

Delta Annex Chapter 8 Reclamation District 554

8.1 Introduction

This Annex details the hazard mitigation planning elements specific to the Reclamation District 554 (RD 554 or District), a previously participating jurisdiction to the 2021 Sacramento 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 the District, with a focus on providing additional details on the planning process, risk assessment, and mitigation strategy for this jurisdiction.

8.2 Planning Process

As described above, the RD 554 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 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 8-1. Additional details on Plan participation and District representatives are included in Appendix A.

Table 8-1 RD 554 – Internal Planning Team

Name	Position/Title	How Participated
Emily Pappalardo	District Engineer	Provide Historical Data and Mitigation Actions
Daniel Wilson	District Trustee	Provide Historical Data 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 FEMA-approved 2021 LHMP into existing planning mechanisms and programs. Specifically, the District incorporated into or implemented the 2021 LHMP through other plans and programs shown in Table 8-2.

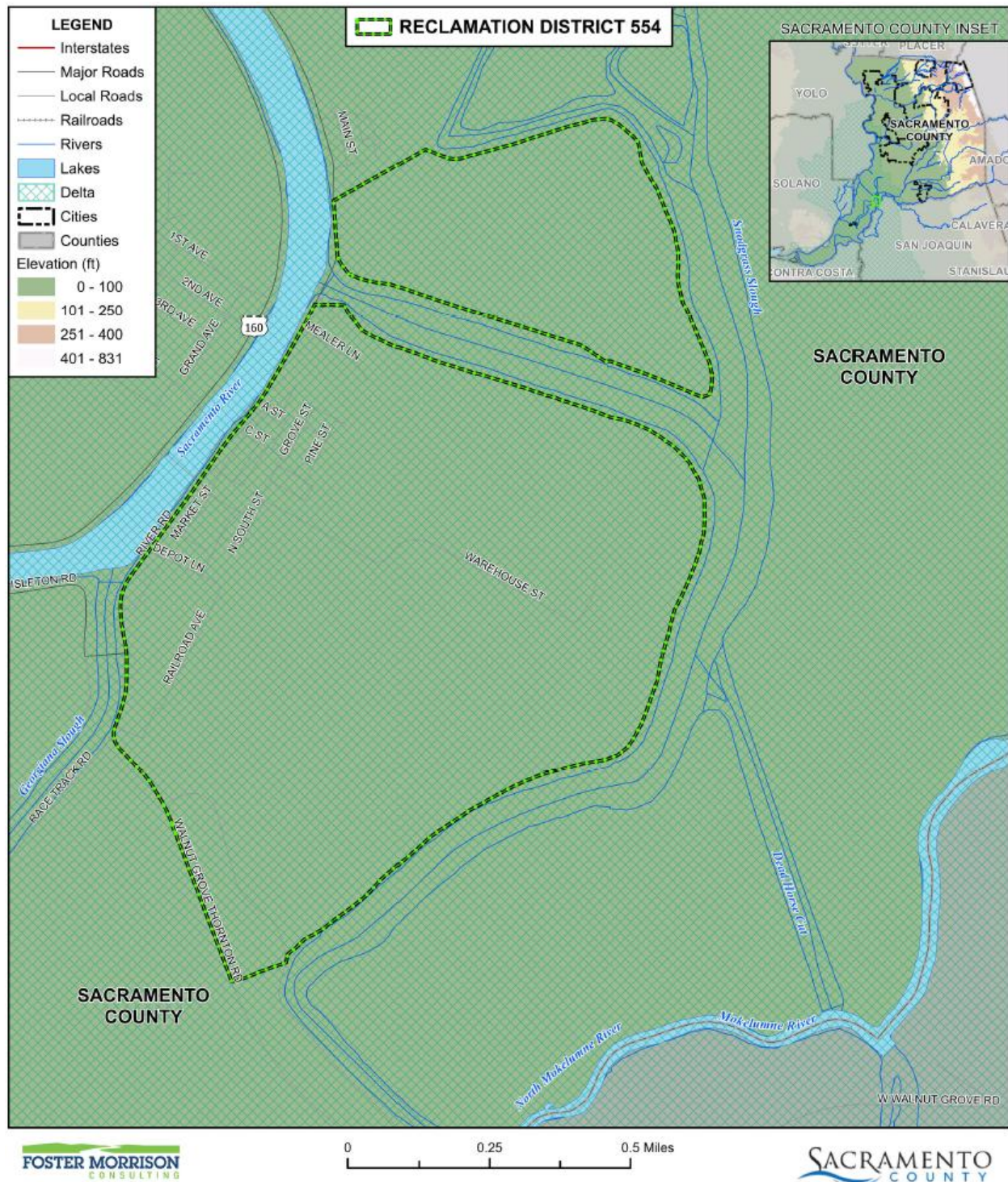
Table 8-2 2021 LHMP Incorporation

Planning Mechanism 2021 LHMP Was Incorporated/Implemented In.	Details: How was it incorporated?
2022-2027 Five-Year Plan	Past occurrences and information on the flooding, localized flooding, and levee failure was used to inform the Five-Year Plan.
2026 Emergency Operations Plan Update	Past occurrences and information on the flooding, localized flooding, and levee failure was used to inform the EOP Update.

8.3 Community Profile

The community profile for the RD 554 is detailed in the following sections. Figure 8-1 displays a District map and the location of RD 554 within Sacramento County.

Figure 8-1 RD 554



8.3.1. Overview and Background

Reclamation District 554 protects the urban, eastern side of Walnut Grove, 374 acres of cropland, and the Walnut Grove Marina service area. Walnut Grove was established in 1850 by John Sharp and became a thriving agricultural center and shipping port by 1865. Like many reclamation districts, RD 554 sits close to sea level in elevation, as shown on Figure 8-1.

Reclamation District 554 is the upper 452-acre portion of Tyler Island that is separately protected by 3.58 miles of levee. The District includes the east Walnut Grove urban area. It is the only town in the Delta that is interdependent and occupies both sides of the Sacramento River. The main commercial corridor is on this side of Walnut Grove along with the main sewer collection system and key government services. But the majority of the land use on this small district is rural/agricultural since the urban area is only 77 acres. The bigger part, 374 acres, is newly planted with high value permanent crops.

RD 554 is bordered by Sacramento River, Georgiana Slough, Snodgrass Slough, the Delta Cross Channel, and the cross levee between RD 554 and RD 563 (lower Tyler Island). Levees along the Sacramento River, Georgiana Slough, and the Delta Cross Channel are federal project levees (1.6 miles). The Cross Channel, Snodgrass Slough, and the cross-levee are non-project levees (1.98 miles), but are still held to the project levee standard. Reclamation District 554 manages levee inspections, levee maintenance, and two pumping stations on the island. The pumping stations are both located along Snodgrass Slough.

8.4 Risk Assessment

As defined by 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 RD 554 risk assessment identifies and profiles relevant hazards and assesses the exposure of lives, property, infrastructure, and the environment to these hazards. The process allows for a better understanding of the District’s potential risk and vulnerability to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

Building on the District Profile above, a risk assessment was performed for the District utilizing the existing District boundaries. This includes the following sections:

- 8.4.1 Assets Inventory and Growth and Development Trends
- 8.4.2 Hazard Identification
- 8.4.3 Hazard Profiles and Vulnerability to Specific Hazards

8.4.1. Assets Inventory and Growth and Development Trends

This section provides an inventory of the RD 554’s total assets potentially at risk to hazards and an overview of growth and development trends. This section is broken into two parts:

- **Asset Inventory** – The assets inventory identifies the RD 554’s total assets, including the people and populations; structures; critical facilities and infrastructure; community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. This data is not hazard specific, but is representative of total assets within the District, potentially at risk to identified hazards as discussed in Section 8.4.3 Hazard Profiles and Vulnerability to Specific Hazards.
- **Growth and Development Trends** – A discussion of growth and development trends in the District, both current and future, is presented.

Assets Inventory

The District’s asset inventory is detailed in the following sections:

- People and Populations
- District Assets and Critical Facilities and Infrastructure
- Community Lifelines
- Natural, Historic, and Cultural Resources
- Economic Assets and Community Activities of Value

A discussion of each of these assets follows and serves as the template for the asset discussion for each hazard in Section 8.4.3.

People and Populations

The most important asset within any community are the people and populations that reside in the community. People and populations in the District include both District staff and workers as well as those populations located within District boundaries and are served by the District. This section includes an inventory of past and current populations of the District and also discusses vulnerable populations and underserved communities as a subsection of people and populations located within the District and potentially at risk to hazards. Information from the District and other sources as detailed below form the basis of this discussion.

Historic Population Trends and Current Population

The most important asset within any community are the people and populations that both work and reside in the District. For special districts, this generally includes District staff and contractors as well as those populations located within its boundaries. The District has no staff that work for the District. The District must rely on contract labor and local contractors to perform necessary work. The District consults with an engineer to review system issues and design and coordinate repair projects. The District provides services to roughly 380 people.

Certain populations in the Delta face elevated risk during hazard events due to limited access to warnings and constrained mobility. The region's agricultural workforce includes many workers that labor in remote fields who may have limited English. During peak flood risk periods and this workforce may not receive or understand English-language alerts; multilingual outreach and coordination with employers can help close this gap. Elderly residents, particularly those living independently in unincorporated Delta communities, face risk from reduced mobility and reliance on digital alert systems in areas with limited cell

coverage, making traditional notification methods (door-to-door, weather radio) an important backup. Seasonal tourists, boaters, and recreational visitors are not enrolled in county alert systems and are often unfamiliar with the Delta's levee geography and limited evacuation routes, so coordination with marinas, resorts, and campgrounds to relay warnings and post evacuation signage is a key mitigation opportunity.

District Assets and Critical Facilities and Infrastructure

This section considers the RD 554's assets at risk, with a focus on key District assets such as structures, critical facilities and 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 Facilities.

Most of the District assets are considered Category 1 critical facilities, specifically essential services facilities. Table 8-3 lists critical facilities and other District assets identified by the District Planning Team as important to protect in the event of a disaster. RD 554's physical assets, valued at over \$65 million, consist of structures, critical facilities and infrastructure, and other District assets to support the District's operations.

Table 8-3 RD 554 Assets: Structures, Critical Facilities and Infrastructure, and Other Facilities.

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
Levee	Infrastructure	\$40,000,000	Floods: 1%/0.2%, Localized Flooding, Levee Failure, Heavy Rain and Storms
Cross-levee	Infrastructure	\$8,000,000	Localized Flooding, Heavy Rain and Storms
Pump Station	Infrastructure	\$1,000,000	Localized Flooding, Levee Failure, Heavy Rain and Storms
Fire/Police Station	Critical Facility	\$5,000,000	Floods: 1%/0.2%, Localized Flooding, Levee Failure,
Community Center	Critical Facility	\$4,000,000	Floods: 1%/0.2%, Localized Flooding, Levee Failure,

Name of Asset	Facility Type	Replacement Value	Which Hazards Pose Risk
Elementary School	Critical Facility	\$7,000,000	Floods: 1%/0.2%, Localized Flooding, Levee Failure,
Total		\$65,000,000	

Source: RD 554

Community Lifelines

Assessing the vulnerability of the RD 554 to natural hazards and disasters also involves reviewing and inventorying the community lifelines in place that could be affected. It is important to include these items in hazard discussions as the continuous operation of critical government and business functions is essential to human health and safety, property protection, and economic security. The importance of community lifelines is discussed below:

- Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function.
- FEMA has developed a method for objectives-based response that prioritizes the rapid stabilization of Community Lifelines after a disaster.
- The integrated network of assets, services, and capabilities that provide lifeline services are used day-to-day to support the recurring needs of the community and enable all other aspects of society to function.
- When disrupted, decisive intervention (e.g., rapid re-establishment or employment of contingency response solutions) is required to stabilize the incident.

Community lifelines, as defined by FEMA, include the following:

- **Safety and Security** – Law Enforcement/Security, Fire Service, Search and Rescue, Government Service, Community Safety
- **Food, Hydration, Shelter** – Food, Water, Shelter, Agriculture
- **Health and Medical** – Medical Care, Public Health, Patient Movement, Medical Supply Chain, Fatality Management
- **Energy** – Power Grid, Fuel
- **Communications** – Infrastructure, Responder Communications, Alerts Warnings and Messages, Finance, 911 and Dispatch
- **Transportation** – Highway/Roadway/Motor Vehicle, Mass Transit, Railway, Aviation, Maritime
- **Hazardous Material** – Facilities, HAZMAT, Pollutants, Contaminants
- **Water Systems** – Potable Water Infrastructure, Wastewater Management

It should be noted that these community lifelines are all in place and functional as part of regular government operations in the Sacramento County Planning Area serving as a partnership between the cities, local special districts and agencies, and Sacramento County. Most all of the District's community lifelines overlap with the Planning Area's and include many of the critical facilities and infrastructure assets inventoried for this LHMP. As such, specific information on these community lifelines in the District and

how they may be affected by a hazard event or disaster are discussed collectively for all jurisdictions in the Base Plan and in the Delta annex.

Natural, Historic, and Cultural Resources

Natural Resources

RD 554 has a variety of natural resources of value to the District. Due to the urban nature of RD 554, there are only a few areas of freshwater wetland, upland, and riparian habitats. The size of the island and development that has taken place over time, has resulted in mostly ruderal vegetation. See Figure 8-2 for a map of vegetation types. According to the Department of Fish and Game Levee Log in the 5-Year Plan, riparian, scrub shrub, and freshwater marsh habitat types exist on and adjacent to the levees. The estimated amount of each type of habitat per lineal feet is shown on Table 8-4.

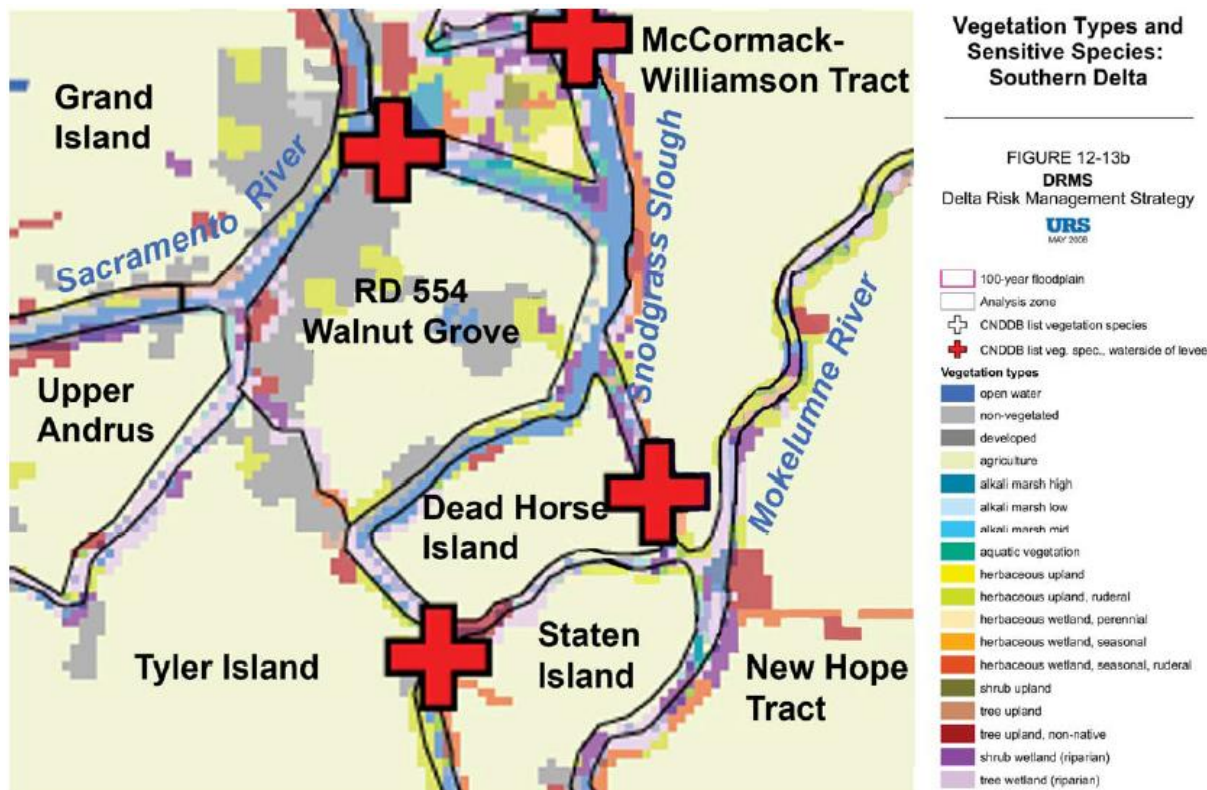
Table 8-4 RD 554 Vegetation Types

Type	Waterside	Landside
Riparian	2223 lf (3.66 ac.), 29 single trees	1710 lf (1.35 ac.), 15 single trees
Scrub Shrub	880 lf (0.62 ac.), 23 single trees	1700 lf (1 ac), 40 single trees
Freshwater Marsh	1229 lf (0.37 ac.)	0 lf

Source: RD 554 2022 5-Year Plan

Note: These estimates are for non-project levees comprising the location of proposed projects in this plan.

