benefits

2. SUSTAINABLE DISASTER RECOVERY

- Quality of Life
- Social Equity
- Hazard Mitigation
- Economic Development
- Environmental Protection/Enhancement
- Community Participation

3. SMART GROWTH PRINCIPLES

- Infill versus Sprawl
- Efficient Use of Land Resources
- Full Use of Urban Resources
- Mixed Uses of Land
- Transportation Options
- Detailed, Human-Scale Design

4. OTHER

- Does measure address area with highest risk?
- Does measure protect …
  - ✓ The largest # of people exposed to risk?
  - ✓ The largest # of buildings?
  - ✓ The largest # of jobs?
  - ✓ The largest tax income?
  - ✓ The largest average annual loss potential?
  - ✓ The area impacted most frequently?

- ✓ Critical Infrastructure (access, power, water, gas, telecommunications)
- Timing of Available funding
- Visibility of Project
- Community Credibility

Mitigation Action Prioritization Instructions

The mitigation actions and projects will be further collated by hazard and will be presented back to the HMPC for prioritization. This will be done the week of January 25th via an email link.

Each person will have 9 votes total to vote for their preferred mitigation actions/projects:

- 3 high priority votes (5 points each)
- 3 medium priority votes (3 points each)
- 3 low priority votes (1 point each)

Your votes will indicate the consensus of the team.

Use your list of mitigation selection criteria to help you make your determinations.

After the votes are tabulated, we will send out an email detailing mitigation action prioritization results.

Mitigation Action Worksheet

Jurisdiction:	
Mitigation Action/Project Title:	
Hazards Addressed:	
Issue/Background:	
Project Description:	
Other Alternatives:	
Existing Planning Mechanism(s) through which Action Will Be Implemented:	
Responsible Office/Partners:	
Cost Estimate:	
Benefits (Losses Avoided):	
Potential Funding:	
Timeline:	
Project Priority:	

Worksheet completed by:	
Name and Title:	
Phone:	

Sutter County 2021 LHMP Update

Mitigation Strategy Meetings – Action Prioritization

89 Voting Members

Actions sorted by Vote Totals

Mitigation Action Title	Hazards Addressed	Points/ Worksheet Status
Evacuation Planning	Dam Failure	72
Levee repair or improvement projects (all RDs)	Flood/Levee Failure	59
New flood/hydrology related studies should factor climate change into models to accommodate future floods events	Climate Change	39
Invasive species reduction projects in problem areas such as Sutter Bypass	Aquatic Invasive Species	34
Backup Power Supply for critical facilities and infrastructure (all)	Multi-Hazard	33
Complete critical levee repairs/improvements along the Sutter Bypass east levee	Flood/Levee Failure	33
Evacuation planning for Yuba City and Prioritized Small Communities	Multi-Hazard	33
Public education	Dam Failure	29
Levee maintenance projects (all RDs)	Flood/Levee Failure	29
Levee projects to achieve 100-year/200-year level of protection	Flood/Levee Failure	26
Climate Adaptation Planning	Climate Change	24
Stormwater Drainage Improvements. Increasing drainage or absorption capacities with detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection	Flood/Levee Failure	21
Complete Feather River West Levee Project (Includes current USACE projects)	Flood/Levee Failure	18
Updated FEMA DFIRM mapping	Flood/Levee Failure	16
Renovating old, inactive groundwater municipal well sites to become Aquifer Storage Recovery wells	Drought and Water Shortage	16
Create (or expand) Levee Improvement Agencies to plan for the future levee system improvements necessary to address risk reduction, FEMA accreditation, climate change resiliency, and other challenges (SBFCA and SAFCA cover portions of the County)	Flood/Levee Failure	15
Groundwater recharge projects	Drought and Water Shortage	15
Update Emergency Operations Plan and Annexes (Flood Contingency Map) for levee maintaining agencies; provide ICS training, and table top exercises	Multi-Hazard	14
Back up generator for Tobbins/Add Delay on Make Relays to the STEP tanks	Multi-Hazard	14

