Annex G American River Flood Control District

G.1 Introduction

This Annex details the hazard mitigation planning elements specific to American River Flood Control District (ARFCD or District), a new participating jurisdiction to the 2021 Sacramento County Local Hazard Mitigation Plan (LHMP) Update.

Note: ARFCD participated in the original 2005 Sacramento County LHMP. A copy of that document could not be located by ARFCD, Sacramento County, Cal OES, or FEMA. Additionally, staff turnover in the past 16 years has reduced institutional memory of that 2005 Plan. It can be assumed that none of ARFCD's proposed mitigation actions were completed, ARFCD's mitigation priorities at that time are unknown, and that the 2005 Plan was not incorporated into any ARFCD planning mechanisms. Development in the District since 2005 was described by ARFCD as minimal, and a general description of more recent development in the District is included in Section G.5.2 of this Annex.

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 ARFCD, with a focus on providing additional details on the risk assessment and mitigation strategy for this District.

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 Sacramento County Hazard Mitigation Planning Committee (HMPC), the District conducted 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.

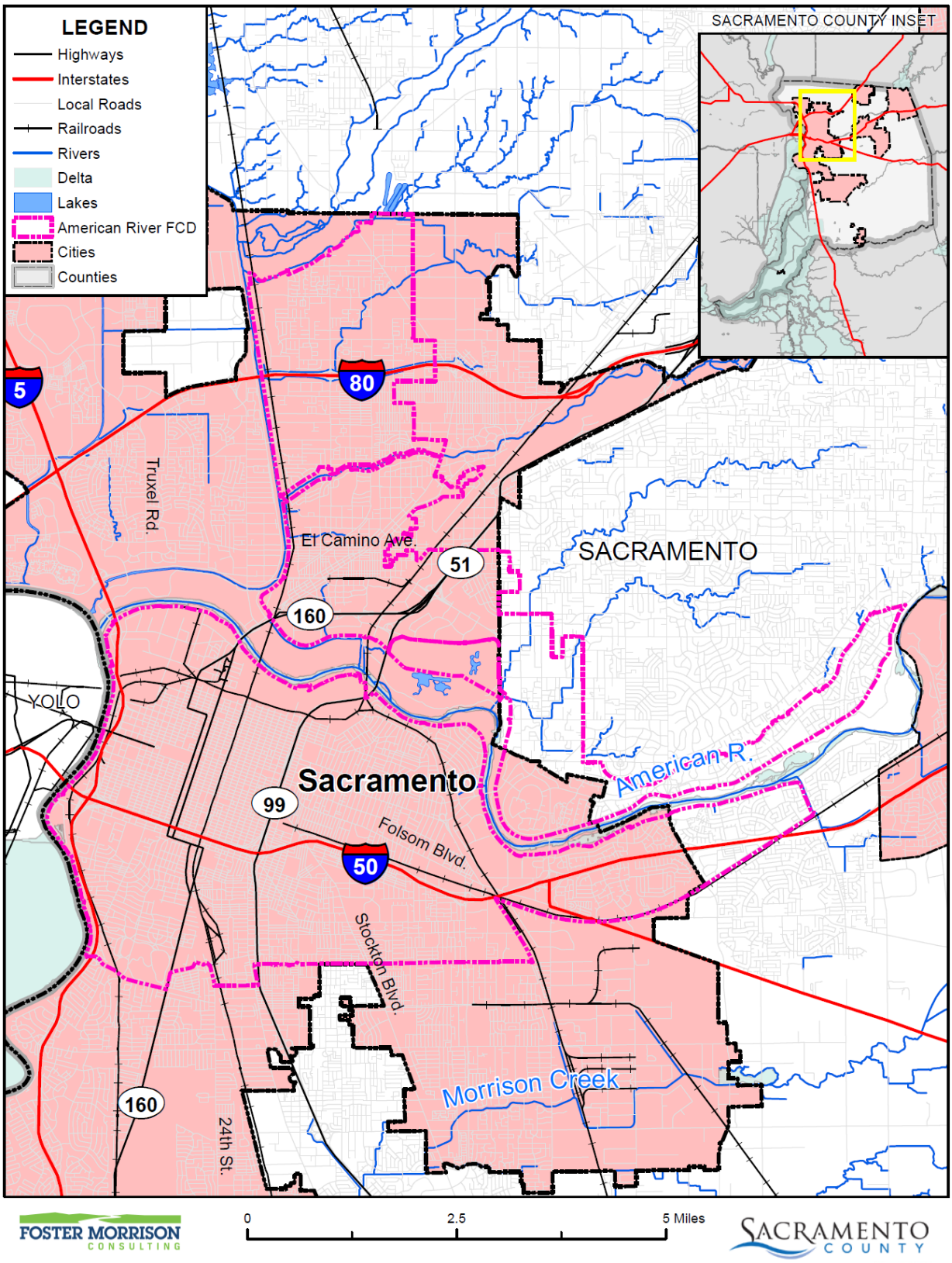
Table G-1 ARFCD – Planning Team

Name	Position/Title	How Participated
Tim Kerr	General Manager	Attended meetings, reviewed documents, submitted mitigation action plans

G.3 District Profile

The District profile for the ARFCD is detailed in the following sections. Figure G-1 displays a map and the location of the District within Sacramento County.

Figure G-1 ARFCD



Data Source: American River Flood Control District, Sacramento County GIS, Cal-Atlas; Map Date: 09/2020.

G.3.1. Overview and Background

The American River Flood Control District has been providing flood protection to the citizens of the Sacramento community for over 75 years. Formed by an act of the State Legislature in 1927 their mission is to protect the citizens in the District by maintaining the 40 miles of levees along the American River and portions of Steelhead, Arcade, Dry, and Magpie Creeks.

The District is governed by a five member Board of Trustees, each of whom is elected by the voters within the District's jurisdiction. Revenues to run the District's operations are raised through a special benefit assessment on properties in the District that benefit from the flood protection provided. The assessment appears on the annual Sacramento County property tax bill as a direct levy and is designated American River Flood Zone A, Zone B, or Zone C.

G.4 Hazard Identification

ARFCD 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-2).