Figure 8-2 RD 554 Vegetation Types

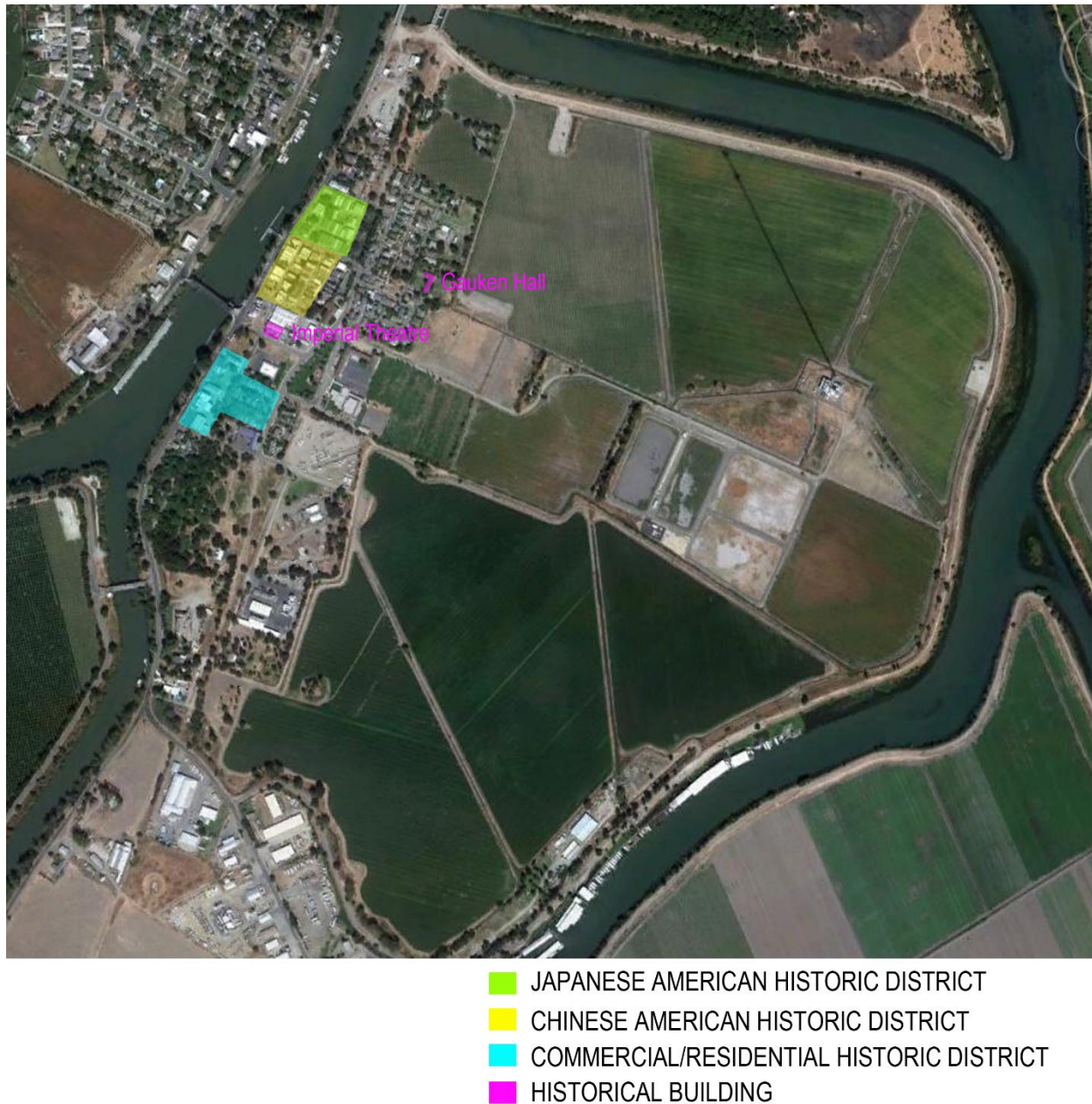


Source: RD 554 2022 5-Year Plan

Historic and Cultural Resources

RD 554 has a variety of historic and cultural resources of value to the District. In the Walnut Grove area, there are three nationally registered historic districts, the Walnut Grove Chinese and Japanese American Historical Districts, and the Walnut Grove Commercial/Residential Historic District. There are three two nationally registered historical buildings, Gakuen Hall and the Imperial Theatre. These are shown on Figure 8-3.

Figure 8-3 Historic Sites in Walnut Grove



Source: RD 554 2022 5-Year Plan

Economic Assets and Community Activities of Value

Assessing the vulnerability of the RD 554 to natural hazards and disasters also involves inventorying the economic assets and community activities of value in the District.

Economic Assets

After a disaster, economic resiliency is one of the major drivers of a speedy recovery. Each community has specific economic drivers. The District protects about 28 businesses located on Tyler Island. Along with this, according to the 2020 US Census data, there are approximately 1,452 residents in Walnut Grove with the majority living on the west side of the Sacramento River. Approximately, 400 residents are in the boundaries of RD 554. Also, the census shows about 48 businesses of which most are located on the east side of the Sacramento river within RD 554, approximately 40. Agricultural assets, such as crop land and farms that produce high value crops are protected by RD 554.

Community Activities of Value

Inventorying economic assets in the District and their vulnerability to natural hazards and disasters also involves inventorying activities that have value to the community. This includes activities that are important to a community, like long-standing traditions such as a festival or fair or other activities that bring money into the communities such as sports tournaments and other recreational activities. Community Activities of Value for the County were discussed in Section 4.2.1 of the Base Plan and are assumed to be the same or similar for the District.

Life in Walnut Grove revolves around a small number of places where people come together. On the first weekend of July, the Walnut Grove Buddhist Church on Pine Street has traditionally opened its doors for its annual bazaar, drawing families, former residents, and visitors from across the region to a town whose year-round population is only about 1,450. The church, established in 1926, also holds monthly services and observances throughout the year.

A few blocks away on Market Street, the Walnut Grove Library serves as the Delta's only full-time public library. Since opening in 1919, it has been a fixture for children's programs, book groups, and homework help, and it supports the local elementary school and area families. It is housed in a county building constructed in 1970.

The Jean Harvie Community Center on River Road, a former schoolhouse from the early 1900s, is where much of the community's calendar plays out. The County-owned building's 6,500 square feet include an auditorium that holds up to 180 people, and it hosts a steady run of gatherings, from community events to celebrations.

Station 96 on Grove Street is more than a firehouse. In addition to sheltering the volunteer fire district's equipment, it hosts meetings of local community organizations and agencies (Reclamation Districts), making it a regular gathering point for the people who keep the town running.

Taken together, these places mean that on any given event day or meeting night, the number of people in Walnut Grove can be much greater than the resident count suggests. That matters for hazard planning. A

flood or levee emergency during a bazaar weekend, for instance, would put hundreds of people who don't live here, and may not know the evacuation routes, in the middle of the community. These same familiar places could also serve as trusted points for sharing information and coordinating during an emergency.

Growth and Development Trends

As part of the planning process, the District looked at changes in growth and development, both current 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. This inventory section details future development/redevelopment projects that are likely to occur over the next five years covered by this 2026 LHMP. For Districts, this generally includes the following:

- Construction/development projects related to adding new District facilities, infrastructure, land acquisition, etc.
- Plans for expansion or build out of the District's service area, including new service hookups, and other District functions related to where the District will be expanding services.

Population Trends and Projections

The District is anticipated to remain predominantly in the same land use as it currently is. The majority of the area is agricultural with no significant development or changes in land use to the existing town. Crop patterns may change over time in response to market conditions; however, the overall agricultural character of the District is expected to remain unchanged. Continued agricultural production and preservation of the District's acreage are important to maintaining the assessment base necessary to support ongoing levee maintenance and rehabilitation. There is no anticipated change in population or population patterns.

Development since 2021 Plan

No significant development or changes have occurred within the District given develop limitations to development in the Primary Zone. No new facilities or improvements affecting hazard risk have been identified, and land use remains predominantly agricultural. There have been no significant changes in population, development intensity, or District staffing.

Future Development Areas

It is important to review future development plans for the District. Future development should be sited in areas that are away from known hazard risks. If this is not possible, mitigation should be done to ensure that future development is protected against future hazards.

No significant new development is anticipated within the District over the next five years. The District development is limited by its location within the Special Planning Area and Delta Primary Zone and floodplain, consistent with the Delta Protection Act of 1992. District improvements may include rehabilitation or replacement of existing drainage and pumping facilities; however, these improvements would support existing land uses and would not result in increased development or population.

8.4.2. Hazard Identification

The RD 554 identified the hazards that affect the District and summarized their location, extent, likelihood of future occurrence, potential magnitude, and significance (or priority of a hazard) specific to the District (see Table 8-5). Those hazards identified as a high or medium significance in Table 8-5 are considered District priority hazards for mitigation planning. Those hazards that occur infrequently or have little or no impact in the District 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, natural and cultural resources, and economic damage. The ability of a jurisdiction 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 to prioritize those hazards of greatest significance, enabling the District to focus resources where they are most needed.

Table 8-5 RD 554—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/Severity	Significance	Climate Change Influence
Aquatic Nuisance Species (plant/animal)	Limited	Highly	Limited	Low	Low
Climate Change	Limited	Occasional	Limited	Low	–
Dam Failure	Extensive	Unlikely	Catastrophic	Medium	Medium
Drought & Water Shortage (w/tree mortality)	Significant	Likely	Limited	Low	High
Earthquake (w/subhazards)	Extensive	Unlikely	Limited	Low	Low
Flood: 1%/0.5%/0.2% annual chance	Extensive	Occasional	Catastrophic	High	Medium
Flood: Localized Stormwater	Significant	Highly Likely	Medium	High	Medium
Landslides, Mudslides, and Debris Flow	Limited	Unlikely	Limited	Low	Medium
Levee Failure	Extensive	Unlikely	Catastrophic	High	Medium
Sea Level Rise	Limited	Likely	Limited	Medium	High
Severe Weather: Extreme Cold and Freeze	Extensive	Likely	Limited	Low	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Low	High
Severe Weather: Heavy Rains and Storms (Hail, Lightning, Wind)	Significant	Likely	Limited	Medium	Medium
Severe Weather: High Winds and Tornadoes	Significant	Likely	Limited	Low	Low
Subsidence	Limited	Occasional	Negligible	Low	Medium
Wildfire (with smoke and air quality)	Limited	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					

8.4.3. Hazard Profiles and Vulnerability to Specific Hazards

This section includes the hazard profiles and vulnerability assessment for the RD 554's priority hazards (i.e., those ranked of medium or high significance specific to the District as identified in the Significance column of Table 8-5). This section focuses on where and how the District is affected by their priority hazards. Chapter 4 of the Base Plan provides 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 4.2 of the Base Plan.

Hazard Profiles and Vulnerability Assessment

Each hazard is profiled in the following format:

- **Hazard Profile** – A hazard profile is included for each hazard. This includes information on:
 - ✓ **Hazard Overview** – A general discussion of the hazard and related issues is detailed here.
 - ✓ **Location and Extent** – Location is the geographic area within the District that is affected by the hazard. Extent is the expected range of intensity for each hazard. These are discussed in specific detail for mapped hazards, and in more general detail for those hazards that do not have discrete mapped hazard areas.
 - ✓ **Past Occurrences** – Past occurrences are discussed for each hazard. A discussion of disaster declarations is included in each hazard section. NCEM events are also discussed. Other past occurrences data specific to the District follow the disaster declarations and NCEM events for each hazard.
 - ✓ **Climate Change** – This section contains the effects of climate change (as applicable). The possible influence of climate change on the hazard is discussed.

After the hazard profile, a vulnerability assessment is presented. As part of the vulnerability assessment, an estimate of the vulnerability of the District to each identified hazard, in addition to the estimate of risk of future occurrence, is provided in each of the hazard-specific sections. 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.

After this classification, a general discussion of hazard vulnerabilities occurs. This is done in the following format:

- **Vulnerability Overview** – A general discussion of the hazard vulnerability and related issues is detailed here.
- **Local Concerns** – This includes District provided information on how the District is uniquely affected by or vulnerable to each hazard.
- **Assets at Risk** – A discussion of the assets at risk follows, presented in the same order as in Section 8.4.1 above, with a few exceptions. This includes sections on: People and Populations; District Assets and Critical Facilities and Infrastructure; and Natural, Historic, and Cultural Resources. These are discussed in specific terms for mapped hazards, and in more general terms for those hazards that are unmapped. Sections on Community Lifelines and Economic Assets and Community Activities of Value are not included in the Sections below, as they are common to all jurisdictions and are fully covered in Section 8.4.1 above and in Chapter 4 of the Base Plan.
- **Impacts** – A discussion on hazard impacts follows. Impacts describe how each hazard can affect the District and its assets. The type and severity of impacts reflect both the potential magnitude of the hazard and the vulnerability of the asset.
- **Future Conditions/Future Development** – A discussion of how future conditions and future development may affect the hazard is also included. This considers both new District assets and improvements as well as any changes with the District’s boundaries.

Power Interruption/Power Failure: A Common Vulnerability of all Hazards

An impact of almost all hazards evaluated as part of this LHMP Update relates to power shortage 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 U.S. 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. Much of the Sacramento County Planning Area is served by Pacific Gas & Electric (PG&E) and Sacramento Municipal Utility District (SMUD). More information on types of power disruptions can be found in Section 4.3 of the Base Plan.

Public Safety Power Shutoff (PSPS)

An intentional disruption type of power shortage/failure event has been implemented in California as a result of wildfires starting 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 preparing all Californians for the threat of wildfires and power outages during times of extreme (fire) weather. To help protect customers and communities during extreme fire weather events, electric power may be shut off for public safety in an effort to proactively prevent wildfire. This is called a PSPS. More information on PSPS criteria can be found in Section 4.3 of the Base Plan. PG&E noted no PSPS events in the Sacramento County Planning Area since the 2021 LHMP. SMUD noted that it has had no PSPS events for its service territories since 2021.

Local Concerns

The District experienced power outages during the 2023 winter storms due to high winds and downed trees. The outages affected the District's ability to operate its drainage pumping facilities. Future hazard-related power outages remain a concern due to the District's reliance on pumping facilities for interior drainage.

Hazard Profiles and Vulnerability Assessment by Hazards

The following sections provide the hazard profile and vulnerability assessments for each of the hazards identified in Section 8.4.2 Hazard Identification.

Dam Failure

Likelihood of Future Occurrence—Unlikely

Vulnerability—Extremely High

Hazard Profile

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 given 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. In addition, with storms increasing in volume and intensity, as seen with the atmospheric river events of recent years, controlled releases from dams can also impact downstream levees and flood control structures resulting in increased and widespread flooding.

Dam failures, for purposes of this Plan, can also result from any one or a combination of the following:

- Earthquake
- Overtopping and uncontrolled releases
- Controlled releases
- 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
- Failure of upstream dams on the same waterway

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.

Location and Extent

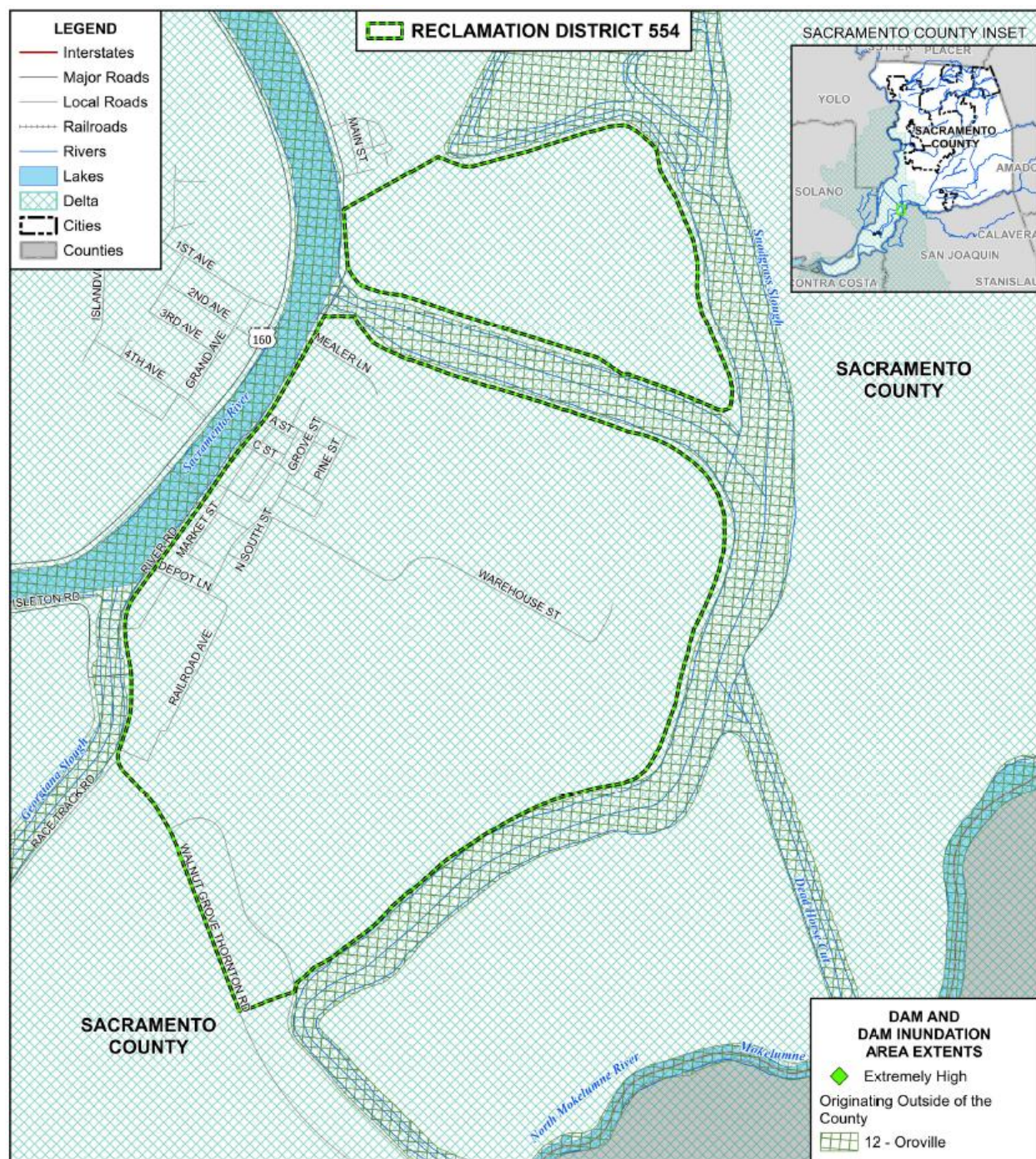
An inventory map of dams located within and around Sacramento County was shown in Section 4.3.8 in the Base Plan. Inundation mapping and analyses were conducted on Extremely High and High Hazard dams with inundation areas located in the Sacramento County Planning Area. Dams with an inundation area within the District are shown on Figure 8-4 for Extremely High Hazard (outside the County) dams, Figure 8-5 for High Hazard (inside the County) dams, and Figure 8-6 for High Hazard (outside the County). The District is affected by one Extremely High Hazard dams (Oroville), one High Hazard dam from within the County (Nimbus), and one High Hazard dam from outside the County (Jackson Creek) intersect the District.