Mitigation Action Title	Hazards Addressed	Points/ Worksheet Status
Pre-identify sites used for Pandemic response	Pandemic	14
Other Pump Plant Improvement Projects	Flood/Levee Failure	14
Design and construct a regional/local stockpile system; acquire and stage flood fight supplies and equipment	Flood/Levee Failure	13
Project Improvements to decrease Localized Flooding (Yuba City)	Flood/Levee Failure	13
Increase broadband in rural areas	Pandemic	13
Feather River bottoms debris clearance and fuels management project	Wildfire	12
Conduct additional evacuation planning (and sheltering in place) for Sutter County, with public education component	Multi-Hazard	12
Home elevation projects	Flood/Levee Failure	10
Multi-hazard Education and Outreach for all hazards (all)	Multi-Hazard	10
Implementation of flood risk reduction measures identified in Phase 1 Small Communities projects	Flood/Levee Failure	10
Require that all critical facilities including emergency operations centers (EOC), police stations, and fire department facilities be located outside of flood-prone areas	Flood/Levee Failure	9
In situations where flood waters tend to wash roads out, construction, reconstruction, or repair can include not only attention to drainage, but also stabilization or armoring of vulnerable shoulders or embankments	Flood/Levee Failure	9
Increase levee security features (e.g., cameras, private security patrols)	Flood/Levee Failure	9
Yuba City Urban Area Emergency Operations Center (Yuba City)	Multi-Hazard	8
Severe Weather Annex update and revision	Severe Weather: All	8
Fuels/vegetation management projects in other areas with high fuel loads	Wildfire	8
Require CFM Certification for Local Floodplain Administrator and Board of Supervisors	Flood/Levee Failure	8
Develop drought emergency plan, with criteria or triggers for drought-related actions	Drought and Water Shortage	7
Bridge Replacement projects (Larkin Road and Nicolaus Ave)	Flood/Levee Failure	7
Elevate roads and bridges above the base flood elevation to maintain dry access	Flood/Levee Failure	7
Add high water flood marks monuments along highways at 5 ft intervals up to maximum flood event	Flood/Levee Failure	6
Develop multi-agency badging system for emergency responders to allow for required travel and response during emergencies	Multi-Hazard	6
Continue efforts for funding of gravel patrol roads	Flood/Levee Failure	6
Updates to regional flood management plans	Flood/Levee Failure	6
Digitize and store vulnerable and irreplaceable county documents currently located in county basements vulnerable to hazards	Multi-Hazard	6
Add additional monitoring systems for waterways (RFMP list will include a few needed gages); (4) total new gages (2) Live Oak Canal and (2) Gilsizer Slough	Flood/Levee Failure	5

Mitigation Action Title	Hazards Addressed	Points/ Worksheet Status
Alternative Methods to Dispose of Treated Wastewater Effluent (Yuba City)	Flood/Levee Failure	5
Karnack Pump Plant Replacement (RD 1500)	Flood/Levee Failure	5
Install a quick-connect emergency generator hook-ups for critical facilities	Multi-Hazard	5
Update Urban Water Master Plan(s)	Drought and Water Shortage	5
Update traffic models to comply with new criteria for reducing vehicle miles traveled vs level of service	Multi-Hazard	5
Establish Cal Fire Mutual Threat Zone (MTZ) contract for Sutter Buttes	Wildfire	4
Ongoing participation in regional groundwater management plans	Drought and Water Shortage	4
Stream cleanout projects	Flood/Levee Failure	4
Acquisition of homes located in flood hazard areas	Flood/Levee Failure	4
Finalize existing: 6 Phase 1 Small Communities Flood Risk Reduction Grants for Feasibility Studies were issued to communities in Sutter County (2 of 6 are complete)	Flood/Levee Failure	4
Pursue support for obtaining permits for cleaning and maintenance of canals	Flood/Levee Failure	3
Elevating low-lying bridges	Flood/Levee Failure	3
Adopt a post-disaster recovery ordinance citing NFIP and Other Requirements that regulate repair activity	Flood/Levee Failure	3
Conduct seismic evaluation of public buildings, critical facilities, and infrastructure	Earthquake	3
Initiate the Oroville Wildlife Area Robinson's Riffle Multi-benefit project	Flood/Levee Failure	3
Dredge the main drain leading to the Karnack Pump Plant so water will flow and not build up near Robbins	Flood/Levee Failure	3
Increase levee access control features (e.g., Blocks and K-rails preventing vehicles from climbing levees)	Flood/Levee Failure	3
Repair and enhanced security for flood fight roads	Flood/Levee Failure	3
Using cool roofing products that reflect sunlight and heat away from a building	Severe Weather: Heat	3
Acquire/perfect easements to allow for O&M, levee patrols, flood emergency response actions, etc/document in GIS WebAppFlood	Flood/Levee Failure	3
Develop Master Stormwater Drainage Plan	Flood/Levee Failure	3
Evaluating urban landscape area and residential water demands in response to SB 606 and AB 1668	Drought and Water Shortage	2
Response Logistics Planning (Yuba City)	Multi-Hazard	1
Utilize goats for fuel reduction	Wildfire	1
Establish levee Project Partnerships between local agencies and state (DWR Maintenance Yards) to seek grants, especially state grants, because DWR's maintenance yards are ineligible to pursue state grants alone	Flood/Levee Failure	1