Table G-2 ARFCD—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Climate Change	Extensive	Likely	Limited	Medium	–
Dam Failure	Significant	Occasional	Catastrophic	High	Medium
Drought & Water Shortage	Extensive	Likely	Limited	Low	High
Earthquake	Extensive	Occasional	Limited	Low	Low
Earthquake Liquefaction	Limited	Occasional	Catastrophic	Medium	Low
Floods: 1%/0.2% annual chance	Significant	Occasional	Limited	High	Medium
Floods: Localized Stormwater	Extensive	Highly Likely	Limited	Low	Medium
Landslides, Mudslides, and Debris Flow	Limited	Occasional	Limited	Low	Medium
Levee Failure	Extensive	Occasional	Catastrophic	High	Medium
Pandemic	Extensive	Likely	Limited	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	Medium	Medium
Severe Weather: Wind and Tornado	Extensive	Likely	Limited	Low	Low
Subsidence	Significant	Likely	Limited	Low	Medium
Volcano	Extensive	Unlikely	Negligible	Low	Low
Wildfire	Significant	Highly Likely	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

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 Sacramento 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 Sacramento 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 G.5.3, includes a hazard profile/problem description as to how each medium or high significant hazard (as shown in Table G-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 Sacramento 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 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 ARFCD'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:

> ***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.***

A critical facility is classified by the following categories: (1) Essential Services Facilities, (2) At-risk Populations Facilities, (3) Hazardous Materials and Solid Waste Facilities.

Table G-3 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. ARFCD's physical assets, valued at over $2 billion, consist of the buildings and infrastructure to support the District's operations.

Table G-3 ARFCD Critical Facilities, Infrastructure, and Other District Assets

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
Headquarters Building	Structure and contents	$6,000,000	Flooding, Fire
Equipment Fleet	Mobile Equipment	$3,000,000	Flooding, Fire
Staging Yards	Land, Infrastructure	$200,000	Flooding
Levees*	Infrastructure	$2,000,000,000	Flooding
Total		**$2,009,200,000**	

Source: ARFCD

The levees are owned by the State of California with a replacement cost of over $2 Billion. ARFCD does not technically own the levees but are the stewards of them for O&M. ARFCD may be required to repair the damage.

Natural Resources

ARFCD has a variety of natural resources of value to the District. These natural resources parallels that of Sacramento County as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Historic and Cultural Resources

ARFCD has a variety of historic and cultural resources of value to the District. These historic and cultural resources parallels that of Sacramento 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 the Sacramento County Planning Area as a whole. Information can be found in Section 4.3.1 of the Base Plan.

Future Development

The District has no control over future development in areas the District services. Future development in these areas parallels that of the Sacramento County Planning Area. More general information on growth and development in Sacramento County as a whole can be found in "Growth and Development Trends" in Section 4.3.1 Sacramento 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-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 Sacramento 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.

Power Outage/Power Failure

An impact of almost all hazards below relates to power outage and/or power failures. 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. Incredibly, 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. In addition to blackouts, brownouts can occur. A brownout is an intentional or unintentional drop in voltage in an electrical power supply system. Intentional brownouts are used for load reduction in an emergency. Electric power disruptions can be generally grouped into two categories: intentional and unintentional. More information on types of power disruptions can be found in Section 4.3.2 of the Base Plan.

Public Safety Power Shutoff (PSPS)

A new intentional disruption type of power outage/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 PSPS. More information on PSPS criteria can be found in Section 4.3.2 of the Base Plan. The District noted that it is possible to experience a PSPS.

The District does not have back-up power arrangements to continue operations at the Headquarters Building.

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.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the District, Sacramento 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 did, however, note that in Sacramento County, 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 2014 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. Sacramento 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 Sacramento County Planning Area.

The California APG: Understanding Regional Characteristics identified the following impacts specific to the North Sierra region in which the Sacramento 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. The District noted that it is thought that climate change contributes to wildfires. The main risk from wildfire is a temporary loss of sod covering on the levees. This could trigger significant erosion during rain events.

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

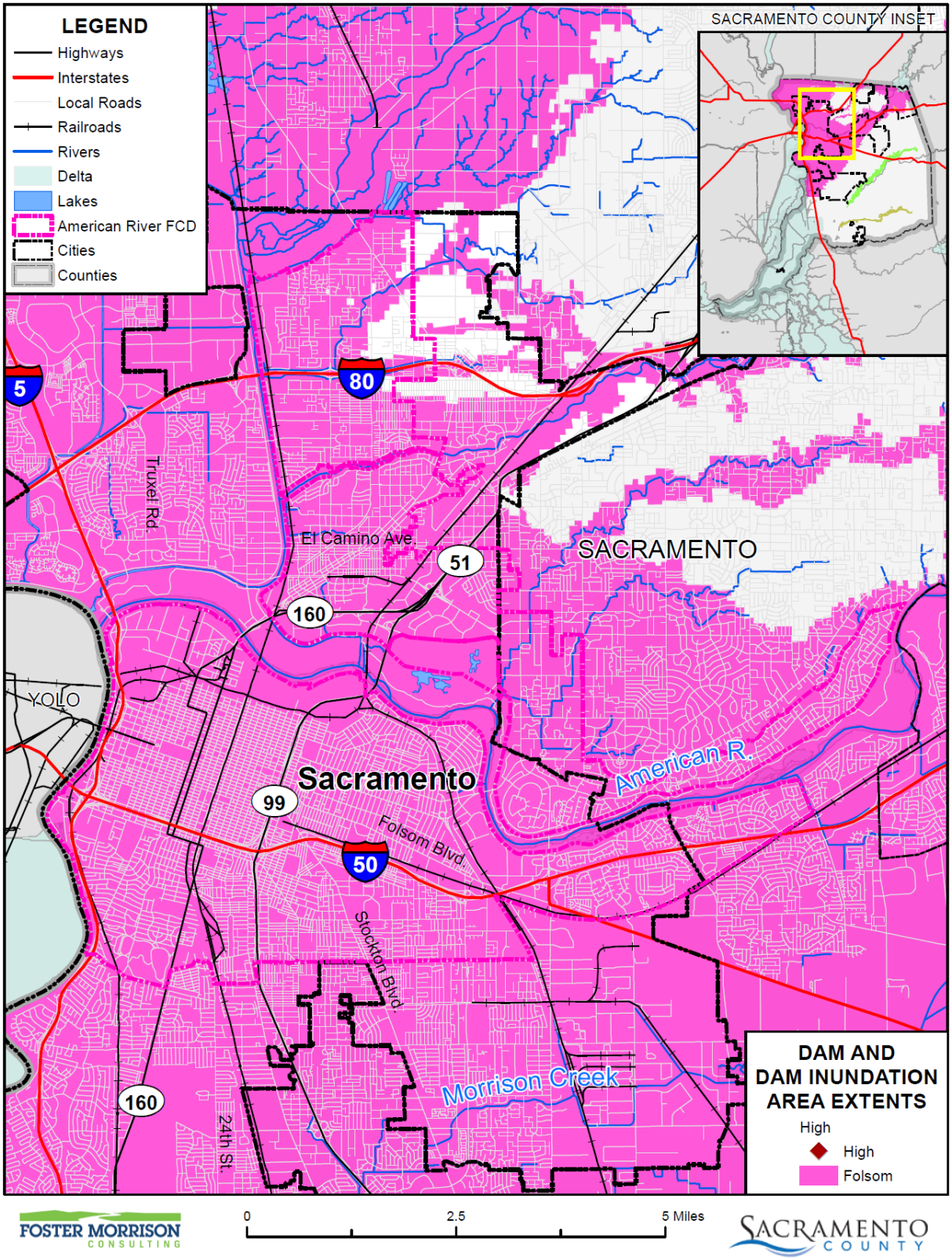
Dam failure is a natural disaster from two perspectives. First, the inundation from released waters resulting from dam failure is related to naturally occurring floodwaters. Second, a total dam failure would most probably happen as a consequence of the natural disaster triggering the event, such as an 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 4.3.7 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.