There is no scale with which to measure dam failure. However, FEMA and CA DWR Division of Safety of Dams (DSOD) assign hazard potential classifications 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. FEMA categorizes the downstream hazard potential into three categories in increasing severity: Low, Significant, and High. DSOD adds a fourth category of Extremely High. Dams are classified in these four categories that identify the potential hazard to life and property. These were discussed in more detail in Section 4.3.8 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. For dam overtopping, the speed of onset is somewhat slower than that of a dam break, and the duration is longer (as evidenced in the 2017 Oroville Dam spillway event). The District would be affected for as long as the flood waters from the dam failure took to drain downstream.

Geographic flood extent from the DSOD and Cal OES dam inundation areas is shown on Figure 8-4 and Table 8-6 for Extremely High Hazard (outside the County) dams, Figure 8-5 and Table 8-7 for High Hazard (inside the County) dams, and Figure 8-6 and Table 8-8 for High Hazard (outside the County) dams.

Figure 8-4 RD 554 – Extremely High (Outside the County) Dam Inundation Areas



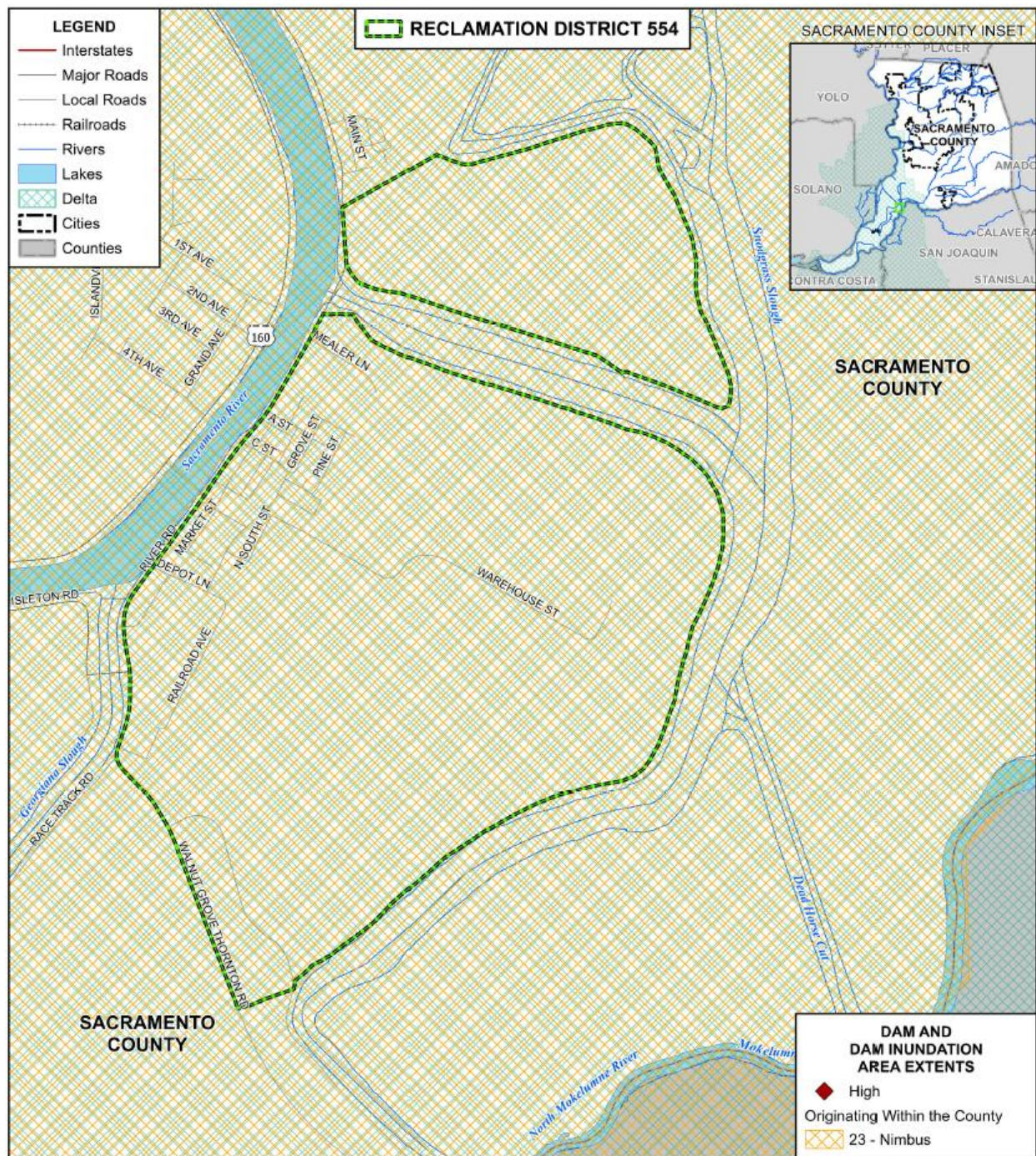
Data Source: DWR DSOD dam inventory and dam inundations (updated 7/2025; data downloaded 10/2025), Sacramento County, Cal-Atlas; Map Date: 6/16/2026.

Table 8-6 RD 554 – Extremely High (Outside the County) Dam Inundation Areas Geographical Extents

Dam Inundation Area	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Oroville	0.1	0.01%	0	0%	0.1	0.04%

Source: DSOD, Cal OES, County GIS

Figure 8-5 RD 554 – High Hazard (Inside the County) Dam Inundation Areas



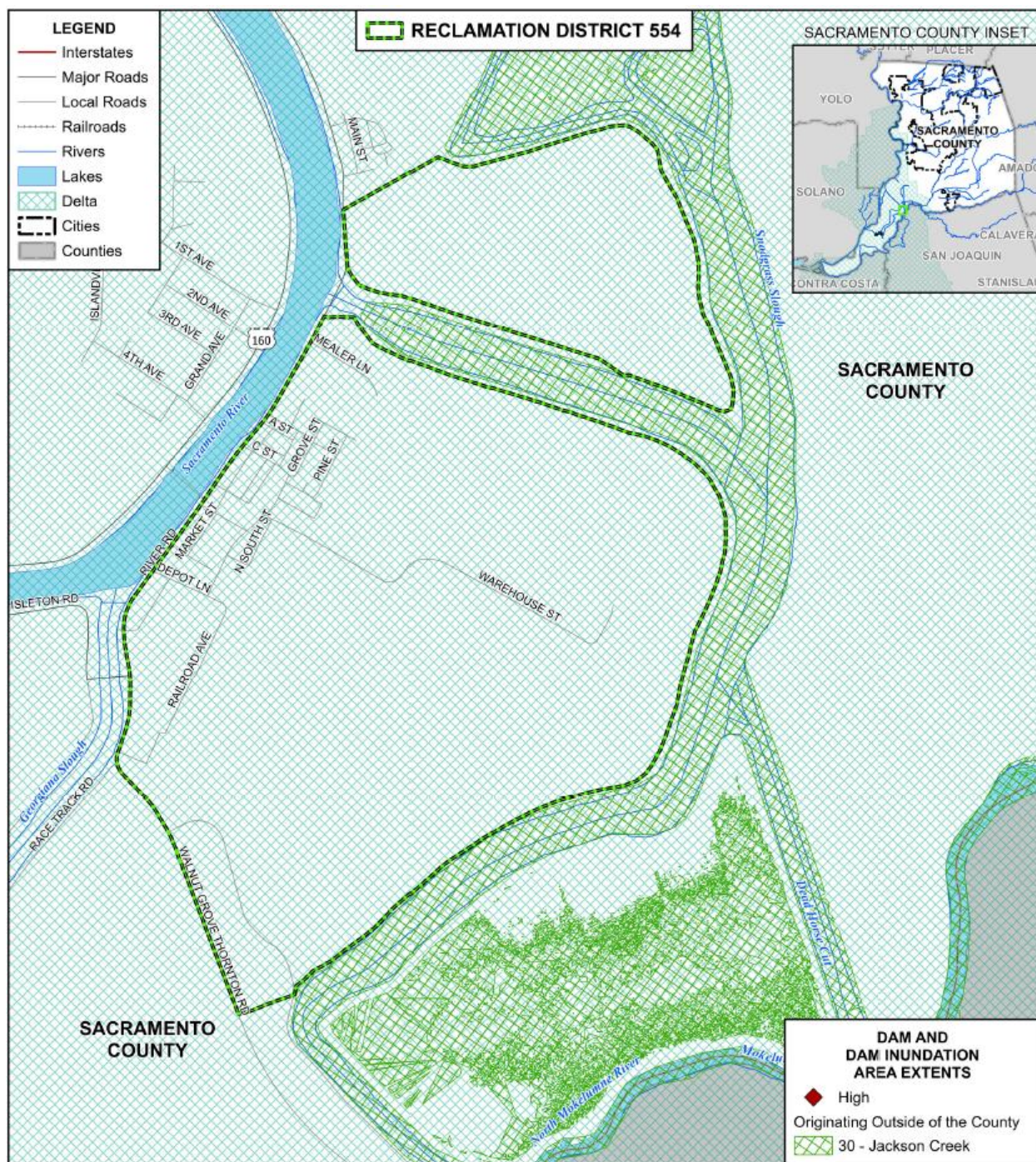
Data Source: DWR DSOD dam inventory and dam inundations (updated 7/2025; data downloaded 10/2025), CalOES CIP dam inundation data (3/2017), Sacramento County, Cal-Atlas; Map Date: 6/16/2026.

Table 8-7 RD 554 – High Hazard (Inside the County) Dam Inundation Areas Geographical Extents

Dam Inundation Area	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Nimbus	603	100%	394	100%	209	100%

Source: DSOD, Cal OES, County GIS

Figure 8-6 RD 554 – High Hazard (Outside the County) Dam Inundation Areas



Data Source: DWR DSOD dam inventory and dam inundations (updated 7/2025; data downloaded 10/2025), Sacramento County, Cal-Atlas; Map Date: 6/16/2026.

Table 8-8 RD 554 – High Hazard (Outside the County) Dam Inundation Areas Geographical Extents

Dam Inundation Area	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Jackson Creek	0.1	0.01%	0	0%	0.1	0.03%

Source: DSOD, Cal OES, County GIS

Past Occurrences

Disaster Declaration History

There have been no state or federal disaster declarations for dam failure in Sacramento County.

NCDC Events

The NCDC does not contain any dam failure events for Sacramento County.

RD 554 Events

The District Planning Team noted no past occurrences of dam failure of any type to affect the District.

Climate Change and Dam Failure

It is likely that climate change will increase the chance of future occurrence as well as future impacts associated with dam failure. More information on future impacts to the District can be found below and in the Future Conditions/Future Development section of the Vulnerability Assessment below.

The 2023 California State Hazard Mitigation Plan noted that modeling described in California’s Fourth Climate Change Assessment projects less frequent but more extreme daily precipitation. Year-to-year precipitation will become more volatile, and the number of dry years will increase by mid-century. As the climate continues to warm, atmospheric rivers will carry more moisture, and extreme precipitation may increase. Climate model projections show a tendency for the northern part of the State to become wetter. Increases in both precipitation and heat causing snow melt in areas upstream of dams could increase the potential for dam failure and uncontrolled (and controlled) releases in Sacramento County. The District could be affected by these changes, especially in those areas of the District located within dam inundation areas.

The 2024 Sacramento County CAP noted that climate change is likely to lead to changes in the frequency, intensity, and duration of extreme weather events. The County is projected to experience a steady increase in average annual precipitation through the end of the century, with much of that precipitation likely to occur during extreme precipitation events, which can lead to flood impacts. According to Cal-Adapt, the historic average annual precipitation in Sacramento County is 18.3 inches, and the historic average annual number of extreme precipitation events is four. The average annual precipitation across the County may rise upwards of 22 inches, with the number of extreme precipitation events potentially exceeding 7 per year by the end of the century, depending on the level of current and future GHG emissions.

In general, California exhibits “booms and busts,” which refers to the existence of both very wet years and very dry years. The amount of precipitation that falls in any particular year is largely influenced by occurrences of large, discrete winter storms, also known as atmospheric rivers, which often provide a substantial fraction of the region’s annual precipitation, inclusive of the county. In California, atmospheric rivers vary in intensity; some are beneficial for water supply and replenish snowpack that naturally melts during the summer, serving as the water supply for people and agriculture, while others are responsible for widespread and adverse impacts (NOAA 2023). Extreme precipitation from these atmospheric rivers in the future may prove to be more variable, volatile, and potentially more severe. These extremes are most likely to occur during storm events, leading to more severe damage from waves and floods, thus possibly leading to more dam failure events, including the need for more controlled releases from dams.

Vulnerability to Dam Failure

The vulnerability of the District to dam failure flooding would vary depending on which dam fails and the nature and extent of the dam failure and associated flooding. 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 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. Dam failure flooding would vary by community depending on which dam fails and the nature and extent of the dam failure and associated flooding.

An assessment of a community’s vulnerability to dam failure begins with an understanding of local exposure to dam failure. This is included in the Local Concerns section below followed by a discussion of the District’s Assets at Risk to this hazard.

Local Concerns

The District has specific concerns and unique vulnerabilities regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce risk and vulnerability to this hazard.

Any Dam that feeds into the Sacramento River, including but not limited to Shasta, Oroville and Folsom, could overload the carrying capacity of the channels adjacent to the District, could result in a levee breach resulting in flooding. Additionally, uncontrolled releases from Pardee/Camanche would also result in additional floodwaters in the Mokelumne River system that impacts flows in Snodgrass Slough in also overload that channel carrying capacity.

Assets at Risk

Assets at risk from dam failure include people and populations; District assets and critical facilities and infrastructure); and natural, historic, and cultural resources. These are discussed in the following sections.

People and Populations

All people and populations (including both District staff and the population within District boundaries) located in dam inundation areas are vulnerable to dam failure. Certain vulnerable populations may be at increased risk to dam failure, especially during a large event with minimal advance notice. These vulnerable populations may include: the unhoused, those with limited mobility, and those that lack the resources to leave the area.

District Assets and Critical Facilities and Infrastructure

Most structures and critical facilities and infrastructure in the District have some measure of risk to dam failure. Dam failure flooding can affect the built environment of the District. Structures in dam inundation areas are at risk and depending on flood depths, can range from slight damage to totally inundated.

A failure or large uncontrolled release from an upstream dam (Folsom, Oroville, or Shasta, and Pardee on the Mokelumne system) could send a flood surge into the Sacramento River and Delta channels that the levees cannot carry. Potentially arriving on top of already elevated storm-season stages, it could subject the levee to combined loading beyond its design basis, raising the risk of overtopping, erosion, and seepage failure along reaches that would otherwise hold.

The cross-levee could help limit how far floodwater spreads through the district, but it is generally not built to the perimeter levee's standard. A sudden, deep load on one side could overtop or breach it, so it should not be relied on to contain a dam-failure flood.

High exterior stage could increase seepage pressures and increase the demand on the pumping station. Prolonged inundation could damage motors, electrical controls, and fuel storage. That would leave the district unable to dewater when it is most needed and would prolong interior flooding.

A dam-failure event could fail the District levees and inundate the fire station, community center or school, or the roads used to reach those areas, with limited warning time to move apparatus and personnel. The fire station could lose function at the moment emergency response demand peaks. Similarly, the other areas are potentially evacuation areas for the immediate region and could also become compromised.

Natural, Historic, and Cultural Resources

A major dam failure event and associated flooding could have a devastating impact on the District. Large flood events can affect all natural, historic, and cultural resources that lie in the dam inundation areas. There are a number of ways floodwaters associated with a dam failure event can impact natural resources and the environment: Wildlife habitats can be destroyed by floodwaters. Contaminated floodwater can pollute rivers and habitats. Silt and sediment can destroy natural areas. Riverbanks and natural levées can be eliminated as rivers reach bankfull capacity. Rivers can be widened, and deposition can increase downstream. Trees can be uprooted by high-velocity water flow. Plants that survive the initial flood may die due to being inundated with water. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to these structures within the inundated areas, but other cultural resources such as those associated with Native Americans and old tribal areas can also be disturbed, damaged, and lost during extreme dam failure flood events.

Impacts from Dam Failure

Impacts to the District from dam failure flooding could be extensive and widespread and 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 may be necessary and compounded by impacts to transportation systems and infrastructure. Economic losses to the District and Sacramento County Planning Area can also be significant.

Other impacts associated with dam failure include landslides, bank erosion, and destruction of habitat. Dam failures can cause downstream flooding and can transport large volumes of sediment and debris and contaminants from the floodwaters. Other environmental impacts can include contamination from septic system failures and releases of contaminants from hazardous materials facilities, contamination of potable water supplies; changes in configurations of streams; loss of wildlife habitats; and degradation of wetlands. A large dam failure event could have significant and catastrophic impacts.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the District may be affected in the future by climate change (which was discussed in the Climate Change and Dam Failure discussion above), changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. These are discussed in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

This section provides a discussion of how future conditions will influence or affect the hazard over time and also discusses future development relative to each hazard.