Mitigation Action Title	Hazards Addressed	Points/ Worksheet Status
Feather River Habitat Restoration (Yuba City)	Flood/Levee Failure	1
Require standard tie-downs of propane tanks	Flood/Levee Failure	1
Obtain easements or acquiring land in fee for drainage areas and levees	Flood/Levee Failure	0
Interactive Critical Facility Data Management (Yuba City)	Multi-Hazard	0
Stormwater drainage study(ies)	Flood/Levee Failure	0
Conduct studies/modelling to meet DWR's upcoming landscape irrigation requirements	Drought and Water Shortage	0
Create (or expand) Levee Improvement Agency(ies) to plan for the future levee system improvements necessary to address risk reduction, FEMA accreditation, climate change resiliency, and other challenges	Flood/Levee Failure	0
Require all critical facilities to meet requirements of Executive Order 11988 and be built 1 foot above the 500-year flood elevation.	Flood/Levee Failure	0
Relocation of Treated Wastewater Effluent Diffuser Line (Yuba City)	Flood/Levee Failure	0
Adopt a post-disaster recovery ordinance citing NFIP and Other Requirements that regulate repair activity	Multi-Hazard	0
Acquire or relocating structures located in hazard areas	Multi-Hazard	0
Perform video inspections of pipes and systems	Flood/Levee Failure	0
Increase tree plantings around buildings to shade parking lots and along public rights-of-way	Severe Weather: Heat	0

Appendix D Adoption Resolution

Note to Reviewers: When this plan has been reviewed and approved pending adoption by FEMA Region IX, the adoption resolutions will be signed by the participating jurisdictions and added to this appendix. Two model resolutions are provided below. The first sample resolution is for the County and incorporated communities; the second is for participating districts.

Sample Resolution: Sutter County and incorporated communities

Resolution # _____

Adopting the Sutter County Local Hazard Mitigation Plan Update

WHEREAS, The (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) recognizes the threat that natural hazards pose to people and property within our community; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

WHEREAS, the U.S. Congress passed the Disaster Mitigation Act of 2000 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards; and

WHEREAS, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments; and

WHEREAS, an adopted Local Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

WHEREAS, the (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) fully participated in the FEMA-prescribed mitigation planning process to prepare this local hazard mitigation plan; and

WHEREAS, the California Office of Emergency Services and Federal Emergency Management Agency, Region IX officials have reviewed the Sutter County Local Hazard Mitigation Plan and approve it contingent upon this official adoption of the participating governing body; and

WHEREAS, the (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Sutter County Local Hazard Mitigation Plan by reference into the Safety Element of the General Plan in accordance with the requirements of AB 2140; and

WHEREAS, adoption by the governing body for the (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Local Hazard Mitigation Plan; and

WHEREAS, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan.