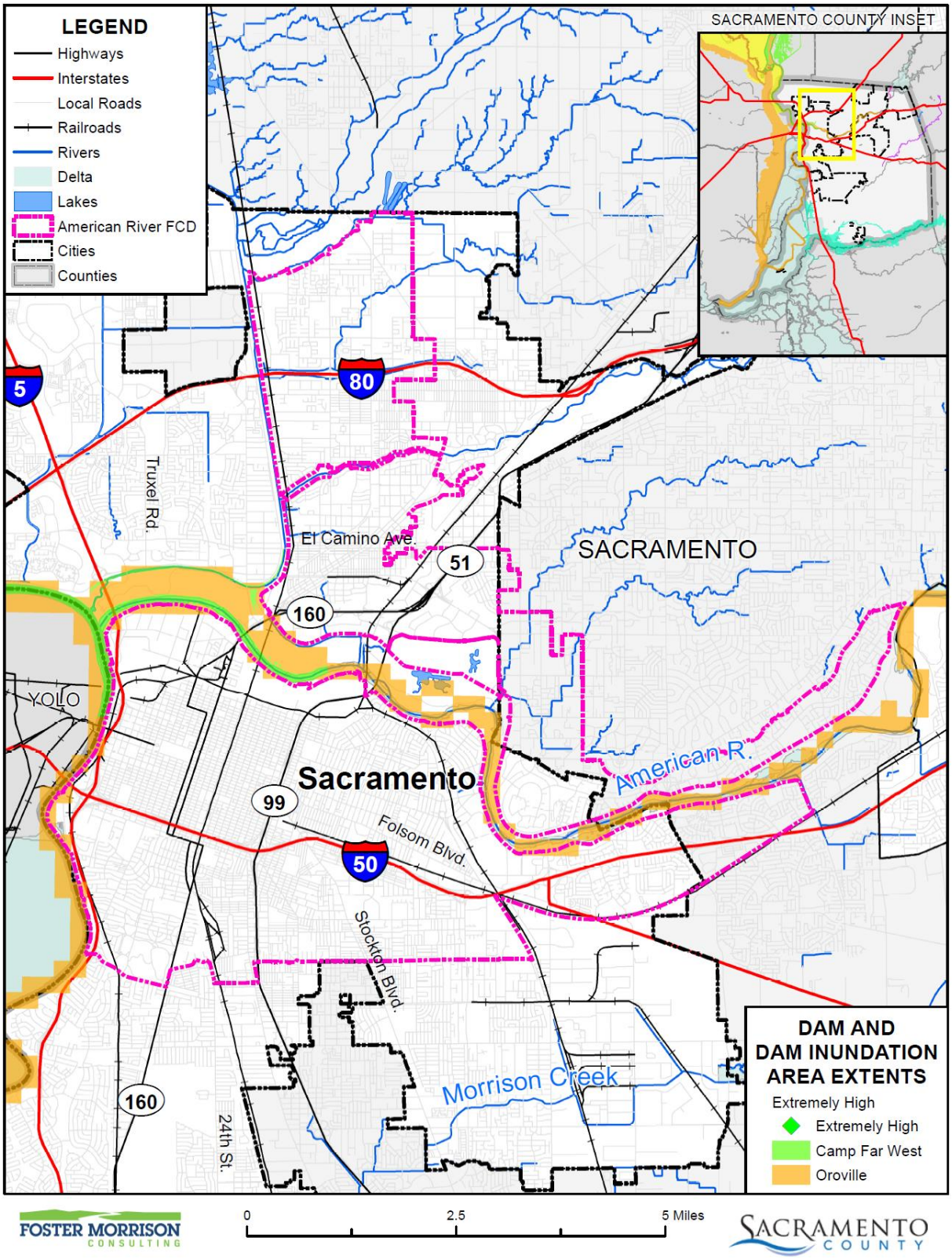
Based on dam inundation data obtained from CA DWR and Cal OES the was discussed in Section 4.3.7 of the Base Plan, dams inside the County that can affect the District can be seen on Figure G-2. Dams outside the County that can affect the District can be seen on Figure G-3. The Folsom Dam 235,000 cfs scenario is shown in Figure G-4. While Figures G-2 and G-3 illustrate dam inundation areas from an actual dam failure, Figure G-4, the Folsom 235,000 cfs scenario reflects the likely inundation area associated with a possible "super" release of water from Folsom. This updated Folsom scenario reflects the Folsom dam improvements which make a dam failure unlikely, with any resulting downstream inundation from Folsom associated with an intentional release of water from the dam. It is anticipated that the worst case scenario would be a 235,000 cfs release, which is comparable to a 200-year flood.