Future Conditions

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for the District include the following:

- Climate change is likely to exacerbate future rain and storm conditions and associated impacts and vulnerability of the District to dam failure. This was discussed in greater detail in the Climate Change and Dam Failure section of the Hazard Profile above.
- Population projections within the jurisdictional boundaries of the District show general populations to be flat or slightly declining. It is unknown how population patterns and demographics in this area of the County will change in the near future. The District may add staff, but this number would be relatively small. The District noted that it has no control over population changes within its jurisdictional boundaries. Additional populations recreating in the District boundaries may lead to a slight increase in the vulnerability of RD 554 to this hazard.
- Land use planning should be proactive to address future hazard conditions. Changes in land use and development in the District are expected to be limited in the near future and thus are not likely to affect dam failure impacts to the District. Locating new development, structures, and critical facilities and infrastructure within or near areas of dam failure risk may put additional development at risk.

Future Development

Future dam failure events may occur in the District. Although new growth and development may 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.

Flood: 1%/0.5%/0.2% Annual Chance

Likelihood of Future Occurrence—Occasional (1%)/Unlikely (0.5/0.2%)

Vulnerability—Extremely High

Hazard Profile

This hazard discusses the FEMA DFIRM 1%, 0.5%, and 0.2% annual chance floods. These tend to be the larger floods that can occur in the District and have caused damage in the past. Flooding can be a significant problem in the District. Historically, the District has been at risk to flooding primarily during the winter and spring months when river systems in the District swell with heavy rainfall and snowmelt runoff. The District has also been at risk during atmospheric river flood events. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures located throughout the Sacramento County Planning Area and the RD 554. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred within the 1% and 0.2% annual chance floodplains and in other localized areas in the District.

Location and Extent

The RD 554 has areas located in the 1% and 0.2% annual chance flood zones. This is seen in Figure 8-7.

Figure 8-7 RD 554 – FEMA DFIRM Flood Zones

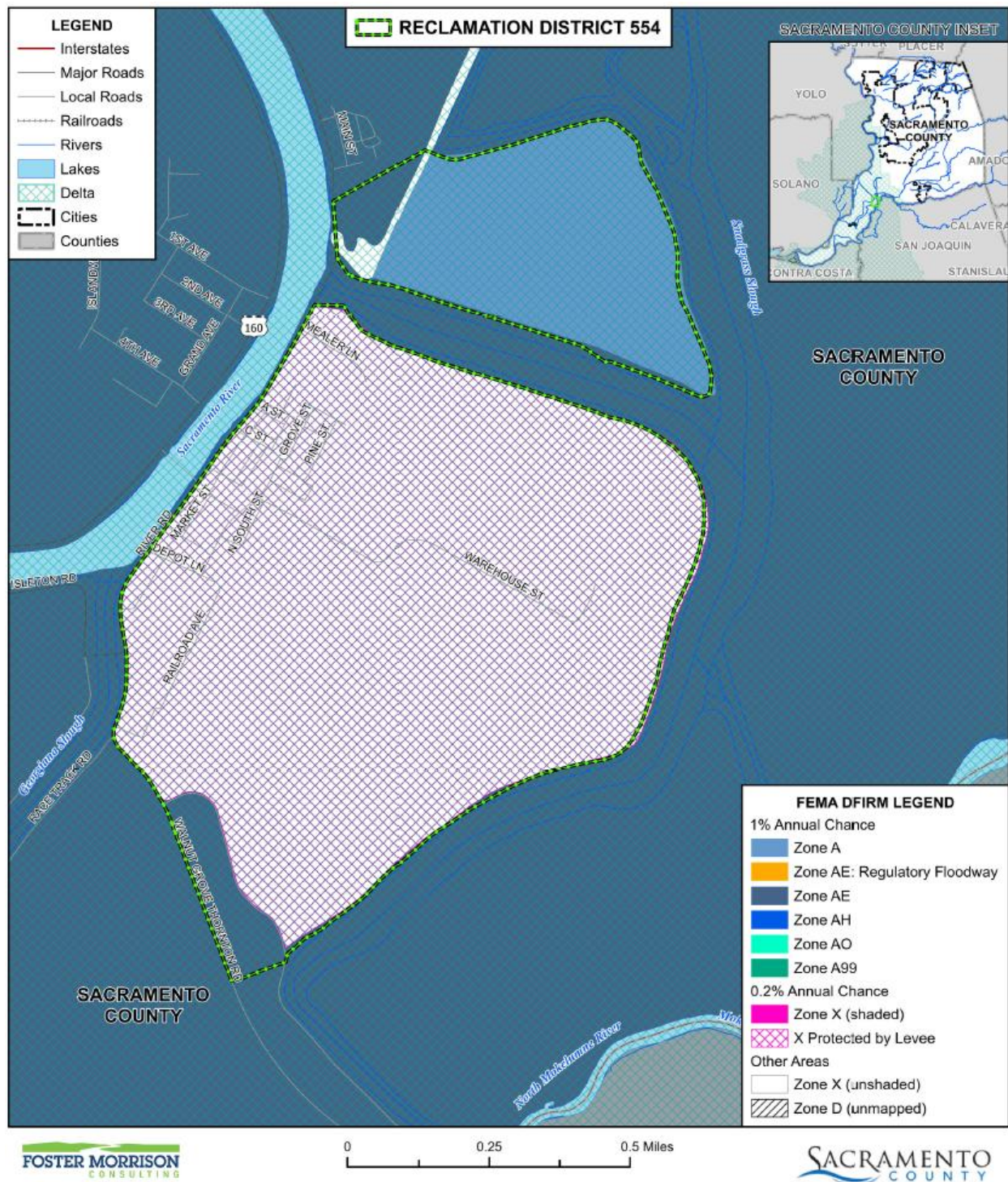


Table 8-9 details the DFIRM mapped flood zones located within the District.

Table 8-9 RD 554– DFIRM Flood Hazard Zones

Flood Zone	Description	Present in District
A	1% annual chance flooding; No base flood elevations provided	X
AE Regulatory Floodway	1% annual chance flood: Regulatory floodway; Base flood elevations provided	
AE	1% annual chance flooding; Base flood elevations provided	X
AH	1% annual chance flood areas of shallow flooding between one to three feet deep. Regulatory floodway; Base flood elevations provided	
AO	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone.	
A99	Areas subject to inundation by the 1-percent-annual-chance flood event, but which will ultimately be protected upon completion of an under-construction Federal flood protection system.. No Base Flood Elevations (BFEs) or depths are shown.	
Shaded X	0.2% annual chance flooding: 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. Flood insurance is not mandatory but is available.	X
X (unshaded)	No flood hazard	

Source: FEMA DFIRM 02/22/2024

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.

Geographical flood extents for the District from the FEMA DFIRMs are shown in Table 8-10.

Table 8-10 RD 554 – Geographical DFIRM Flood Zone Extents

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance Flood Hazard	138	23%	24	6%	114	54%
0.2% Annual Chance Flood Hazard	462	77%	369	94%	93	44%
Other Areas	3	1%	1	0.2%	3	1%
RD 554 Total	603	100%	394	100%	209	100%

Source: FEMA DFIRM 02/22/2024

Past Occurrences

Disaster Declaration History

A list of state and federal disaster declarations for Sacramento County from flooding is shown on Table 8-11. These events also likely affected the District to some degree.

Table 8-11 Sacramento County – State and Federal Disaster Declarations from Flood 1950-2025

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	26	1950, 1955, 1958 (twice), 1963, 1969, 1982 (twice), 1983, 1986, 1995 (twice), 1996, 1997, 1998, 2008, 2017 (three times), 2022*, 2023 (three), 2024 (twice)	18	1955, 1958, 1964, 1969, 1983, 1986, 1995 (twice), 1997, 1998, 2006, 2017 (three times), 2023 (three times)*, 2024*

Source: Cal OES, FEMA

*included a landslide component.

NCDC Events

The NCDC tracks flood events for the County. Events have been tracked for flooding since 1993. Sacramento County has seen 174 events. These events most likely had some impact on the District.

RD 554 Events

1986 was the closest the District came to experiencing a 100-year flood event when adjacent lower Tyler flooded. The District has not experienced a 200 or 500-yr flood. Floods and high water events (HWE) in the District include:

- **1997 HWE:** Erosion on unrevetted waterside sloped from high water with increase patrols to watch the water level. No notable damage.
- **2017 HWE:** Event initiated extra monitoring. No notable damage.
- More recently, a winter storm event in **2022/2023** caused flooding in the District. A boil occurred through Snodgrass Slough levee requiring placement of rip rap to stabilize the waterside slope and the levee was grouted to temporarily stop the boil until it could be addressed during lowered water levels. Along with this, a void was discovered in bottom of levee. Sheet pile were driven to stop the boil and caused \$800,000 in infrastructure damages. Waterside erosion was documented from the high flows. Evacuation warnings were issued from high water and boil threat.

Climate Change and Flood

It is likely that climate change will increase the chance of future occurrence as well as future impacts associated with flood. More information on future impacts to the District can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

According to the 2024 CAS, climate change may affect flooding in California, the Sacramento County Planning Area, and the District. 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.

Cal Adapt future precipitation projections were shown in Section 4.3.4.

The 2024 Sacramento County CAP noted that climate change is likely to lead to changes in the frequency, intensity, and duration of extreme weather events, such as sustained periods of heavy precipitation, increased rainfall intensity during precipitation events, and increased risk of rain-on-snow events. Further, more winter-time precipitation that falls as rain instead of snow, and higher temperatures that will cause earlier snowmelt, which could produce substantial surface water flows over a short period of time and may potentially affect dams and spillways and overwhelm levee systems designed for historical precipitation patterns. Historically, the County experienced an average of four extreme precipitation events per year (as shown in Section 4.3.4 of the Base Plan). Under the medium and high emissions scenarios, the County is expected to experience five to six extreme precipitation events per year by mid-century and six to seven extreme precipitation events per year by the late century.

The 2026 American, Bear, and Cosumnes Watersheds Resilience Plan noted that a key driver of climate vulnerability, adaptive capacity, and implementation readiness in the watershed group is flooding. An equity analysis was performed as part of this Plan. An Equity Analysis Technical Appendix demonstrates how social vulnerability aligns with the physical hazard environment across the watershed. It noted that flooding impacts are most severe downstream, where rising flows increasingly stress Sacramento's levee system; a modeled levee-breach scenario affects 12.5% of the watershed population, and 59% of those affected fall into the highest flood-sensitivity category.

Future flooding exacerbated by climate change will result in a range of potential impacts across the County. For populations, there is an array of social vulnerability factors that exacerbate flood-related risks, and those residing in floodplains are especially vulnerable to the direct impacts of flooding. Floodwaters can interact with sources of pollution and distribute hazardous pollutants locally and regionally, which may result in water contamination and a range of human health impacts. Additionally, flooding can disrupt transportation networks, cause economic losses through business and government facility closures, disrupt communications, disrupt the provision of utilities, and cause significant damage to buildings and critical infrastructure. Further, flooding may also threaten ecosystems and agricultural resources; unlike natural flooding regimes that deposit useful sediment resulting in increased soil fertility as well as groundwater recharge, catastrophic flooding from levee overtopping could lead to soil erosion and loss of viable cropland. It could also release sewage and hazardous materials into the environment if wastewater treatment plants are inundated, storage tanks are damaged, and pipelines are severed.

The June 2025 Delta Adapts Adaptation Plan noted that climate change will affect flooding in the Delta. Located at the confluence of the Sacramento and San Joaquin Rivers and San Francisco Bay, the Delta is a complex system whose water levels are influenced by riverine inflows, tides, storm surge, and in some

locations, flood hazard management and water supply infrastructure. Climate change will affect many of these factors, increasing the risk of flooding. Riverine flows are the primary driver of high-water levels in the north and south Delta, where more frequent and stronger watershed precipitation events and a shift in winter precipitation from snow to rain will drive flood vulnerabilities. In contrast, higher sea levels will increase the likelihood of flooding in Suisun Marsh and the western and central Delta. Climate change is expected to increase the frequency of large runoff events across the Delta watershed. Most of the Delta's flood management infrastructure, including 1,100 miles of levees and upstream reservoirs, were designed to operate under historical conditions that did not consider climate change. Climate change will place greater stress on the flood management system, and Delta levees will become increasingly vulnerable to breaches, overtopping, or other types of failure if no action is taken.

Vulnerability to Flood: 1%, 0.5%, and 0.2% Annual Chance

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 damage and potential loss of life and injury. Predominantly, the effects of 1% and 0.2% annual chance flooding are generally confined to areas near the waterways of the District. As waterways grow in size from local drainages, so grows the threat of flood and dimensions of the threat.

The whole of the District is at some measure of vulnerability to floods. An assessment of a community's vulnerability to flood begins with an understanding of local exposure to flood. This is included in the Local Concerns section below followed by a discussion of the District's Assets at Risk to this hazard.

Local Concerns

The District has specific concerns and unique vulnerabilities regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce risk and vulnerability to this hazard.

A high-water event, depending on the water elevation, is unlikely to cause failure due to overtopping as many other surrounding Districts are lower and more likely to fail before failure of RD 554 levees. Higher levels of water could increase hydraulic gradients within the levee section resulting in landside seepage or boils. Continued seepage, if left unaddressed, could erode the levee and result in failure. Heavy flows could also cause erosion and scour on the waterside bank that could undermine the levee and cause failure. Historic districts are a high concern due to their age and inability to be replaced. Additionally, a breach would cause quickly inundation parts of the town with full inundation in about 8 hours. This leaves little time for evacuation.

Flooding within the District will likely overtop the cross levee and inundate Tyler Island south of the District and is approximately 8,600 acres of agriculture.

Assets at Risk

Assets at risk from flood include people and populations; District assets and critical facilities and infrastructure); and natural, historic, and cultural resources. These are discussed in the following sections.

People and Populations

All people and populations located in the 1% and 0.2% annual chance floodplains within the District (including both District staff and the population within District boundaries) are at some risk to flooding. Certain vulnerable populations located within areas prone to flooding may be at increased risk to this hazard, especially during a large event with minimal advance notice. These vulnerable populations include: the unsheltered, those with limited mobility, and those that lack the resources to leave the area.

Populations within District boundaries can be the most vulnerable. Not only are the residents at risk, but their homes and contents are all at risk, compounding the impacts associated with significant hazard events.

District Assets and Critical Facilities and Infrastructure

Certain District structures are at risk of DFIRM flooding and primarily include those structures located within the 1% and 0.2% annual chance floodplains. Flooding presents a threat to both critical facilities and infrastructure, as well as community lifelines. Critical infrastructure plays an immensely important role in the District and surrounding communities. The levee system and pumping stations are vulnerable to a 1%/0.5%/0.2% annual chance flood. As the flows could exceed the capacity of both the levee system and the pumping station that is needed to drain the island. District assets listed in Table 8-12 would be at risk to flooding.

Table 8-12 RD 554 Assets: Structures, Critical Facilities and Infrastructure, and Other Facilities at Risk of Flooding: 1%, 0.5%, and 0.2%

Name of Asset	Facility Type	Replacement Value
Levee	Infrastructure	\$40,000,000
Fire/Police Station	Critical Facility	\$5,000,000
Community Center	Critical Facility	\$4,000,000
Elementary School	Critical Facility	\$7,000,000

Source: RD 554

At the 1% event, the levee should perform near its design condition but could be loaded for days, increasing the risk of underseepage, boils, and slope instability, especially where maintenance has been deferred, where toe ditches are present or where freeboard is reduced. A 0.2% event has a greater chance of exceeding design water levels and overtopping.

In a 1% event, the cross-levee is not the primary barrier, but its condition and crest elevation matter for controlling where water goes if the perimeter is breached. In a 0.2% event, higher interior water could load it beyond its intended function and inundate the Tyler Island to the south.

High river stage reduces effective discharge head while local rainfall increases interior inflow, so demand rises as capacity falls. In a 0.2% event, the pump station could be overwhelmed or need to shut down.

Flooded access roads could delay response even if the building itself stays dry. At the 0.2% level, more of the community and the station's service area would likely be affected. Depending on its mapped flood zone,

the building could see inundation or lose road access, which could limit its use as a shelter. Flooding could force closure of the school and displace students, and could block evacuation routes.

Natural, Historic, and Cultural Resources

Large flood events can affect natural, historic, and cultural resources. There are a number of ways floodwaters can impact natural resources and the environment. Wildlife habitats can be destroyed by floodwaters. Contaminated floodwater can pollute rivers and habitats. Silt and sediment can destroy natural areas. Riverbanks and natural levees can be eliminated as rivers reach bankfull capacity. Rivers can be widened, and deposition can increase downstream. Trees can be uprooted by high-velocity water flow. Plants that survived the initial flood may die due to being inundated with water. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to structures within the flooded areas, but other cultural resources such as those associated with Native Americans and old tribal areas can also be disturbed, damaged and lost during extreme flood events. Any of these that fall in the flood zones shown on Figure 8-7 would be vulnerable.

There are three nationally registered historic districts protected by the levee system, the Walnut Grove Chinese and Japanese American Historic Districts and the Walnut Grove Commercial/Residential Historic District. There are also two nationally registered historical buildings, Gauken Hall and Imperial Theater. There are also historic homes that are over 100 years old. A 1% and 0.2% annual chance flood event could inundate these districts and historic places if the event results in levee failure. Such an event may also exceed the District's pumping facility and improper drainage could also flood the districts. Flooding could cause irreparable damage to some structures and they could be lost.

Impacts from Flood: 1%, 0.5%, and 0.2% Annual Chance

Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide. Large flood events, including those associated with 1% and 0.2% annual chance floods, can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. People may be swept away in floodwaters, causing injuries or deaths. 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. Direct impacts, such as drowning, can be limited with adequate warning and public education about what to do during floods. Floodwaters can transport large objects downstream which can damage or remove stationary structures. Structures can be damaged directly from floodwaters and can also be damaged from trees falling as a result of water-saturated soils. 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 causing power outages. The interruption of power causes major problems and can result in the 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. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, loss of environmental resources, and economic impacts.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the District may be affected in the future by climate change (which was discussed in the hazard profile discussion above), changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. These are discussed below.