NOW, THEREFORE, BE IT RESOLVED that the (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) adopts the Sutter County Local Hazard Mitigation Plan as an official plan; and

BE IT RESOLVED, that the (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) adopts the Sutter County Local Hazard Mitigation Plan by reference into the safety element of their general plan in accordance with the requirements of AB 2140; and

BE IT FURTHER RESOLVED, the (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) will submit this adoption resolution to the California Office of Emergency Services and FEMA Region IX officials to enable the plan's final approval in accordance with the requirements of the Disaster Mitigation Act of 2000 and to establish conformance with the requirement of AB 2140.

Passed:_____
(date)

_____
Certifying Official

Sample Resolution: Special Districts in Sutter County

Resolution # _____

Adopting the Sutter County Local Hazard Mitigation Plan Update

Whereas, (Name of Government/District/Organization seeking FEMA approval of hazard mitigation plan) recognizes the threat that natural hazards pose to people and property within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, the U.S. Congress passed the Disaster Mitigation Act of 2000 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards;

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments;

Whereas, an adopted Local Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, (Name of Government/District/Organization) fully participated in the FEMA-prescribed mitigation planning process to prepare this local hazard mitigation plan; and

Whereas, the California Office of Emergency Services and Federal Emergency Management Agency, Region IX officials have reviewed the Sutter County Local Hazard Mitigation Plan and approved it contingent upon this official adoption of the participating governing body;

Whereas, the (Name of Government/District/Organization) desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Sutter County Local Hazard Mitigation Plan;

Whereas, adoption by the governing body for the (Name of Government/District/Organization), demonstrates the jurisdiction's commitment to fulfilling the mitigation goals and objectives outlined in this Local Hazard Mitigation Plan.

Whereas, adoption of this legitimizes the plan and authorizes responsible agencies to carry out their responsibilities under the plan.

Now, therefore, be it resolved, that the (Name of Government/District/Organization) adopts the Sutter County Local Hazard Mitigation Plan as an official plan; and

Be it further resolved, (Name of Government/District/Organization) will submit this adoption resolution to the California Office of Emergency Services and FEMA Region IX officials to enable the plan's final approval in accordance with the requirements of the Disaster Mitigation Act of 2000.

Passed:_____
(date)

_____
Certifying Official

Appendix E Threatened and Endangered Species

Table E–1 Special Status Species in Sutter County

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank
Animals – Amphibians					
Ambystoma californiense	California tiger salamander	Threatened	Threatened	WL	-
Rana boylii	foothill yellow-legged frog	None	Endangered	SSC	-
Animals – Birds					
Aquila chrysaetos	golden eagle	None	None	FP ; WL	-
Buteo swainsoni	Swainson's hawk	None	Threatened	-	-
Branta hutchinsii leucopareia	cackling (=Aleutian Canada) goose	Delisted	None	WL	-
Ardea alba	great egret	None	None	-	-
Ardea herodias	great blue heron	None	None	-	-
Botaurus lentiginosus	American bittern	None	None	-	-
Egretta thula	snowy egret	None	None	-	-
Ixobrychus exilis	least bittern	None	None	SSC	-
Nycticorax nycticorax	black-crowned night heron	None	None	-	-
Charadrius montanus	mountain plover	None	None	SSC	-
Pica nuttalli	yellow-billed magpie	None	None	-	-
Coccyzus americanus occidentalis	western yellow-billed cuckoo	Threatened	Endangered	-	-
Falco mexicanus	prairie falcon	None	None	WL	-
Falco peregrinus anatum	American peregrine falcon	Delisted	Delisted	FP	-
Spinus lawrencei	Lawrence's goldfinch	None	None	-	-
Antigone canadensis tabida	greater sandhill crane	None	Threatened	FP	-
Riparia riparia	bank swallow	None	Threatened	-	-
Agelaius tricolor	tricolored blackbird	None	Threatened	SSC	-
Lanius ludovicianus	loggerhead shrike	None	None	SSC	-
Pandion haliaetus	osprey	None	None	WL	-
Aimophila ruficeps canescens	southern California rufous-crowned sparrow	None	None	WL	-
Melospiza melodia	song sparrow (-inModesto-in population)	None	None	SSC	-
Phalacrocorax auritus	double-crested cormorant	None	None	WL	-
Laterallus jamaicensis coturniculus	California black rail	None	Threatened	FP	-