Figure G-2 ARFCD – Dam Inundation Areas from Dams Inside the County



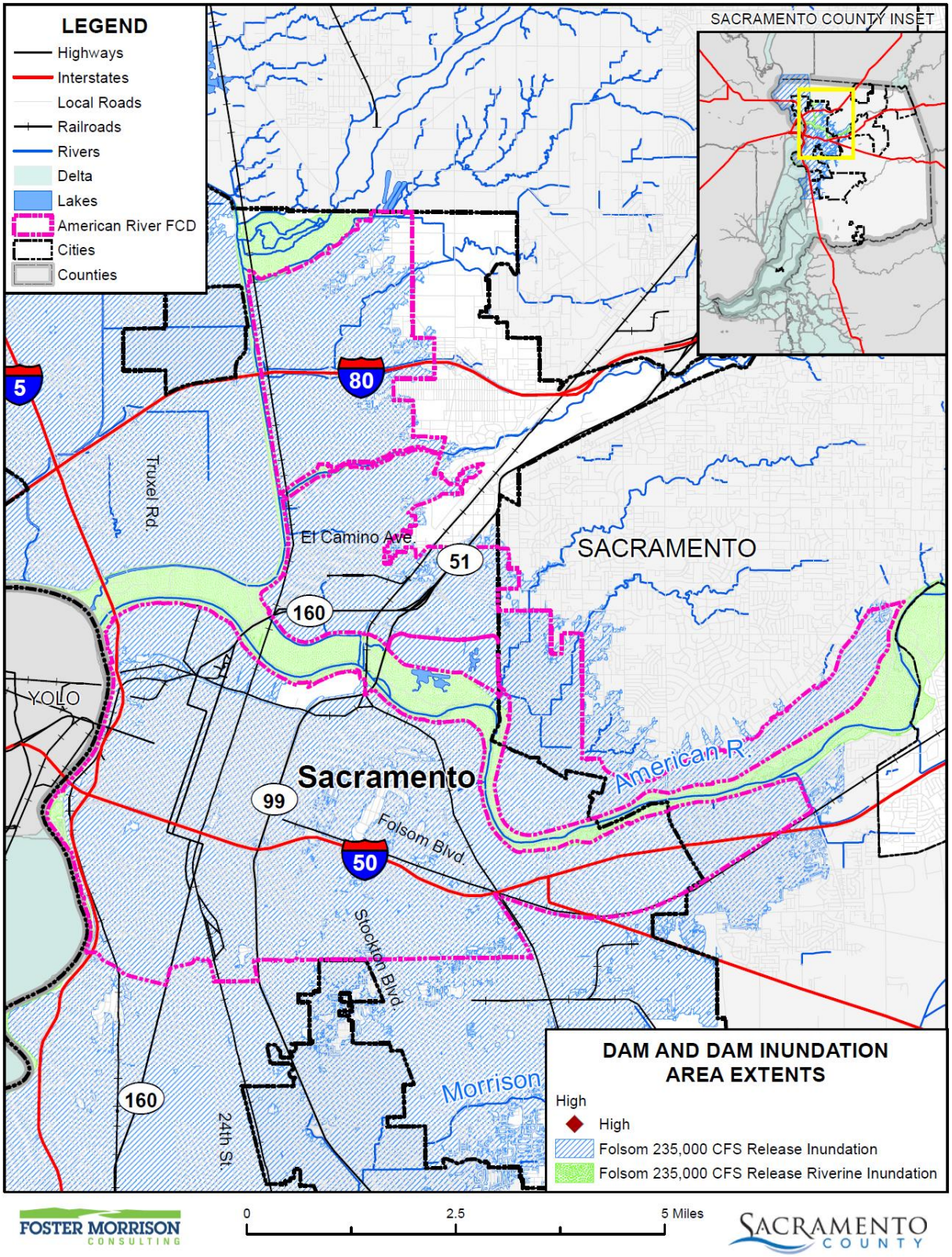
Data Source: County-provided dam inundation data (FOLSOM_DAM_INUNDATION_AREA.shp 2016), DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, Sacramento County GIS, Cal-Atlas; Map Date: 2/2021.

Figure G-3 ARFCD – Dam Inundation Areas from Dams Outside the County



Data Source: DWR DSOD Data 2020 and Cal OES Dam Status 10/2017, American River Flood Control District, Sacramento County GIS, Cal-Atlas; Map Date: 09/2020.

Figure G-4 ARFCD – Dam Inundation Areas from Folsom Dam 235,000 cfs Scenario



Data Source: County-provided dam inundation data (CA_DWR_200YEAR_FLOODPLAIN.zip 2020), DWR DSOD Data 2020, Sacramento County GIS, Cal-Atlas; Map Date: 02/2021.

Past Occurrences

There has been no federal or state disaster declarations for dam failure in the County. 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 could 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.

A dam failure at Folsom Dam would cause significant overtopping on the 12-mile levied stretch of the Lower American River. It is likely the overtopping would cause severe erosion on the back side of the levees and ultimately destroy the levees.

Assets at Risk

District assets at risk from a dam failure include the District Headquarters Building, its contents, and the Equipment Fleet. Approximately 12-miles of State owned levees would also be at risk of failure.