Future Conditions/Future Development

This section provides a discussion of how future conditions will influence or affect the hazard over time and also discusses future development relative to each hazard.

Future Conditions

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for the RD 554 include the following:

- Climate change is likely to exacerbate future flood conditions and associated impacts and vulnerability of the District to 1% and 0.2% annual chance flooding. This was discussed in greater detail in the Climate Change and Flood section of the Hazard Profile above.
- Population projections within the jurisdictional boundaries of the District show the population to be flat or slightly declining. It is unknown how population patterns and demographics will change in the near future. The District may add staff, but this number would be small. The District noted that it has no control over population changes within its jurisdictional boundaries. With no notable changes in populations numbers and makeup, the vulnerability of the District to this hazard is unlikely to change.
- Changes in land use and development in the District are expected to be limited in the near future and thus are not likely to affect flooding and associated impacts to the District. Additional development traditionally leads to additional flooding. In addition, adherence to protective building codes for new development will assist in limiting future impacts and associated vulnerabilities of the District to this hazard.

Future Development

Future development in the District may be built in the floodplain, as long as it conforms to the standards of the floodplain ordinance. The County enforces their floodplain management ordinance on areas inside the District. More detail on the specifics of the floodplain ordinance can be found in Section 4.4.1 of the Base Plan. New District facilities and assets will be sited in such a way as to reduce the risk from flooding to District structures and assets.

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence—Highly Likely

Vulnerability—High

Hazard Profile

Flooding occurs in areas other than the FEMA mapped 1%, 0.5%, 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 District, during the rainy season from November through April. Prolonged heavy rainfall (including that from atmospheric river events) contributes to a large volume of runoff resulting in high peak flows of moderate duration.

Location and Extent

The RD 554 is subject to localized flooding throughout the District. Areas prone to localized flooding are included in past occurrences section below. 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.

Past Occurrences

Disaster Declaration History

There have been no state or federal disaster declarations from localized floods. There would most likely have been localized flood events during the disaster declarations from flood as shown in the previous 1%/0.2% annual chance flood section.

NCDC Events

The NCDC occurrences of localized flooding are included in the 1% and 0.2% annual chance flood hazard profile above where past flood events were noted.

RD 554 Events

The District noted that localized flooding generally occurs during periods of heavy rain and storms and often occurs in conjunction with the larger, more significant flood events. Many of these were discussed in the Past Occurrences Section of the Flood: 1% and 0.2% annual chance flood section above. In addition to those events, the following events occurred resulting in localized flooding within the District:

There have been no federal or state disaster declarations in the County due to localized flooding. The District noted the following past occurrences of localized flooding:

Some form of localized stormwater flooding occurs during most heavy rains. The most likely time this could have occurred in the past was during the wet year in 2006. The District noted following events occurred:

- **2017 HWE:** Event initiated extra monitoring. Produced excess electrical cost for pumping the excess run off required to prevent localized flooding and the threat of overtopping on Snodgrass Slough.
- More recently, a winter storm event in **2022/2023** caused localized flooding in the District.

Climate Change and Localized Flood

It is likely that climate change will increase the chance of future occurrence as well as future impacts from localized flood. More information on future impacts to the District can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

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 to Localized Flood

Flood vulnerability and their impacts vary by location and severity of any given flood event and will likely only affect certain areas of the District during specific times. Based on the risk assessment, it is evident that floods will continue to have potentially significant impacts to certain areas of the District. However, while flooding can cause significant impacts, depending on the duration and volume of precipitation and the drainage in any given area, many of the floods in the District are minor, localized flood events that are more of a nuisance than a disaster.

Many areas of the District are at some measure of vulnerability to localized flooding. An assessment of a community's vulnerability to localized flooding begins with an understanding of local exposure to localized flooding. This is included in the Local Concerns section below followed by a discussion of the District's Assets at Risk to this hazard.

Local Concerns

The District has specific concerns and unique vulnerabilities regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce risk and vulnerability to this hazard.

Historically, the District has been affected by flooding of rivers, streams and creeks occurring during heavy rain and storm (including atmospheric river) events. Additional development in the District and in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff and contributes to localized flooding occurring in areas throughout the District. The lack of or inadequate drainage infrastructure in the District contributes to localized flooding issues. Localized stormwater flooding can occur during heavy rains or seepage events that exceed the District's drainage capabilities. Lower areas around the island may be subject to minor flooding.

Historically, the District has been affected by flooding of rivers occurring during heavy rain and storm (including atmospheric river) events. Additional development in the watersheds of these streams affects both the frequency and duration of damaging floods through an increase in stormwater runoff and contributes to increased flooding downstream of the developed areas than has been historically seen. If the drainage infrastructure has issues or inefficiencies, it will contribute to localized flooding issues. Localized stormwater flooding can occur during heavy rains or seepage events that exceed the District's drainage capabilities. Lower areas around the island may be subject to minor flooding these are generally agricultural areas, not areas within the town which sits at a higher elevation.

Assets at Risk

Assets at risk from localized flood include people and populations; District assets and critical facilities and infrastructure); and natural, historic, and cultural resources. These are discussed in the following sections. District assets at risk to this hazard are included in Table 8-13 below.

Table 8-13 RD 554 Assets: Structures, Critical Facilities and Infrastructure, and Other Facilities.

Name of Asset	Facility Type	Replacement Value
Levee	Infrastructure	\$40,000,000
Cross-levee	Infrastructure	\$8,000,000
Pump Station	Infrastructure	\$1,000,000
Fire/Police Station	Critical Facility	\$5,000,000
Community Center	Critical Facility	\$4,000,000
Elementary School	Critical Facility	\$7,000,000

Source: RD 554

People and Populations

People and populations (including both District staff and the population within District boundaries) are traditionally not highly vulnerable to localized flooding, but their structures and contents can be at risk. Likewise, most vulnerable populations are not uniquely vulnerable to localized flooding. Localized flooding may cause transportation issues as roads and bridges are impacted or closed and affect the ability for people to travel throughout the District.

District Assets and Critical Facilities and Infrastructure

District assets and critical facilities and infrastructure in areas with localized flooding can be affected if floodwaters intrude into the structure. Structures and critical facilities in low lying areas, can be at greater risk. Buildings with older foundations that are prone to water intrusion are also at greater risk. Once water finds its way into a structure, it tends to continue to do so until the path that brings water into a structure is mitigated. Structures can also be damaged by trees that have become uprooted and fall during rain and storm events. Large trees falling onto structures can cause significant damage. Localized stormwater flooding can occur during heavy rains or seepage events that exceed the District's drainage capabilities. Lower areas around the island may be subject to minor flooding.

Localized flooding can overtax the Districts pumping system and create a more hazardous situation involving the levee system by limiting the ability for inspection.

Natural, Historic, and Cultural Resources

Natural resource assets may have some vulnerabilities to localized flood during major storm events, but can benefit from floodwaters, often by design. Many parks and green spaces are designed to take overflow water and release it into the underlying soils and natural areas. Wetland areas in the District actually help reduce the risk of flooding, as they can absorb excess rainfall that would have to be drained away from

impervious surfaces. Flooding can provide many benefits to the natural environment, including recharging wetlands and groundwater, increasing fish production, creating wildlife habitat, and rejuvenating soil fertility. These smaller localized flooding events often provide more benefits to the environment in comparison to negative impacts associated with large flood events. Historic and cultural resources may be at some measure of vulnerability if they are located in areas subject to repeated localized flooding.

Impacts from Localized Flood

Primary concerns associated with localized stormwater flooding include impacts to infrastructure that provide 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.

Life safety issues from localized flooding would be more limited. The amount and type of damage or flooding that occurs varies from year to year and from storm to storm, depending on the quantity of precipitation and runoff.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the District may be affected in the future by climate change (which was discussed in the Likelihood of Future Occurrence discussion above), changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. These are discussed below.

Future Conditions/Future Development

This section provides a discussion of how future conditions will influence or affect the hazard over time and also discusses future development relative to each hazard.

Future Conditions

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for the RD 554 include the following:

- Climate change is likely to exacerbate future heavy rain conditions and associated impacts and vulnerability of the District to localized flood. This was discussed in greater detail in the Climate Change and Localized Flood section of the Hazard Profile above.
- Population projections within the jurisdictional boundaries of the District show the population to be flat or slightly declining. It is unknown how population patterns and demographics will change in the near future. The District may add staff, but this number would be small. The District noted that it has no control over population changes within its jurisdictional boundaries. With no notable changes in populations numbers and makeup, the vulnerability of the District to this hazard is unlikely to change.
- Changes in land use and development in the District are expected to be limited in the near future and thus are not likely to affect flooding and associated impacts to the District. Additional development

traditionally leads to additional localized flooding. However, adherence to protective building codes for new development will assist in limiting future impacts and associated vulnerabilities of the District to this hazard.

Future Development

The District will need to be proactive to ensure that increased development has proper siting and drainage for stormwater. 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 can reduce future flood losses.

Levee Failure

Likelihood of Future Occurrence–Unlikely

Vulnerability–Extremely High

Hazard Profile

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 stream channel, levees can also increase the speed of the water. Levees can be natural or man-made. A natural levee is formed when sediment settles on the streambank, raising the level of the land around the stream.

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 a release from or failure of a dam. 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.

Over 518 miles of levees are located throughout the Sacramento County Planning Area. These include both accredited and unaccredited levees, as discussed in Section 4.3.14 of the Base Plan, all which pose a risk to adjacent communities should a levee fail or overtop. While the levee analysis included in this section focuses on the accredited levees and those with improvements in process based on the DFIRM A99 and X-Protected by Levee Flood Zones, there are many older, unaccredited levees located throughout the County Planning Area, including the District, that may have a greater potential for overtopping or breaching and pose a significant risk to communities should they fail.

Location and Extent

A majority of the District is at risk to levee failure flooding. There is not a scientific scale or measurement system in place for levee failure. It is usually measured in area covered and depth of flooding. A map of levees located in the Sacramento County Planning Area is shown in Section 4.3.14 of the Base Plan. This map of estimated inundation depths due to a levee failure in the County are shown on Figure 8-8. Note, not all levees and levee inundation depths are depicted on these maps. 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. Those levees accredited as providing protection against the 1% or greater annual chance flood and those in levees in the certification process are identified in the FEMA DFIRMs which also include those areas protected by the levees. Geographical DFIRM A99 and X Protected by Levee flood zone extent from the FEMA DFIRMs is shown on and included in Table 8-14. A levee status map is provided in Figure 8-9 below.

Note: Many more unaccredited levees are also located throughout the County, with many of these concentrated in the Delta area. It should be noted that these unaccredited levees may have a greater potential for failure or breach and can pose even a greater risk to those communities in which they are located.

Figure 8-8 RD 554 – Levee Flood Protection Zones

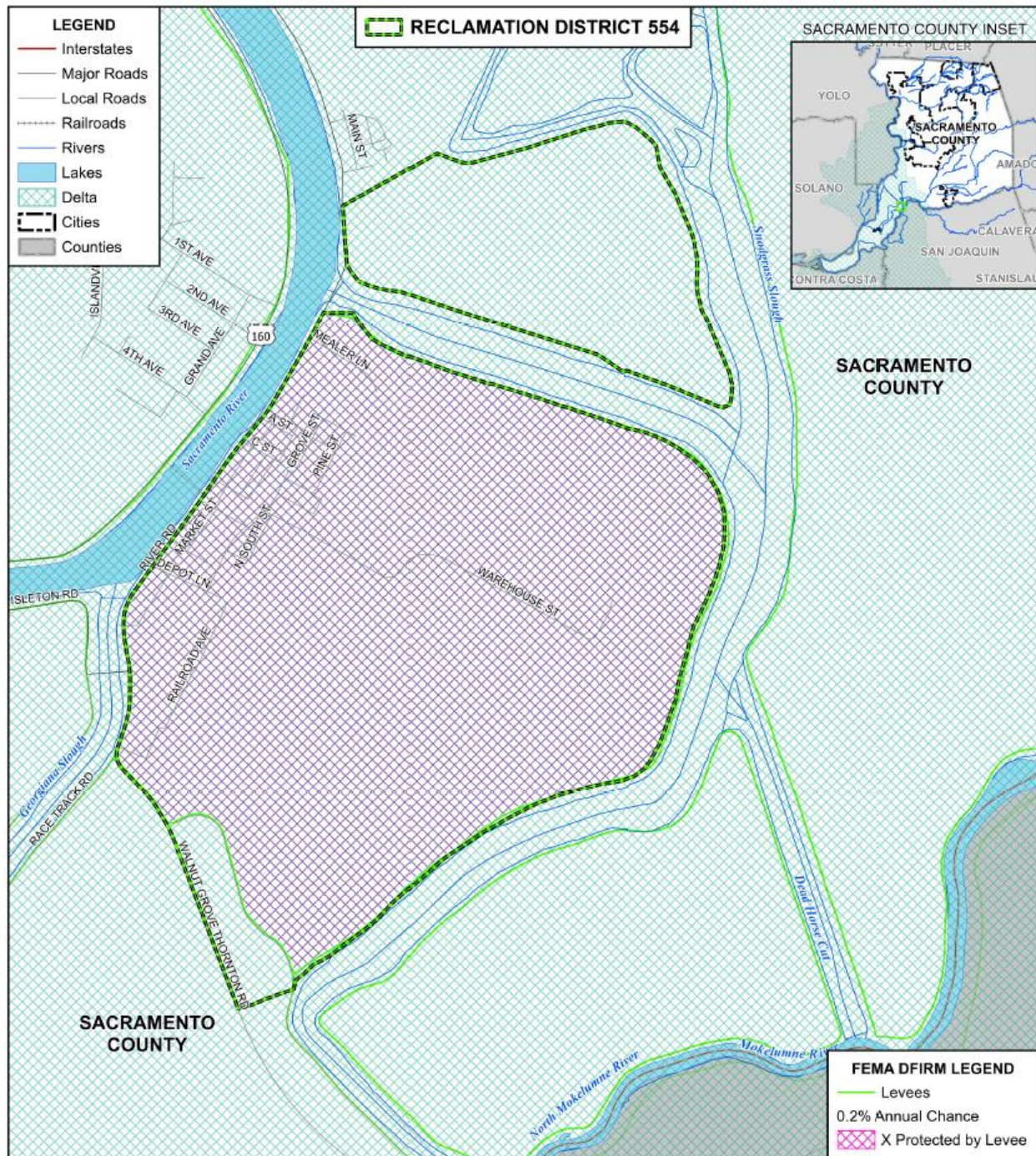


Table 8-14 RD 554 – Geographical Flood Hazard Extents in FEMA X Protected by Levee DFIRM Flood Zones

Flood Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
0.2% Annual Chance Flood Hazard						
X Protected by Levee	462	77%	369	94%	93	44%
0.2% Annual Chance Flood Hazard Total	462	77%	369	94%	93	44%
Other Areas						
Other Areas Total	142	23%	25	6%	116	56%
Grand Total	603	100%	394	100%	209	100%

Source: 02/2024 DFIRM

LEGEND

- GEORGIANA SLOUGH: PROJECT LEVEE
- STA: 0+00 - 15+00
- SACRAMENTO RIVER: PROJECT LEVEE
- STA: 15+00 - 46+58
- DELTA CROSS CHANNEL: FEMA RURAL LEVEE
- STA: 46+58 - 87+50
- SNOODGRASS SLOUGH: FEMA RURAL LEVEE (LANDSIDE ENHANCEMENT NEEDED)
- STA: 87+50 - 152+50
- TYLER ISLAND CROSS LEVEE: FEMA RURAL LEVEE
- STA: 152+50 - 180+00

DATE: 8-2-2021
SHEET: 1
PROJECT NO: 75860 1A

RECLAMATION DISTRICT 554 (EAST WALNUT GROVE)

LEVEE SYSTEM STATUS MAP

SCALE: 1"=1000'

AS SHOWN

DESIGNED BY: SCALE
B. NEELY
JOHN BY: 1/2"
BLMONTANEZ ORIGINAL DRAWING SCALE
CHECK BY: 1/2"
G. LARSEN

PLANNING
ENGINEERING
CO., INC.
 1040 7th St. Ste. 200
 P.O. Box 145, Walnut Grove, CA 95690

ARCHITECT
 1040 7th St. Ste. 200
 P.O. Box 145, Walnut Grove, CA 95690

Sacramento County
Local Hazard Mitigation Plan Update
October 2026

Past Occurrences

Disaster Declaration History

There have been two state and two federal disasters declarations directly related to levee failure in Sacramento County, as shown on Table 8-15. Also, it is important to note that many of the flood disaster declarations included in Section 4.3.11 of the Base Plan (like the December 31, 2022 event near Wilton) also may include flooding associated with levee breach or failure events.

Table 8-15 Sacramento County – State and Federal Disaster Declarations Summary 1950-2025

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Levee Break	2	1972, 1980	2	1972, 1980

Source: Cal OES, FEMA

NCDC Events

There have been no NCDC levee failure events in Sacramento County, as the NCDC does not track levee failure flooding as a stand-alone hazard.

RD 554 Events

In **2023**, there were another set of atmospheric rivers that occurred January through March. The levees held well between January and February, but in March a boil developed in the Snodgrass Slough levee near the District pump station. This was temporarily repaired using a levee seal material. The boil reopened that July as the District was preparing to perform a final repair with sheet pile. Once the sheet pile was installed, the boil stopped. This was likely caused by an existing beaver den, and the pressure of the consistent high water revealed it. As a result, several levee toe ditches were relocated to eliminate the potential of a den in the levee section.

In **2017**, Sacramento County was impacted by storm systems/atmospheric rivers (Jan 3–Jan 24, 2017). The County noted combined effects of storms, king tides, releases, and runoff affecting several areas. District levees held well, but there were areas in the District of erosion on unvetted waterside slopes.