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank
Athene cunicularia	burrowing owl	None	None	SSC	-
Plegadis chihi	white-faced ibis	None	None	WL	-
Vireo bellii pusillus	least Bell's vireo	Endangered	Endangered	-	-
Animals - Crustaceans					
Branchinecta lynchi	vernal pool fairy shrimp	Threatened	None	-	-
Linderiella occidentalis	California linderiella	None	None	-	-
Lepidurus packardi	vernal pool tadpole shrimp	Endangered	None	-	-
Animals – Fish					
Acipenser medirostris	green sturgeon	Threatened	None	SSC	-
Acipenser transmontanus	white sturgeon	None	None	SSC	-
Cottus gulosus	riffle sculpin	None	None	SSC	-
Lavinia exilicauda exilicauda	Sacramento hitch	None	None	SSC	-
Mylopharodon conocephalus	hardhead	None	None	SSC	-
Pogonichthys macrolepidotus	Sacramento splittail	None	None	SSC	-
Hysterocarpus traskii traskii	Sacramento-San Joaquin tule perch	None	None	-	-
Hypomesus transpacificus	Delta smelt	Threatened	Endangered	-	-
Spirinchus thaleichthys	longfin smelt	Candidate	Threatened	-	-
Thaleichthys pacificus	eulachon	Threatened	None	-	-
Entosphenus tridentatus	Pacific lamprey	None	None	SSC	-
Lampetra ayresii	western river lamprey	None	None	SSC	-
Oncorhynchus mykiss irideus pop. 11	steelhead - Central Valley DPS	Threatened	None	-	-
Oncorhynchus mykiss irideus pop. 8	steelhead - central California coast DPS	Threatened	None	-	-
Oncorhynchus tshawytscha pop. 13	chinook salmon - Central Valley fall / late fall-run ESU	None	None	SSC	-
Oncorhynchus tshawytscha pop. 30	chinook salmon - upper Klamath and Trinity Rivers ESU	Candidate	Candidate Endangered	SSC	-
Oncorhynchus tshawytscha pop. 6	chinook salmon - Central Valley spring-run ESU	Threatened	Threatened	-	-
Animals – Insects					
Anthicus antiochensis	Antioch Dunes anthicid beetle	None	None	-	-
Anthicus sacramento	Sacramento anthicid beetle	None	None	-	-
Cicindela hirticollis abrupta	Sacramento Valley tiger beetle	None	None	-	-
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	Threatened	None	-	-

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank
Animals – Mammals					
Vulpes vulpes patwin	Sacramento Valley red fox	None	None	-	-
Erethizon dorsatum	North American porcupine	None	None	-	-
Dipodomys californicus eximius	Marysville California kangaroo rat	None	None	SSC	-
Perognathus inornatus	San Joaquin pocket mouse	None	None	-	-
Eumops perotis californicus	western mastiff bat	None	None	SSC	-
Antrozous pallidus	pallid bat	None	None	SSC	-
Lasiurus blossevillii	western red bat	None	None	SSC	-
Lasiurus cinereus	hoary bat	None	None	-	-
Myotis ciliolabrum	western small-footed myotis	None	None	-	-
Myotis yumanensis	Yuma myotis	None	None	-	-
Animals – Mollusks					
Gonidea angulata	western ridged mussel	None	None	-	-
Animals – Reptiles					
Masticophis flagellum ruddocki	San Joaquin coachwhip	None	None	SSC	-
Emys marmorata	western pond turtle	None	None	SSC	-
Thamnophis gigas	giant gartersnake	Threatened	Threatened	-	-
Community – Terrestrial					
–	Coastal and Valley Freshwater Marsh	None	None	-	-
–	Great Valley Cottonwood Riparian Forest	None	None	-	-
–	Great Valley Mixed Riparian Forest	None	None	-	-
–	Great Valley Willow Scrub	None	None	-	-
–	Northern Hardpan Vernal Pool	None	None	-	-
Plants – Vascular					
Sagittaria sanfordii	Sanford's arrowhead	None	None	-	1B.2
Hemizonia congesta ssp. calyculata	Mendocino tarplant	None	None	-	4.3
Hesperevax caulescens	hogwallow starfish	None	None	-	4.2
Layia septentrionalis	Colusa layia	None	None	-	1B.2
Pseudobahia bahiifolia	Hartweg's golden sunburst	Endangered	Endangered	-	1B.1
Trichocoronis wrightii var. wrightii	Wright's trichocoronis	None	None	-	2B.1
Amsinckia lunaris	bent-flowered fiddleneck	None	None	-	1B.2