Earthquake: Liquefaction

Likelihood of Future Occurrence–Occasional
Vulnerability–Medium

Hazard Profile and Problem Description

Liquefaction can be defined as the loss of soil strength or stiffness due to a buildup of pore-water pressure during a seismic event and is associated primarily with relatively loose, saturated fine- to medium-grained unconsolidated soils. Seismic ground shaking of relatively loose, granular soils that are saturated or submerged can cause the soils to liquefy and temporarily behave as a dense fluid. If this layer is at the surface, its effect is much like that of quicksand for any structure located on it. If the liquefied layer is in the subsurface, the material above it may slide laterally depending on the confinement of the unstable mass. Liquefaction is caused by a sudden temporary increase in pore-water pressure due to seismic densification or other displacement of submerged granular soils. Liquefiable soil conditions are not uncommon in alluvial deposits in moderate to large canyons and could also be present in other areas of alluvial soils where the groundwater level is shallow (i.e., 50 feet below the surface). Bedrock units, due to their dense nature, are unlikely to present a liquefaction hazard.

Location and Extent

There is no scientific scale for earthquake related liquefaction. The speed of onset is short, as is the duration. The effects from liquefaction can last for days, weeks, months or even years as areas of the County are rebuilt or leveed areas are dewatered, and the levees rebuilt. In Sacramento County, the Delta and areas of

downtown Sacramento are at risk to liquefaction. The Delta sits atop a blind fault system on the western edge of the Central Valley. Moderate earthquakes in 1892 near Vacaville and in 1983 near Coalinga demonstrate the seismic potential of this structural belt. The increasing height of the levee system has prompted growing concern about the seismic stability of the levees. The concern is based on the proximity of faulting, the nature of the levee foundations, and the materials used to build the levees. Many levees consist of uncompacted weak local soils that may be unstable under seismic loading. The presence of sand and silt in the levees and their foundations indicates that liquefaction is also a possibility.

Past Occurrences

There have been no past federal or state disaster declarations from this hazard. The District noted no past occurrences of earthquake liquefaction or that affected the District in any meaningful way.

Vulnerability to and Impacts from Liquefaction

Earthquake is discussed above, but is primarily focused on the vulnerability of buildings and people from earthquake shaking. This section deals with a secondary hazard associated with earthquake – the possible collapse of structural integrity of the ground underneath liquefaction prone areas. In Sacramento County, two of these areas have been identified: downtown Sacramento and the Delta area, which could lead to a possible collapse of delta levees and any above ground structures. While this levee failure differs from the levee failure discussion below which generally focuses on levee failure due to high water conditions or other types of structural failure, the resulting impacts would be similar and include those related to a large flood event.

Districts risks would primarily be due to flooding from liquefaction causing a levee failure.

Assets at Risk

District assets at risk from liquefaction and flooding include the District Headquarters Building, its contents, and the Equipment Fleet. Approximately 12-miles of State owned levees would also be at risk.

Flood: 1%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–High

Hazard Profile and Problem Description

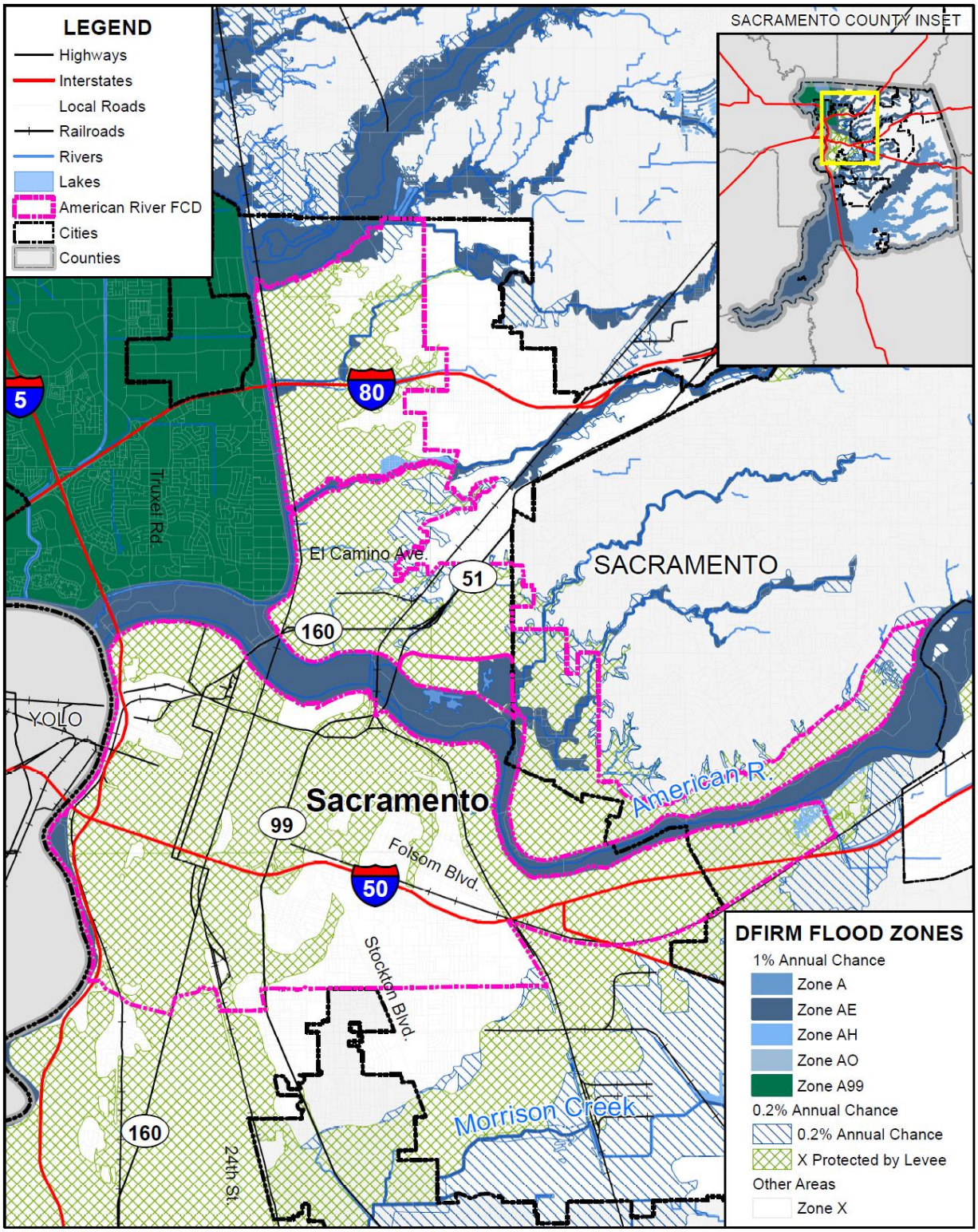
This hazard analyzes the FEMA DFIRM 1% and 0.2% annual chance floods. These tend to be the larger floods that can occur in the County or in the District, and have caused damages in the past. Flooding is a significant problem in Sacramento County and the District. Historically, the District has been at 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 4.3.11 of the Base Plan, the Sacramento County Planning Area and the ARFCD have been subject to historical flooding.