The 5-Year Plan noted that in **1986**, lower Tyler Island flooded and threatened to flood RD 554. At that time, an effort was undertaken to enhance the cross levee height by adding a berm on the lower Tyler side of the levee to ensure that the urban area did not get flooded. The added height was not necessary when the water crested but the emergency construction paved the way for the more permanent configuration that exists today. That levee upgrade then led to a successful LOMR for eastern Walnut Grove and its Zone X determination in 1987.

Climate Change and Levee Failure

The 2024 Sacramento County CAP noted that climate change is likely to lead to changes in the frequency, intensity, and duration of extreme weather events. The County is projected to experience a steady increase in average annual precipitation through the end of the century, with much of that precipitation likely to

occur during extreme precipitation events, which can lead to flood impacts. According to Cal-Adapt, the historic average annual precipitation in Sacramento County is 18.3 inches, and the historic average annual number of extreme precipitation events is four. The average annual precipitation across the County may rise upwards of 22 inches, with the number of extreme precipitation events potentially exceeding 7 per year by the end of the century, depending on the level of current and future GHG emissions.

In general, California exhibits “booms and busts,” which refers to the existence of both very wet years and very dry years. The amount of precipitation that falls in any particular year is largely influenced by occurrences of large, discrete winter storms, also known as atmospheric rivers, which often provide a substantial fraction of the region’s annual precipitation, inclusive of the county. In California, atmospheric rivers vary in intensity; some are beneficial for water supply and replenish snowpack that naturally melts during the summer, serving as the water supply for people and agriculture, while others are responsible for widespread and adverse impacts (NOAA 2023). Extreme precipitation from these atmospheric rivers in the future may prove to be more variable, volatile, and potentially more severe. These extremes are most likely to occur during storm events, leading to more severe damage from waves and floods, thus possibly leading to more levee failure events.

The June 2025 Delta Adapts Adaptation Plan noted that climate change will affect levee failure flooding in the Delta. The Delta’s 1,300 miles of levees protect more than 800,000 acres of land and play a critical role in conveying water supply through the Delta. By mid-century, overtopping of Delta levees by an event with a 1-percent annual chance of occurrence may result in the exposure of over \$1.8 billion in annual agricultural and commercial economic activity and \$10.5 billion in agricultural, residential, commercial, and infrastructure assets. Most of the Delta’s flood management infrastructure, including levees and upstream reservoirs, are designed to operate under historical sea level and hydrologic conditions that do not consider potential future climate change. Changing climatic conditions will place greater stress on the flood management system in the future.

Vulnerability to Levee Failure

According to historical hazard data and levee mapping, levee failures can occur in or near the District. Portions of the District are at some measure of vulnerability to levee failure floods, including failure or breach of accredited levees, those in the certification process, and unaccredited levees. An assessment of a community’s vulnerability to levee failure flooding begins with an understanding of local exposure to levees. This is included in the Local Concerns section below followed by a discussion of the District’s Assets at Risk to this hazard.

Local Concerns

The District has specific concerns and unique vulnerabilities regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce risk and vulnerability to this hazard.

General Concerns

The District noted that RD 554 is high ground. This urban area is on higher ground and would be less affected if there was a 100 year flood.

Not only would a breach inundate RD 554, but it would also overtop (or by an intentional breach) the dry cross levee and flood the rest of Tyler Island. Flood waters would flow down to the lower part of the island since it is at a lower elevation than RD 554. The lowest elevation on the southern part of Tyler Island is -15.0 feet (NAVD 88) according to the LIDAR survey supplied by DWR. By the same survey, the lowest elevation on RD 554 is -1.0 feet. The average elevation for Tyler Island is +9.0 feet.

Analysis from Five-Year Plan

The 2022 Five-Year Plan addressed levee repair costs due to failure. The Five-Year Plan broke down costs by land use type:

- **Residential** – For RD 554, it is estimated that there could be a one-time displacement cost of \$69,000 for all occupied households along with an additional \$5,750 per day to house these residents elsewhere. On lower Tyler Island, the estimated one-time displacement could be \$10,800 and an additional \$900 per day. The Walnut Grove Marina adds a transient population that is difficult to quantify since there are no statistics covering that element to determine associated costs. Furthermore, this number would fluctuate with the seasons. To house this population in emergency shelters it is estimated to cost \$96 a day (URS 8). As there would be sufficient time to evacuate, the costs to accommodate this unique group of part-time residents may not be significant. But the marina would be shut down until the island was pumped out.
- **Commercial** – Commercial structures will be adversely impacted from the time they are inundated through the time it takes to repair such damage and damage to surrounding infrastructure. There are about 48 businesses on all of Tyler Island. Overall, a flood could cost Walnut Grove and Tyler Island businesses an estimated \$127,314 per day. Some businesses may be unable to recover from a flood and could possibly be lost as the result of a flood event.
- **Agricultural** – Crops grown on Tyler Island are generally alfalfa, wheat, corn, pears, truck crops, tomatoes, rice, and wine grapes. Tyler Island has a total of 8,687 acres of crops. Average cost for rehabilitation and field cleanup is \$265 per acre. This involves the removal of debris and sediment deposits after floodwaters have receded. Silt and debris can also clog drainage and irrigation ditches adding a variable cost to rehabilitation. The estimated total one-time cost for clean-up and rehabilitation is estimated to be \$3 million. If inundation lasts longer than 14 days, it is assumed that the crops will be permanently lost. Any flood event that occurs between planting and harvest, could completely destroy the crops. Reestablishment of a lost crop dramatically increases economic losses. The inundation period is assumed to be five weeks on lower Tyler Island, meaning all crops on the lower end could potentially be lost in a flood event. However, due to the smaller size of RD 554 and an assumed inundation period of five days, not all crops may be lost. Not including clean-up costs, reestablishment of all crops on the island could total an estimated \$32.7 million.

Using the 2021 adjusted figure for breach repair, Walnut Grove RD 554 estimates \$1,875,000 for repair, recovery, and associated damages. Additionally, land values have increased because of the changes in crops. A breach at RD 554 would impact RD 563 and therefore would result in expenses for damage on both islands and increase the estimate to approx. \$33,000,000. So, a major event would impact both upper and lower Tyler Island.

The 5-Year Plan also addressed infrastructure issues related to levee failure. Levee failure on Reclamation District 554 could cause direct physical damage to the island's infrastructure. If a break were to occur in

the north inundating Walnut Grove/Thornton Road/J11, it would disrupt the island's connection to Highway 160 or 1-5, delaying up to 1,500 trips. The cost due to lost trips is small but the estimated time delay could cost \$54,096 per day, \$59,506 if 10% are assumed to be truck trips. Some of Walnut Grove's surface streets could be inundated affecting the area on a local level by removing access to the town's residential areas. The District also houses a FM radio and television transmission tower with support facilities serving KOVR, KXTV, and KQCA. This 2049' tower currently serves the Stockton-Sacramento-Modesto broadcasting area stations and radio stations (Fybush). The transmitter building is on stilts so the equipment will not be affected in a flood. But a flood could still restrict maintenance access to the building, and potentially interfere with broadcasting if there is a lengthy power disruption.

Overall, residential, commercial, agriculture, and infrastructure losses due to a flood event on all of Tyler Island could cost approximately \$193,356 per day. The one-time/direct cost of the event to relocate the residents and businesses and reestablish cropland would be around \$2.5 million. Assuming an inundation residence period 5 days on RD 554 (upper Tyler) a flood event there could cost approximately \$3 million. Lower Tyler with an assumed inundation residence period of 5 weeks (35 days), a flood event could cost approximately \$33 million of direct and indirect costs. These figures include daily losses to residents and business, one-time costs of displacement, rehabilitation costs of cropland, and reestablishment and annual production loss costs for vineyards and orchards. A flood event occurring between February and October, that would delay planting until the next season and is assumed to kill all crops, could add up to approximately \$90 million of direct and indirect costs for both districts. This figure includes the estimated costs associated with repairing the breach and pumping out the islands, about \$33.8 million.

Water quality issues were also addressed in the 5-Year Plan. Due to the urban nature of a portion of RD 554, a flood could release household and commercial chemicals potentially contaminating the surrounding waterways. A flood could also suspend sediment, metals, fertilizers, and pesticides that are attached to soil particles. Increased sedimentation of the waterway can reduce the amount of sunlight to reach submerged aquatic plants and also smother fish larvae and harm fish by clogging their gills. The extent of the effects on fish and aquatic species from suspended sediment and chemicals depend on the quantities of pollutants, amount of dilution, and frequency of freshwater releases.

Besides those listed above, other potential in-island pollutant sources could degrade water quality on the island and in the waterways. A long inundation period could create anoxic conditions in the soil can release toxic substances, such as manganese that is naturally occurring but can be dangerous to health in high concentrations. Other toxic substances such as, organochlorine "legacy" pesticides that, although have been banned for over 20 years, slowly degrade in the environment and can still be present in soils where it was applied. This can have harmful effects on fish species in terms of reducing food production, namely a primary producer, phytoplankton if released into the waterway. Although not harmful in small traces, "legacy" pesticides can become more concentrated through bioamplification and not only harm fish species but terrestrial and avian species as well.

StormReady Flood Scenarios and Evacuation Routes

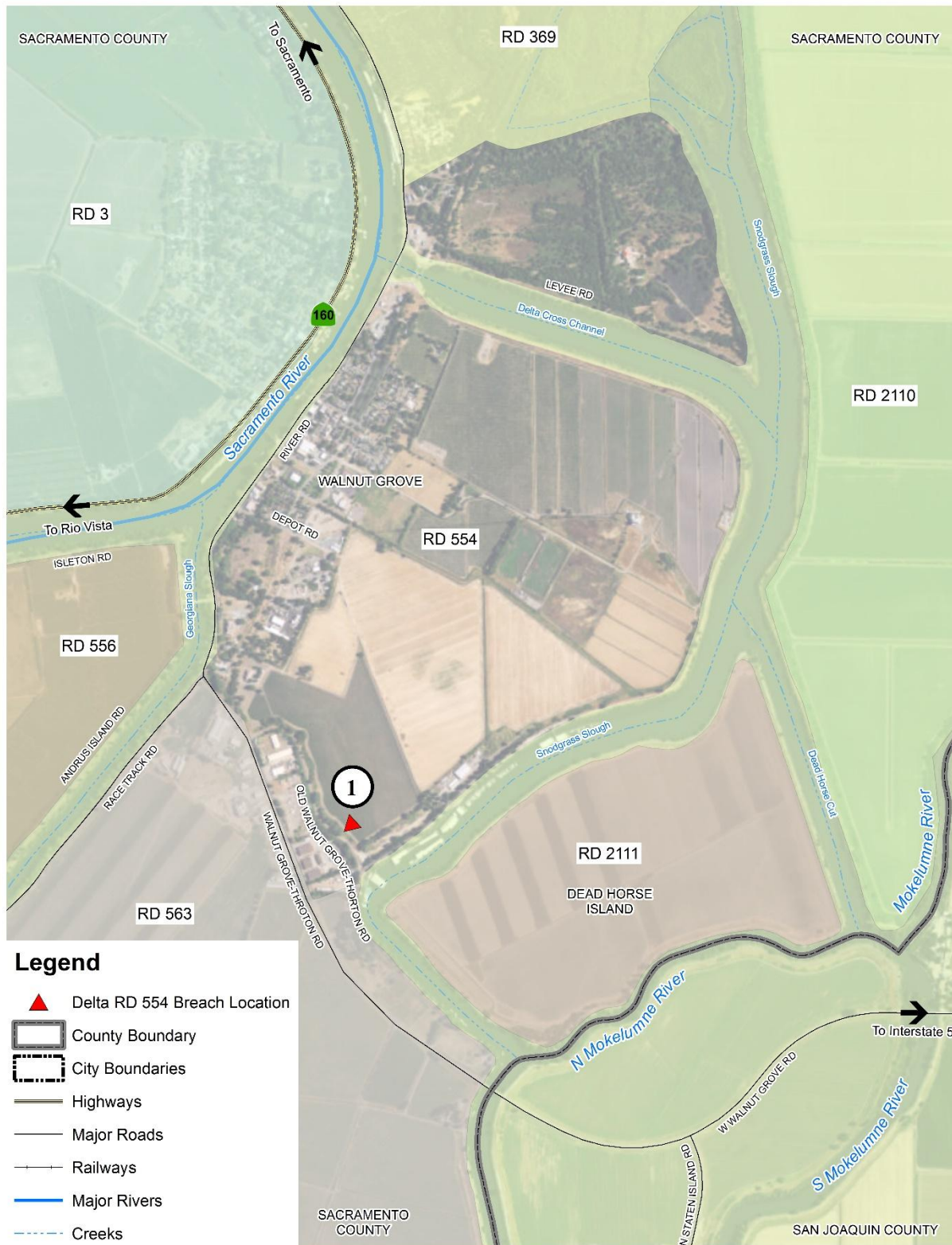
The County of Sacramento and the City of Sacramento have prepared various detailed maps showing hypothetical levee breaks, inundation levels and the time it would take for waters to rise in affected neighborhoods, and rescue and evacuation zones. It is important to note that these maps deal with potential

scenarios. These are to help Sacramento County citizens think of how to escape before an emergency occurs. It should be noted that it would be incorrect to assume that the evacuation routes shown on the maps will necessarily be citizens only way out in a flood. Escape routes could be affected by localized flooding, traffic accidents, and different flooding situations occurring at the time. Emergency officials will monitor roads and let the public know through radio stations and other media if alternate routes should be taken.

For RD 554, Figure 8-10 details the locations in the Delta within RD 554 where flooding could occur. The red triangles denote potential levee breach locations. RD 554 has a potential levee break scenario. Maps regarding time to one foot inundation (Figure 8-11), estimated flood depths (Figure 8-12), and suggested evacuation routes (Figure 8-13) are displayed below.

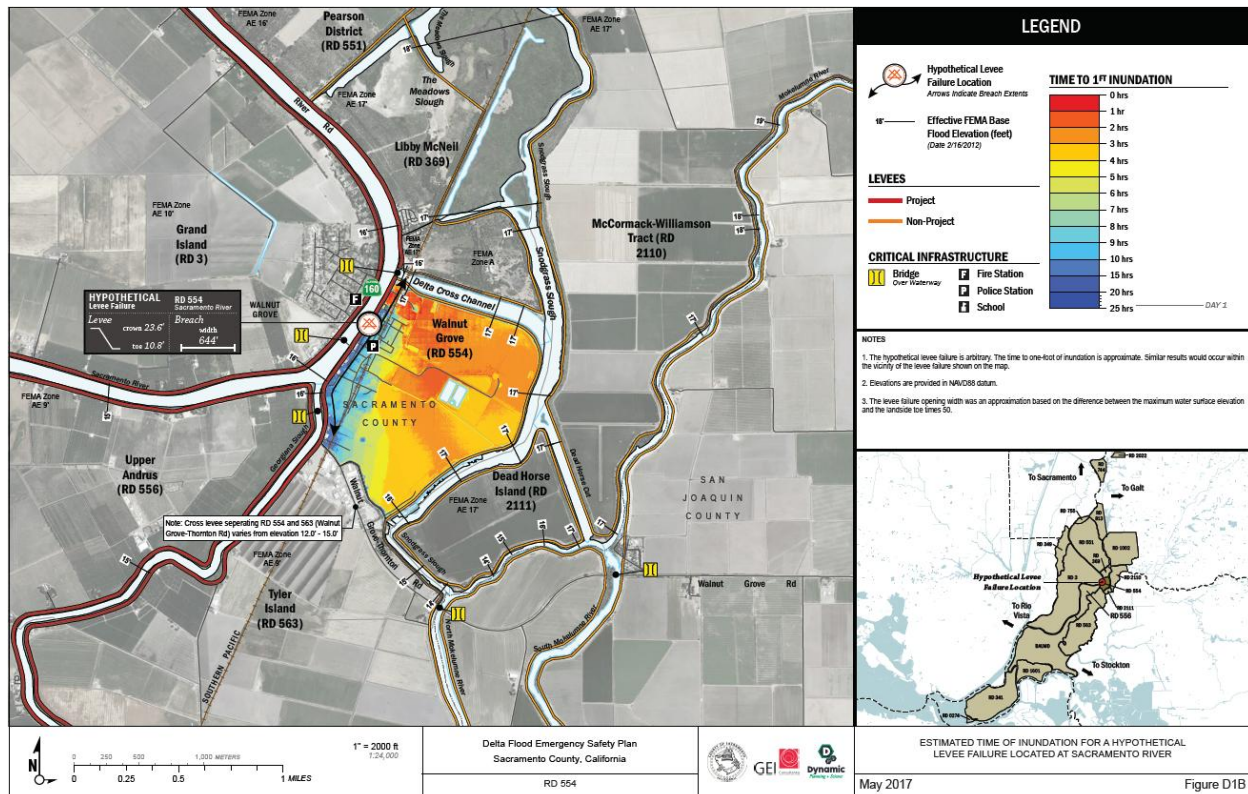
Note: This information is based on assumptions and scenarios developed as part of the flood safety planning done for Delta RDs in 2017; areas of possible flooding depicted in these maps may or may not reflect current conditions and would change depending on the location of breach areas and conditions during any given event. Current conditions should be verified with an LMA representative.