Scientific Name	Common Name	Federal Status	State Status	CDFW Status	CA Rare Plant Rank
Cryptantha rostellata	red-stemmed cryptantha	None	None	-	4.2
Brasenia schreberi	watershield	None	None	-	2B.3
Cuscuta obtusiflora var. glandulosa	Peruvian dodder	None	None	-	2B.2
Astragalus tener var. ferrisiae	Ferris' milk-vetch	None	None	-	1B.1
Lathyrus delnorticus	Del Norte pea	None	None	-	4.3
Monardella venosa	veiny monardella	None	None	-	1B.1
Wolffia brasiliensis	Brazilian watermeal	None	None	-	2B.3
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	None	None	-	1B.2
Navarretia leucocephala ssp. bakeri	Baker's navarretia	None	None	-	1B.1
Heteranthera dubia	water star-grass	None	None	-	2B.2
Delphinium recurvatum	recurved larkspur	None	None	-	1B.2
Brodiaea rosea ssp. vallicola	valley brodiaea	None	None	-	4.2

Sources: California Natural Diversity Database BIOS Viewer Tool

Federal Status

Endangered: The classification provided to an animal or plant in danger of extinction within the foreseeable future throughout all or a significant portion of its range.

Threatened: The classification provided to an animal or plant which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Proposed Endangered: The classification provided to an animal or plant that is proposed for federal listing as Endangered in the Federal Register under Section 4 of the Endangered Species Act.

Proposed Threatened: The classification provided to an animal or plant that is proposed for federal listing as Threatened in the Federal Register under Section 4 of the Endangered Species Act.

Candidate: The classification provided to an animal or plant that has been studied by the United States Fish and Wildlife Service, and the Service has concluded that it should be proposed for addition to the Federal Endangered and Threatened species list.

None: The plant or animal has no federal status.

Delisted: The plant or animal was previously listed as Endangered or Threatened, but is no longer listed on the Federal Endangered and Threatened species list.

CDFW Status

FP: Fully Protected: This classification was the State of California's initial effort to identify and provide additional protection to those animals that were rare or faced possible extinction.

SSC: Species of Special Concern: To this end, the Department has designated certain vertebrate species as "Species of Special Concern" because declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction. The goal of designating species as "Species of Special Concern" is to halt or reverse their decline by calling attention to their plight and addressing the issues of concern early enough to secure their long–term viability.

WL: Watch List: Species that were previously designated as "Species of Special Concern" but no longer merit that status, or which do not yet meet SSC criteria, but for which there is concern and a need for additional information to clarify status.

CA Rare Plant Rank

1A: Plants presumed extinct in California and rare/extinct elsewhere

1B.1: Plants rare, threatened, or endangered in California and elsewhere; seriously threatened in California

1B.2: Plants rare, threatened, or endangered in California and elsewhere; fairly threatened in California

1B.3: Plants rare, threatened, or endangered in California and elsewhere; not very threatened in California

2A: Plants presumed extirpated in California, but more common elsewhere

2B.1: Plants rare, threatened, or endangered in California, but more common elsewhere; seriously threatened in California

2B.2: Plants rare, threatened, or endangered in California, but more common elsewhere; fairly threatened in California

2B.3: Plants rare, threatened, or endangered in California, but more common elsewhere; not very threatened in California

3.1: Plants about which we need more information; seriously threatened in California
3.2: Plants about which we need more information; fairly threatened in California
3.3: Plants about which we need more information; not very threatened in California
4.1: Plants of limited distribution; seriously threatened in California
4.2: Plants of limited distribution; fairly threatened in California
4.3: Plants of limited distribution; not very threatened in California

Appendix F Critical Facilities

Table F-1 Sutter County Critical Facilities

STILL NEED FROM COUNTY

Source: Sutter County GIS