Location and Extent

The ARFCD has areas located in the 1% and 0.2% annual chance floodplain. This is seen in Figure G-5.

Figure G-5 ARFCD – FEMA DFIRM Flood Zones



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SACRAMENTO COUNTY

Data Source: FEMA NFHL 07/19/2018, American River Flood Control District, Sacramento County GIS, Cal-Atlas; Map Date: 09/2020.

Table G-4 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-4 ARFCD– DFIRM Flood Hazard Zones

Flood Zone	Description	Flood Zone Present in the District
A	100-year Flood: No base flood elevations provided	
AE	100-year Flood: Base flood elevations provided	X
AH	An area inundated by 1% annual chance flooding (usually an area of ponding), for which BFEs have been determined; flood depths range from 1 to 3 feet	
AO	Areas subject to inundation by 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet	
A99	Areas with a 1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or base flood elevations are shown within these zones	X
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
X Protected by Levee	An area determined to be outside the 500-year flood and protected by levee from 100-year flood	X
X	Outside flood zone	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 Sacramento County from flooding is shown on Table G-5. These events also likely affected the District to some degree.

Table G-5 Sacramento 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)	19	1950, 1955, 1958 (twice), 1963, 1969, 1982 (twice), 1983, 1986, 1995 (twice), 1996, 1997, 1998, 2008, 2017 (three times)	14	1955, 1958, 1964, 1969, 1983, 1986, 1995 (twice), 1997, 1998, 2006, 2017 (three times)

Source: Cal OES, FEMA

In the 2017 Flood Events, damage to District levees primarily consisted of damage to patrol roadways. Waterside toe roads were submerged and stripped of aggregate base rock from flood flows. Levee crown roadways were heavily rutted from extensive patrolling during wet conditions. Approximately 10-miles of gravel roadways had to be resurfaced after the floods at a cost of roughly $100,000.

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. 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.

Assets at Risk

District assets at risk from include the District Headquarters Building, its contents, and the Equipment Fleet. Approximately 12-miles of State owned levees would also be at risk.

Levee Failure

Likelihood of Future Occurrence–Occasional
Vulnerability–High

Hazard Profile and Problem Description

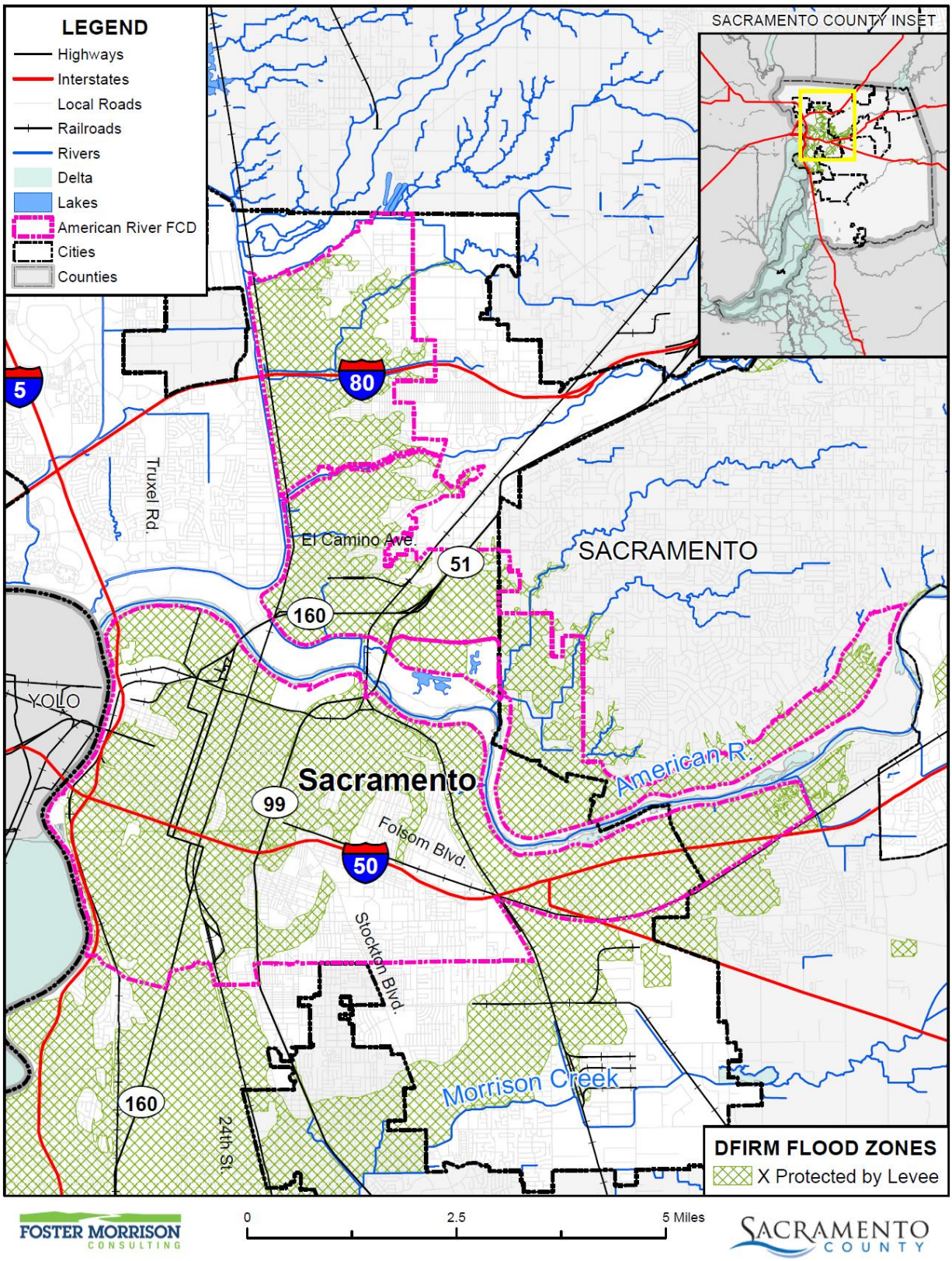
A levee is a raised area that runs along the banks of a stream or canal. Levees reinforce the banks and help prevent flooding by containing higher flow events to the main stream channel. By confining the flow to a narrower steam channel, levees can also increase the speed of the water. Levees can be 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 vary by event and location. 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 dams and reservoirs are nearing maximum capacity, they release water through the river systems, causing additional burdens on County levees. Levees in the District are shown on Figure G-6.