Figure 8-10 RD 554 – Potential Levee Breach Location



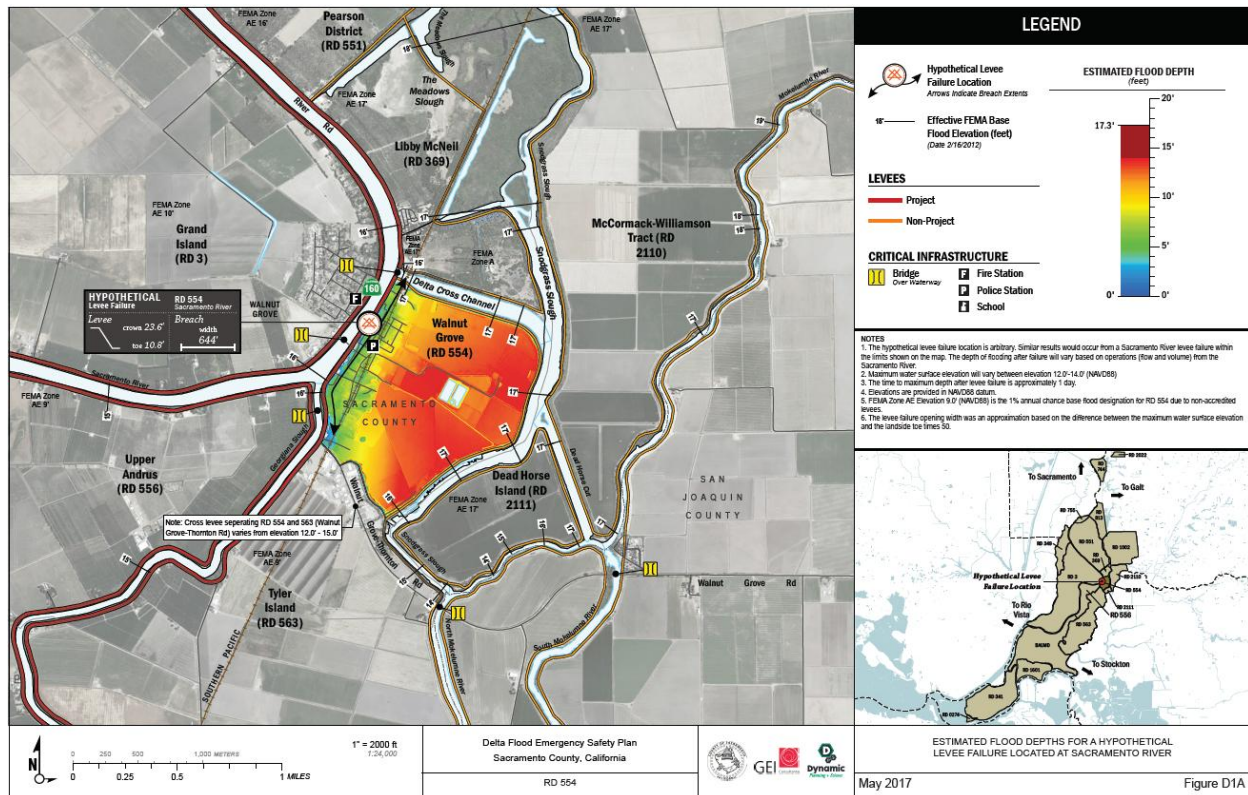
Source: Sacramento County Storm Ready – retrieved July 29, 2026

Figure 8-11 RD 554 – Time to One Foot Inundation after Levee Breach



Source: Sacramento County Storm Ready – retrieved July 29, 2026

Figure 8-12 RD 554 – Estimated Flood Depth from Levee Breach Scenario



Source: Sacramento County Storm Ready – retrieved July 29, 2026

LEGEND

TRANSPORTATION

EVACUATION ROUTES

Interstate Highway On Levee Levee Road Local Road

INFRASTRUCTURE

Bridge Fire Station
Over Waterway Hospital
Ferry Police Station
School

JURISDICTIONS

City Boundary
County Boundary
RD Boundary

**EVACUATION ROUTES FOR RD 554
HYPOTHETICAL LEVEE FAILURE AT SACRAMENTO RIVER**

May 2017

Figure D10

Assets at Risk

People and Populations

District Assets and Critical Facilities and Infrastructure

Certain District assets and critical facilities are at risk of levee failure flooding and primarily include those structures located adjacent to levee protected areas. In the District, levees and district pumping plants are at risk. One island inundation can create an open water situation where a large fetch could develop and erode the interior of other levees within the District. Inundation of the drainage pump can make it inoperable and require replacement. Other critical facilities at risk include a fire department, police station and elementary school. The fire department and police station are non-critical facilities because they are

above the potential high water flood elevations. District assets listed in Table 8-3 would be at risk to flooding.

Table 8-16 RD 554 Assets: Structures, Critical Facilities and Infrastructure, and Other Facilities.

Name of Asset	Facility Type	Replacement Value
Levee	Infrastructure	\$40,000,000
Pump Station	Infrastructure	\$1,000,000
Fire/Police Station	Critical Facility	\$5,000,000
Community Center	Critical Facility	\$4,000,000
Elementary School	Critical Facility	\$7,000,000

Source: RD 554

A breach or overtopping failure would cause rapid, uncontrolled flooding of the town and land behind it, with onset measured in hours and little warning time. Failure could also occur without a flood, from seepage, erosion, failed pipe facilities within the levee, or rodent dens. The cross-levee could confine flooding to part of the district if it holds, which would limit the number of acres or facilities affected on the larger island to the south of the District, Tyler Island. If it fails, or if the breach is inside it, the protection it provides is lost.

A breach could raise interior water faster than the pump station is designed to handle, or inundate the station if it occurs nearby, disabling equipment when it is most needed and delaying recovery. A back up pumping system would need to be brought in to aiding in pumping out the island.

The critical facilities, such as the fire/police station, community center, and elementary school that either provide emergency services or are used for community coordination and shelter will be inaccessible and potentially damaged and unable to service the region well after the flood.

Natural, Historic, and Cultural Resources

Large flood events, such as those occurring as a result of a levee failure, can affect natural, historic, and cultural resources. There are a number of ways floodwaters can impact natural resources and the environment. Wildlife habitats can be destroyed by floodwaters. Waterside habitat that is adjacent to the break could be lost due to the erosive forces of the water flowing through the break. Contaminated floodwater can pollute rivers and habitats. Silt and sediment can destroy natural areas. Riverbanks and natural levees can be eliminated as rivers reach bankfull capacity. Rivers can be widened, and deposition can increase downstream. Trees can be uprooted by high-velocity water flow. Plants that survived the initial flood may die due to being inundated with water. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to structures within the flooded areas, but other cultural resources such as those associated with Native Americans and old tribal areas can also be disturbed, damaged and lost during extreme flood events. Any of these that fall in the X Protected by Levee flood zones shown on Figure 8-8 as well as those resources located in areas adjacent to or downstream of unaccredited levees would be vulnerable.

The 2022 Five-Year Plan noted that due to the urban nature of a portion of RD 554, a flood could release household and commercial chemicals potentially contaminating the surrounding waterways. A flood could also suspend sediment, metals, fertilizers, and pesticides that are attached to soil particles. Increased sedimentation of the waterway can reduce the amount of sunlight to reach submerged aquatic plants and also smother fish larvae and harm fish by clogging their gills. The extent of the effects on fish and aquatic species from suspended sediment and chemicals depend on the quantities of pollutants, amount of dilution, and frequency of freshwater releases.

Impacts from Levee Failure

Floods and their impacts vary by location, including impacts associated with a levee failure flood event, and will only affect certain areas of the District that are in areas protected by levees. Based on the areas of the District surrounded by levees, it is evident that levee failure floods could potentially have significant impacts to the District, depending on the location, timing, and severity of the event. Impacts that are not quantified, but could be anticipated in large levee failure event, include:

- Injury and loss of life
- Structural and property damage
- Crop damage
- Disruption of and damage to public critical infrastructure and services
- Health hazards associated with mold and mildew, contamination of drinking water, etc.
- Impacts to natural resource areas, including stream bank erosion
- Damage to roads/bridges resulting in loss of mobility

In addition to flood related levee failures, the levees in the District are potentially at risk to failure during an earthquake event. Levee failure flooding could accompany an earthquake and could be compounded further if a dam or storage reservoir fails. Channels and water courses with earthen banks and levees are particularly vulnerable and could collapse in a major earthquake resulting in partial or complete blockage of channels causing flooding upstream of the impoundment. Levees are especially susceptible to rapid settlement due to liquefaction or horizontal spreading of underlying soils.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the District may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

This section provides a discussion of how future conditions will influence or affect the hazard over time and also discusses future development relative to each hazard.

Future Conditions

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for the RD 554 include the following:

- Climate change is likely to exacerbate future flood and levee failure conditions and associated impacts and vulnerability of the District to levee failure flooding. This was discussed in greater detail in the Climate Change and Levee Failure section of the Hazard Profile above.
- Population projections within the jurisdictional boundaries of the District show the population to be flat or slightly declining. It is unknown how population patterns and demographics will change in the near future. The District may add staff, but this number would be small. The District noted that it has no control over population changes within its jurisdictional boundaries. With no notable changes in populations numbers and makeup, the vulnerability of the District to this hazard is unlikely to change.
- Changes in land use and development in the District are expected to be limited in the near future and thus are not likely to affect levee failure flooding and associated impacts to the District. Additional development traditionally leads to additional flooding, especially in levee protected areas. However, adherence to protective building codes for new development will assist in limiting future impacts and associated vulnerabilities of the District to this hazard.

Future Development

Future development considerations should be ongoing and proactive. Ensuring that comprehensive land use planning is conducted, regulatory requirements, such as building codes and the floodplain ordinance, are followed, and levee improvements, inspections, and maintenance is ongoing will help reduce impacts to future development.

Sea Level Rise

Likelihood of Future Occurrence–Likely

Vulnerability–Medium

Hazard Profile

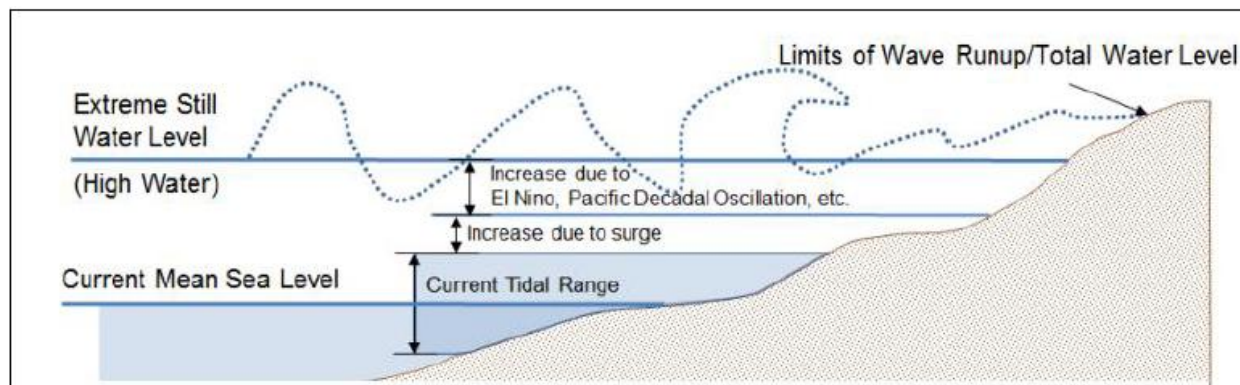
Historically, cities, towns and villages were often settled around ports and waterways along the nation's coastlines, providing individuals and families opportunities for trade, jobs and transportation, and recreation. These areas are extremely important to our nation, with great economic, historic and cultural significance. Although the coastal areas of the United States comprise only one-fifth of the land area of the contiguous 48 states, they account for more than half of the nation's population and housing supply. In 1990, over 133 million Americans lived in the 673 counties along the Atlantic and Pacific Oceans, the Gulf of Mexico and the Great Lakes. Since 1960, population in these areas have increased by 41 percent. The continued increase in coastal population leads to increased coastal development, which places greater numbers of people and structures at risk from coastal hazards including sea level rise.

While Sacramento is not typically considered a coastal community, the southwestern portion of the County follows the course of the Sacramento River as it flows into the Sacramento-San Joaquin Delta. The area of Sacramento County near the Delta is vulnerable to the influences of sea-level rise.

The 2023 California State Hazard Mitigation Plan noted that sea-level rise generally progressively worsens the impact of high tides and wind-driven waves associated with severe storms. Coupled with increased frequency, severity, and duration of high tide and storm events related to climate change, sea-level rise will exacerbate these extreme events along the coast and other affected areas. El Niño events exacerbate storms

and coastal inundation that is already occurring due to sea-level rise and normal coastal weather and tidal patterns. The additive effects of high tides, storm surge, atmospheric patterns (e.g., El Niño) and sea-level rise are shown in Figure 8-14.

Figure 8-14 Additive Effects of Sea-Level Rise



Source: 2023 California State Hazard Mitigation Plan

King Tides may also affect sea level rise. This was discussed in detail in Section 4.3.15 of the Base Plan.

Location and Extent

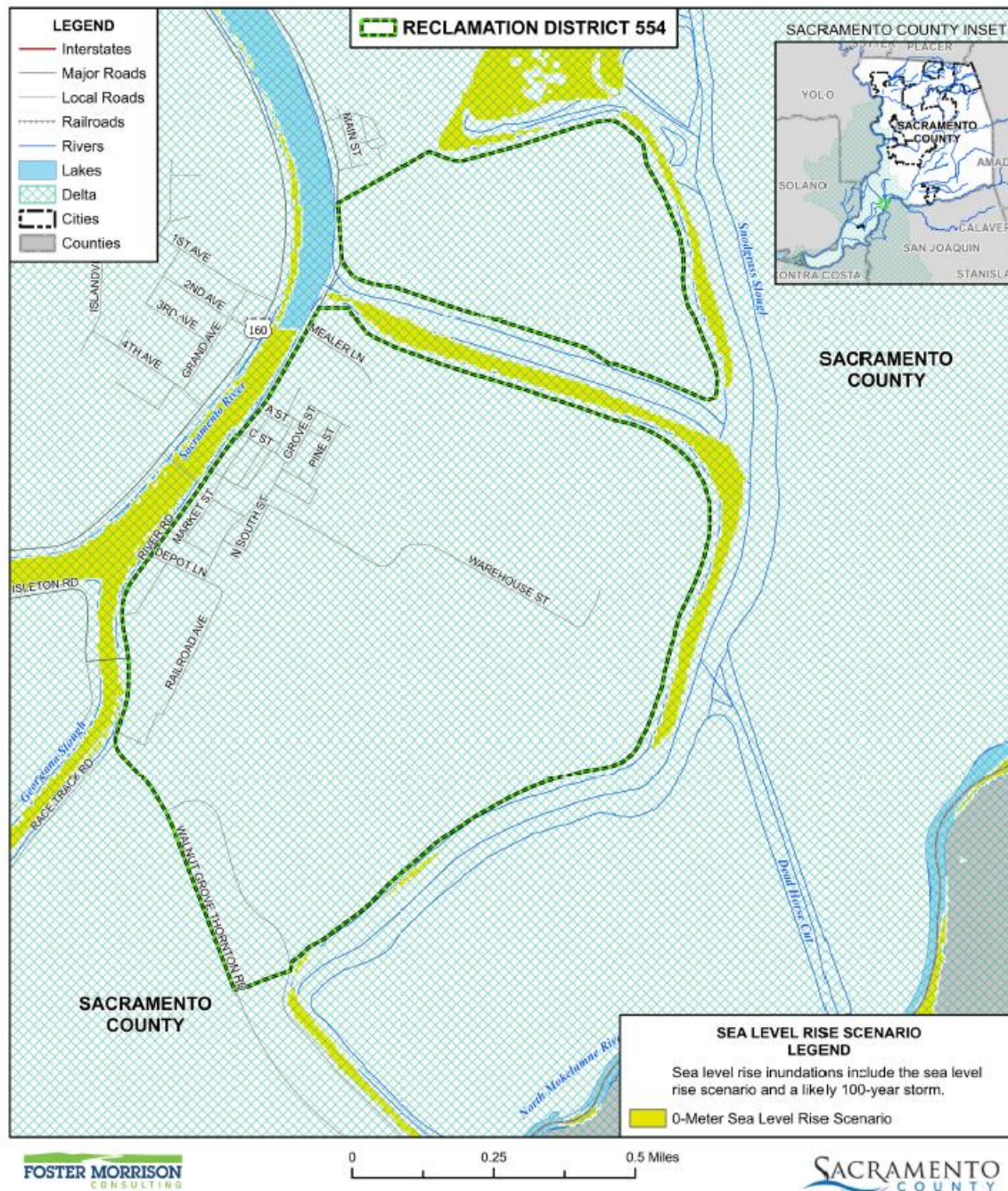
The coastally influenced areas of the Sacramento Planning Area are at risk from sea level rise (especially during periods of extreme tides and as compounded by storm events). Sacramento County is located inland within the Central Valley of California. The southwestern portion of the County follows the course of the Sacramento River as it flows into the Sacramento-San Joaquin Delta. The area of Sacramento County near the Delta is vulnerable to the influences of sea-level rise. Duration of sea level rise is thought to be long. The speed of onset is slow. There is no scientific scale for sea level rise, other than the actual physical measurement of sea level and depth.