Figure G-6 ARFCD – Levee Protected Areas



Data Source: FEMA NFHL 07/19/2018, American River Flood Control District, Sacramento County GIS, Cal-Atlas; Map Date: 09/2020.

Past Occurrences

There have been no federal or state disaster declarations from levee failure. Levee failures have occurred in Sacramento in 1852, 1862, and 1950. A neighborhood was flooded on Arcade Creek in 1986 due to a breached floodgate on Norwood Avenue.

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 District is concerned with scour and erosion events at extremely high flows. A levee failure in the District would inundate most of Sacramento and would prevent the District from continuing flood patrolling during the flood event for a large section of the region.

Assets at Risk

District assets at risk include the District Headquarters Building, its contents, and the Equipment Fleet. Approximately 12-miles of State owned levees would also be at risk.

Severe Weather: Heavy Rains and Storms

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, Sacramento County, and the District 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

There have been past disaster declarations from heavy rains and storms, which were discussed in Past Occurrences of the flood section above. 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.

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 outage and failure can be found at the beginning of Section G.5.3 above, as well as in Section 4.3.3 of the Base Plan.

District impacts would include a temporary loss of access to District information systems and communications. Lights and electricity for fleet maintenance would also be down.

Assets at Risk

What District assets from Table G-3 are at risk from this hazard.

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-6 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 ARFCD.

Table G-6 ARFCD 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	2015	Emergency Action Plan (no, no, no)
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?
Test the EAP periodically with a functional exercise with other stakeholders.

Source: ARFCD

G.6.2. Administrative/Technical Mitigation Capabilities

Table G-7 identifies the District department(s) responsible for activities related to mitigation and loss prevention in ARFCD.

Table G-7 ARFCD'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	Y	We participate in the mutual aid agreement with Sac County and partners
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	Y, FT	Yes, yes, & yes
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?		
Due to financial constraints, it is difficult for the District to expand these capabilities. Additional revenue would be needed to expand.		

Source: ARFCD

G.6.3. Fiscal Mitigation Capabilities

Table G-8 identifies financial tools or resources that the District could potentially use to help fund mitigation activities.

Table G-8 ARFCD'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	General Fund, Reserve Funds
Authority to levy taxes for specific purposes	N	
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	At our formation in 1928
Incur debt through private activities	Y	None yet
Community Development Block Grant	N	
Other federal funding programs	Y	Funding has not been used yet, but it is the intent of the District to use this LHMP to seek federal grant opportunities.
State funding programs	Y	Yes, funding for O&M and Equipment, Yes
Other		
How can these capabilities be expanded and improved to reduce risk?		
The District is subject to Prop 218 and cannot raise rates without getting on the ballot. This limits the District's ability to take on new projects. Establishing additional revenue sources would help the District with implementation of mitigation and other key District projects.		

Source: ARFCD

G.6.4. Mitigation Education, Outreach, and Partnerships

Table G-9 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 G-9 ARFCD'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)	Y	Annual District Newsletter
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?		
The District could expand outreach to community groups		

Source: ARFCD

G.6.5. Other Mitigation Efforts

The District has many other completed or ongoing mitigation efforts that include the following:

Autumn and Winter Maintenance Schedule

During autumn, the District's levee staff focuses on preparation for the rainy season. Sandbags and flood fight materials are inventoried. Excess vegetation is trimmed and removed to allow visibility. Levee roads are resurfaced to provide all-weather drivability. Levee staff attends an annual flood fight training sponsored by the CA Department of Water Resources.

Crews begin patrolling the levees around the District to locate any areas which need last minute maintenance before the rain comes. Once winter sets in, the levees are inspected on a daily basis. If necessary, crews are put on a 24-hour patrol to ensure the integrity of the levee and the safety of the surrounding properties

Improving the River Park Levee Slope

In the past, some residents whose property is next to the River Park levee obtained permits to install landscaping and vegetation terraces at the bottom of the levee, also known as the levee toe. For some, these features were even permitted on the levee slope. Over time many of these landscape features were not maintained and eventually became overgrown or deteriorated. Many sites became a mysterious lump on the side of the levee or a mound at the levee toe. These encroachments interfere with the District's ability to mow and traverse the levees on foot. They also limit ARFCD's ability to inspect the levees and identify new problem areas during a flood event.

In an ongoing effort to keep District levees accessible and safe, the American River Flood Control District developed a collaborative project with River Park residents to improve the condition of their levee slope.

To maintain a clean and uniform levee slope and a levee toe with clear access for maintenance and flood inspection, in 2008 the District began working with numerous landowners to remove abandoned encroachments. ARFCD used a long-reach excavator positioned at the top of the levee to remove deteriorating retaining walls, debris, and mounds of dirt. The result was a clean levee slope free of obstructions that will no longer compromise levee safety. ARFCD then restored each site with a grass seed mix and erosion control straw and wattles (a tube of straw used to slow water run-off). With the help of participating landowners, we placed timed watering systems at each site to provide the optimum amount of watering for healthy germination. These sites now have a lush mat of grass to help the slope resist erosion.

Flood Fight Training

Every fall there are the reminders that winter is coming. Leaves change colors and start to fall; clouds gather and sprinkle us with rain; and crews of levee maintenance personnel and flood fighters flock to the annual Flood Fight Training along the American River levee. New recruits and old hands train to properly fill and install sandbags and practice other necessary tasks like applying plastic wave wash protection to levee slopes.

Each year the District's crew as well as the crew of the County of Sacramento and other local levee maintenance districts gather for training in Flood Fight Techniques. This training is provided by the State of California's Department of Water Resources and the trainers are veterans of flood fight situations all across the State.

Deferred Maintenance Program - Levee Pipe Project

The District recently completed a levee pipe study with support from State DWR grant funding. The District created a levee pipe database, performed geophysical investigations on historic pipe locations, and removed a previously abandoned pipe from the levee prism.

Flood Maintenance Assistance Program

The District received grant fund from the State to get caught up on levee operations and maintenance. Funds were used to remove a high hazard tree in the levee and to replace aging or outdated equipment due to air resource constraints.

G.7 Mitigation Strategy

G.7.1. Mitigation Goals and Objectives

The ARFCD 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 ARFCD 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
- Earthquake Liquefaction
- Floods: 1%/0.2% annual chance
- Levee Failure
- Severe Weather: Heavy Rains and Storms

After a review of mitigation actions, Earthquake: Liquefaction was removed as a hazard of concern. The District noted that threat is for Delta levees as they are on softer foundations and have constant high water loading on them. Our levees are typically dry unless there is an event

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. Arcade Creek Erosion Repair Project

Hazards Addressed: Climate Change, Dam Failure, Floods: 1%/0.2% annual chance, Levee Failure, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: Arcade Creek is a narrow channel constrained by flood control levees. Frequent flood flows from heavy rains (made worse by climate change) exhibit high velocities and cause downcutting of the channel. This occurrence has created a tall 8-foot vertical bank that has encroached into the levee cross-sectional prism in 4 discrete locations. If an upstream dam failure occurred, these erosion areas would need to be fixed for the levees to stand a chance of surviving a dam failure event.

Project Description: The Arcade Creek Erosion Repair Project will repair the vertical erosion cuts by laying back the vertical slope and placing rip rap in each of the four damage sites. The sites will then be covered with 1-foot of soil topping and re-seeded with sod covering.

Other Alternatives: The 'no-action' alternative would require continued monitoring and possible flood fights.

Existing Planning Mechanism(s) through which Action Will Be Implemented: The project is currently being proposed as an operation and maintenance activity under the US Army Corps of Engineers Section 404 process.

Responsible Agency/ Department/Partners: American River Flood Control District (Resp. Agency), CA Central Valley Flood Protection Board (Regulatory Authority)

Cost Estimate: $620,000

Benefits (Losses Avoided): This project will prevent the District from having to perform an expensive flood fight during a high water event and possible flood inundation of North Sacramento (potential 19-foot flood depths)

Potential Funding: ARFCD General Fund, CA DWR FMAP Grant Funding

Timeline: Planning, Design, and Permitting – 2021, Construction - 2022

Project Priority (H, M, L): H

Action 2. American River Emergency Rock Revetment Preparedness Stockpile

Hazards Addressed: Climate Change, Dam Failure, Floods: 1%/0.2% annual chance, Levee Failure, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: During major catastrophic flood events in the Sacramento Valley, rock revetment (rip rap) can be in short supply or only found in quarries long distances from the flood control levees. Also, many quarries do not make revetment sized material unless there is a need. This effort proposes to purchase revetment and store it at strategic locations near the Sacramento levees for use during critical flood emergencies.

Project Description: The American River Emergency Rock Revetment Preparedness Stockpile project will acquire rock revetment of a suitable size and specification to place at staging areas currently operated by the District. The material will be ordered, prepared, and hauled to the sites during non-critical operational periods to best utilize staff time and budget.

Other Alternatives: An alternative to this project would be to order rock revetment during the time of critical need.

Existing Planning Mechanism(s) through which Action Will Be Implemented: The work will be done in accordance with the ARFCD flood operations plan and its Emergency Action Plan.

Responsible Agency/ Department/Partners: American River Flood Control District

Cost Estimate: $500,000

Benefits (Losses Avoided): The benefit of this project will be to ensure availability of rock revetment to conduct an emergency flood fight. Rock will be difficult to obtain in a timely manner during a flood.

Potential Funding: ARFCD General Fund

Timeline: ARFCD 5-year Plan

Project Priority (H, M, L): High

Action 3. Highway 160 Bridge Gap Levee Access

Hazards Addressed: Climate Change, Dam Failure, Floods: 1%/0.2% annual chance, Levee Failure, Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 4, 5

Issue/Background: State Highway 160 crosses the American River with two elevated bridge structures to convey northbound and southbound traffic. There is an isolated segment of the South Levee of the American River in the gap between these two structures. This levee segment is completely cut-off and there is no way to access the levee segment for maintenance or inspection accept by boat. The waterside slope of the levee downstream of the bridge crossing is extremely steep and is not traversable on foot without rappelling gear. There is some rock revetment evident under the bridge but there is no pathway to traverse the site.

Project Description: This proposed project would study and construct waterside levee access ramps upstream and downstream of the highway and a short length of waterside bench for an access pathway that would allow crews to take maintenance equipment under the bridge. This would allow crews to operate and maintain the currently isolated segment of levee between the spans and allow bridge crews to inspect the highway bridge.

Other Alternatives: The only other feasible alternative is to use a boat to inspect the site and a barge to bring maintenance equipment to the site for repairs.

Existing Planning Mechanism(s) through which Action Will Be Implemented: This project would require a Section 408 permit from the US Army Corps of Engineers

Responsible Agency/ Department/Partners: ARFCD, CA Central Valley Flood Protection Board, US Army Corps of Engineers

Cost Estimate: $3,000,000

Benefits (Losses Avoided): This project would allow operation and maintenance activities to identify potential defects in the levee. A levee failure at this location would inundate downtown Sacramento and the State Capitol

Potential Funding: ARFCD General Fund

Timeline: 10-year planning and construction window

Project Priority (H, M, L): High