Sea level rise scenarios identified in the Sacramento County Climate Action Plan (2024) and the Sacramento County Climate Change Vulnerability Assessment (2017) based on SLR GIS mapping from Cal-Adapt, and California Coastal Inundation Depth Layer Mosaics (2016) were utilized for this assessment. Three sea level rise scenarios were selected based on guidance from the State of California Sea Level Rise Guidance 2024 Science and Policy Update that includes available Cal-Adapt SLR GIS data providing coverage for the Sacramento County area. It should be noted that the SLR scenarios include both the SLR combined with a likely 100-year storm. The scenarios are:

- 0-meter scenario – reflects existing conditions (no SLR) with a 100-year storm
- 0.5 meter scenario – with a 100-year storm is roughly equal to the median projection for 2060 (mid century) and was selected to be representative of plausible 2060 intermediate to high conditions
- 1.41 meter scenario– with a 100-year storm is roughly equal to the median projection for 2100 (end of century) and was selected to be representative of plausible 2100 intermediate to high conditions

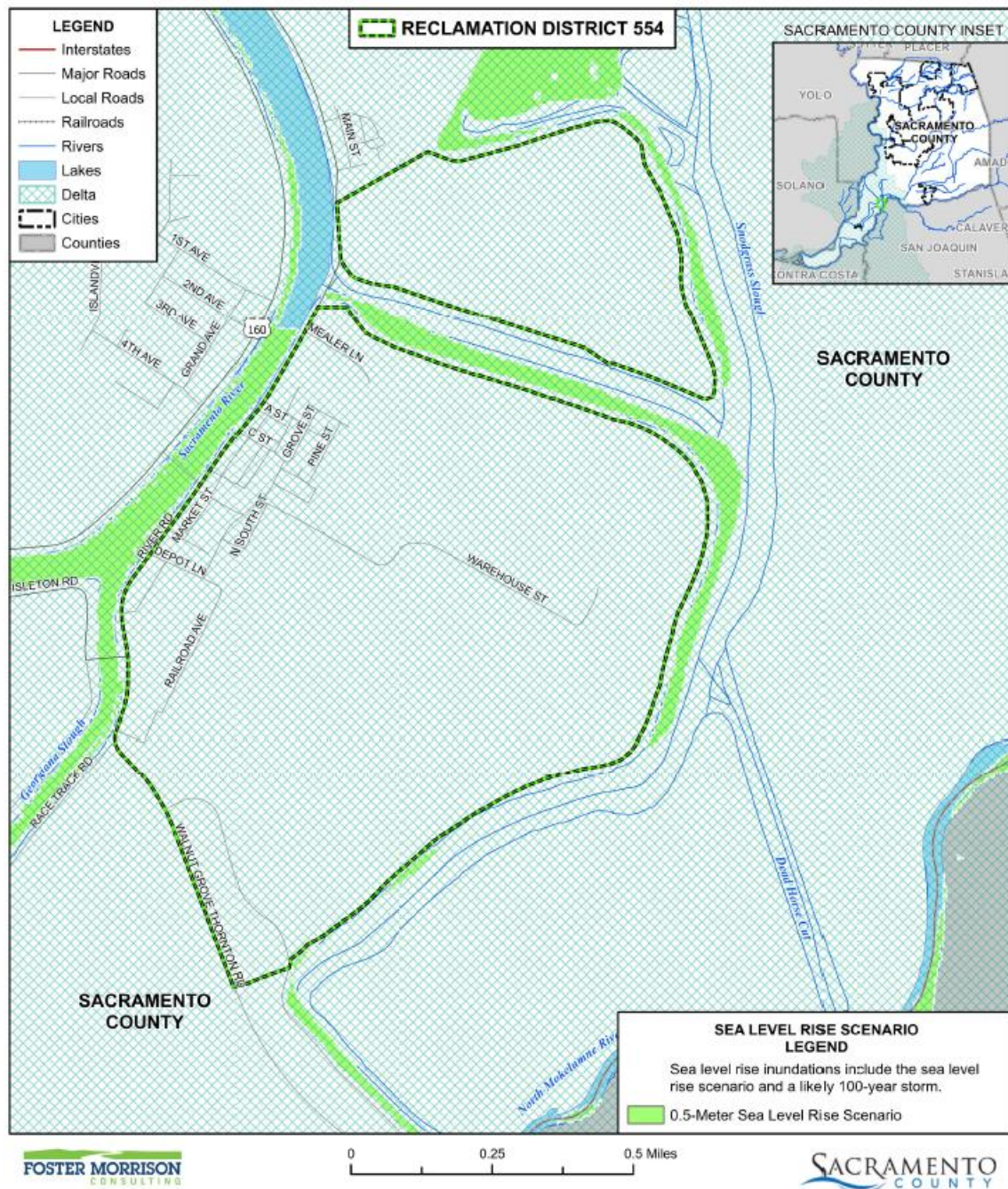
Inundations for these three scenarios are shown on the three maps below. They are broken out for the 0-meter (Figure 8-15), 0.5 meter (Figure 8-16), and 1.41 meter (Figure 8-17) scenarios individually. Geographical extents by scenario for the District are detailed in Table 8-17.

Figure 8-15 RD 554 – Sea Level Rise 0-meter Scenario



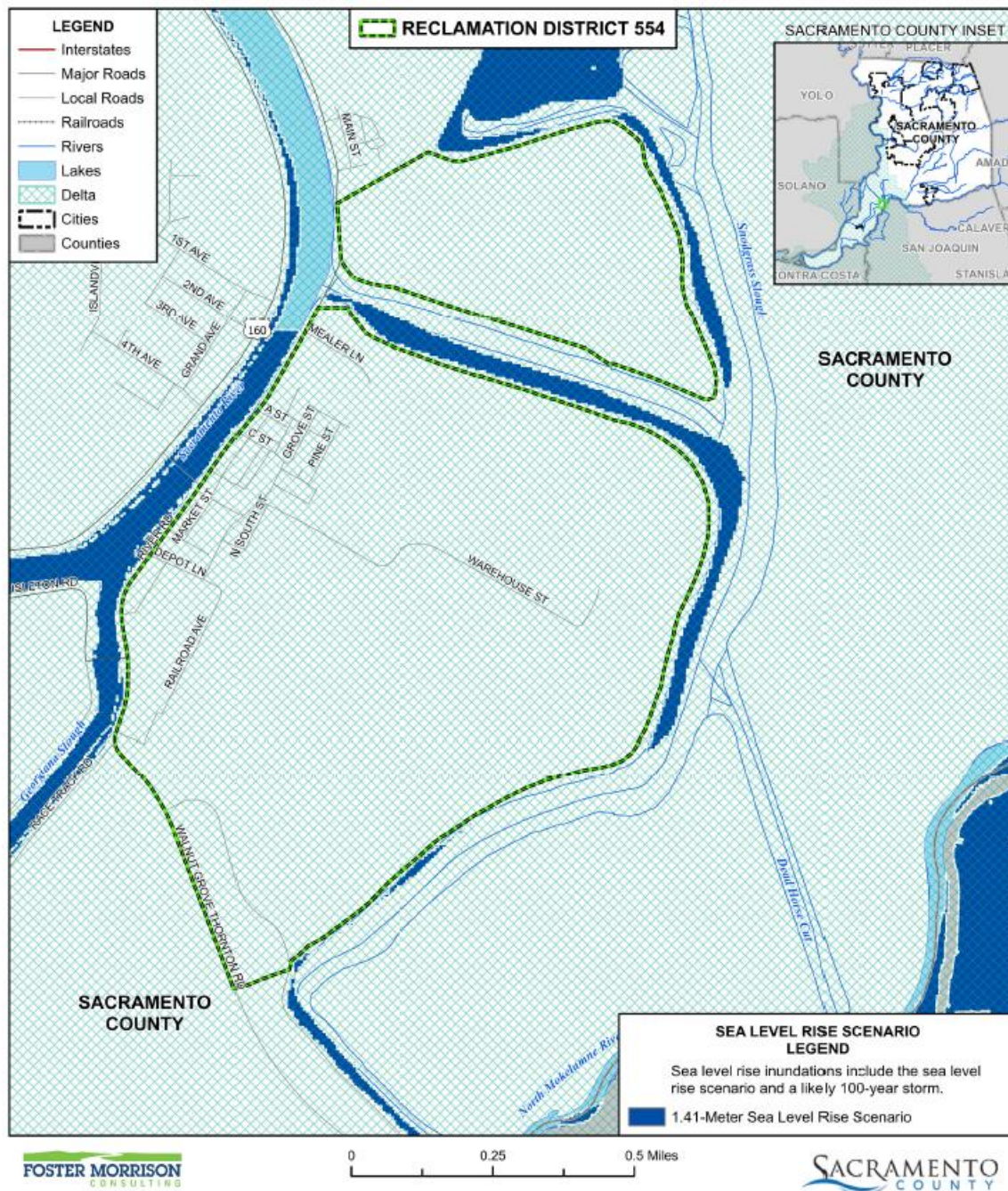
Data Source: Sacramento County Climate Action Plan 2024,
Climate Change Vulnerability Assessment 2017,
Cal-Adapt Sea Level Rise <https://cmip5.cal-adapt.org/tools/slr-calflod-3d/>,
San Francisco Bay, Sacramento-San Joaquin Delta and California Coastal Inundation Depth Layer Mosaics 2016
(Datasets: Bay_0m, 0.5m, 1.41m)slr_max_bilinear_snap_float)
Sacramento County, Cal-Atlas; Map Date: 7/25/2026.

Figure 8-16 RD 554 – Sea Level Rise 0.5-meter Scenario



Data Source: Sacramento County Climate Action Plan 2024,
 Climate Change Vulnerability Assessment 2017,
 Cal-Adapt Sea Level Rise <https://cmip5.cal-adapt.org/tools/slr-califlod-3d/>,
 San Francisco Bay, Sacramento-San Joaquin Delta and California Coastal Inundation Depth Layer Mosaics 2016
 (Datasets: Bay_[0m, 0.5m, 1.41m]slr_max_bilinear_snap_float)
 Sacramento County, Cal-Atlas; Map Date: 7/25/2026.

Figure 8-17 RD 554 – Sea Level Rise 1.41-meter Scenario



Data Source: Sacramento County Climate Action Plan 2024,
 Climate Change Vulnerability Assessment 2017.
 Cal-Adapt Sea Level Rise <https://cmip5.cal-adapt.org/tools/slr-caiflod-3d/>,
 San Francisco Bay, Sacramento-San Joaquin Delta and California Coastal Inundation Depth Layer Mosaics 2016
 (Datasets: Bay_0m, 0.5m, 1.41m)slr_max_bilinear_snap_float)
 Sacramento County, Cal-Atlas; Map Date: 7/25/2026.

Table 8-17 RD 554 – Sea Level Rise Scenario Geographical Extents by Scenario

Sea Level Rise Scenario	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres"
0-Meter Sea Level Rise Scenario	0.01	0.002%	0.01	0.003%	0	0%
0.5-Meter Sea Level Rise Scenario	0.02	0.003%	0.02	0.005%	0	0%
1.41-Meter Sea Level Rise Scenario	0.01	0.002%	0.01	0.003%	0	0%

Source: Sacramento County Climate Action Plan (CAP) 2024, Climate Change Vulnerability Assessment 2017, Cal-Adapt Sea Level Rise, UC Berkeley, San Francisco Bay, Sacramento-San Joaquin Delta and California Coastal Inundation Depth Layer Mosaics 2016

Past Occurrences

Disaster Declaration History

No disaster declarations have occurred specific to sea level rise.

NCDC Events

The NCDC does not track sea level rise.

RD 554 Events

The District noted that no standalone sea level flood rise events have been documented in the District. Instead, sea level rise has acted as a background amplifier during other flood related hazards. These were discussed in Section 4.3.15 of the Base Plan.

Climate Change and Sea Level Rise

The 2023 California State Hazard Mitigation Plan noted that coastal areas may be impacted by climate change in different ways. A warmer atmosphere means storms have the potential to be more intense and occur more often. Sea level rise is driven by climate change. As the planet warms, land ice melts and flows into the ocean. Ocean temperatures rise and thermal expansion takes place.

The 2017 Sacramento County Climate Vulnerability Assessment noted that an effect of global climate change is sea level rise. The average global sea level rose approximately seven inches during the last century. Assuming that it continues to reflect global trends, sea levels along the California coastline, and other areas affected by sea level rise, could be 10-18 inches higher in 2050 than 2000 levels, and 31-55 inches higher than 2000 levels by the end of this century.

Vulnerability to Sea Level Rise

According to historical hazard data and hazard mapping, sea level rise is occurring in the Sacramento County Planning Area. The whole of the District is at some measure of vulnerability to increased flooding and inundation of land areas from sea level rise.

The 2024 Sacramento County CAP noted that while many of the potential impacts associated with sea level rise are similar to those with flooding, sea level rise presents additional potential impacts, such as saltwater intrusion, which can affect the quality of the region's water supplies, especially when coupled with increased municipal and agricultural demand for freshwater.

Sea level rise can be exacerbated during king tides. King tides are simply the very highest tides. They are naturally occurring, predictable events. King tides of today may give an idea of future normal conditions that may occur due to sea level rise. High tides may coincide with heavy rain causing increased flooding, bluff erosion, and landslides, such as were experienced during the 1998 and 2016 El Niño storms. The 2023 California State Hazard Mitigation Plan noted that coupled with increased frequency, severity, and duration of high tide and storm events related to climate change, sea level rise will exacerbate these extreme events along the coast and other affected areas. These events may expose coastal and other areas to severe flooding and erosion; damage to structures, real estate, public access, and habitat areas; and seawater intrusion into Delta areas and coastal aquifers. El Niño events exacerbate storms and sea level rise inundation above that already occurring due to sea-level rise and normal coastal weather and tidal patterns.

An assessment of a community's vulnerability to levee failure flooding begins with an understanding of local exposure to sea level rise. This is included in the Local Concerns section below followed by a discussion of the District's Assets at Risk to this hazard.

Local Concerns

The District has specific concerns and unique vulnerabilities regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce risk and vulnerability to this hazard.

The greatest risk to the District is sea level rise contributing to levee failure of District levees (discussed above in greater detail in the Levee Failure section). Climate change-related sea level rise will likely increase pressure on fragile levees.

In addition, the District noted that the 2017 Sacramento County Climate Vulnerability Assessment noted that that sea level rise will likely affect the salinity of the Sacramento-San Joaquin Delta waters. The salinity of the Sacramento-San Joaquin Delta has historically been extremely changeable. The salt content of the Delta ebbs and flows depending on the function of a variety of variables such as tides, storms, and river outflow. As California has developed, the freshwater demand has introduced an additional strain on the Delta that has affected water quality and ecosystem health. The Delta provides a freshwater source for the State Water Project and the Central Valley Project, which diverts approximately two thirds of the State's freshwater supply for agricultural and municipal purposes in Southern California. While sea level rise is expected to attenuate as it moves farther into the Delta, water quality may be an issue for crop yields if salinity gradients increase.

Assets at Risk

Assets at risk from sea level rise include people and populations; District assets and critical facilities and infrastructure); and natural, historic, and cultural resources. These are discussed in the following sections.

People and Populations

All people and populations (including both District staff and the population within District boundaries) that live or work in areas prone to sea level rise are often the most vulnerable to future impacts from this hazard. Not only are the residents at risk, but their homes and contents are all at risk, compounding the impacts associated with this hazards. Certain vulnerable populations might be at greater risk to this hazard and include low income populations that cannot afford to relocate. Due to the very slow progression of this hazard, most populations located within sea level rise inundation areas should have sufficient advance notice to relocate to other areas, but not without economic impact.

District Assets and Critical Facilities and Infrastructure

Certain District assets and critical facilities in the District are at risk to sea level rise and primarily include those structures located in areas in and around the Delta area. Sea level rise presents a threat to critical facilities and infrastructure. Critical infrastructure plays an immensely important role in our communities. Damage to any one of these systems can threaten public safety, wreak havoc on daily life, impact properties far from flood zones, and result in economic impacts that cascade throughout California.

Natural, Historic, and Cultural Resources

According to the 2024 CAP, rising sea levels can disrupt coastal wetlands by drowning plant species, increasing salt levels in the soil and water, and outpacing wetland's migration further inland. This puts important ecosystems in danger, threatens habitats, and leaves communities exposed to dangerous storm surge. Without wetlands and other critical ecosystems, many species could lose their homes or become extinct. Large flood events exacerbated by sea level rise can affect natural, historic, and cultural resources. Any of these resources that fall in the sea level rise scenarios shown on Figure 8-15, Figure 8-16, or Figure 8-17 would be vulnerable.

Future Conditions/Future Development

This section provides a discussion of how future conditions will influence or affect the hazard over time and also discusses future development relative to each hazard.

Future Conditions

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for the District include the following:

- Climate change is likely to exacerbate future sea level rise conditions and associated impacts and vulnerability of the County. This was discussed in greater detail in the Climate Change and Sea Level Rise section of the Hazard Profile above
- Population projections within the jurisdictional boundaries of the District show the population to be flat or slightly declining. It is unknown how population patterns and demographics will change in the near future. The District may add staff, but this number would be small. The District noted that it has no control over population changes within its jurisdictional boundaries. With no notable changes in populations numbers and makeup, the vulnerability of the District to this hazard is unlikely to change.
- Changes in land use and development in the District are expected to be limited in the near future and thus are not likely to affect sea level rise flooding and associated impacts to the District. Additional development in coastally influenced areas traditionally leads to additional flooding. However, adherence to protective building codes for new development will assist in limiting future impacts and associated vulnerabilities of the District to this hazard.

Future Development

The 2024 CAP noted that guiding development out of areas vulnerable to sea level rise will reduce future flooding impacts to people and property. The District should work closely with the County and cities in which it is located to determine how and where to expand District assets to avoid placing future development in harms way. In addition, levee improvements, including levee setbacks and levee modernization efforts will need to be consider to mitigate sea level impacts to the District.

Severe Weather: Heavy Rains and Storms

Likelihood of Future Occurrence–Likely

Vulnerability–Medium

Hazard Profile

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. Wind often accompanies these storms; hail and lightning are rare in the District. In recent years, heavy rain and storms have been compounded by more frequent and higher intensity atmospheric river events.

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 and storms. Most of the severe rains occur during the fall, winter, and spring months in the District as discussed below (with problem flooding areas associated with heavy rains and storms shown in the Past Occurrences in the Flood: Localized Stormwater section). 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 rarer in the District and Sacramento County. Duration of severe storms in the District can range from minutes to hours to days. According to the WRCC, average annual precipitation in the County is 18.15 inches per year. Information on precipitation extremes can be found in Section 4.3.4 of the Base Plan.

Past Occurrences

Disaster Declaration History

According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the District. This contributes to many of the federal disaster declarations related to flooding. Disaster declarations from flooding are shown on Table 8-18.

Table 8-18 Sacramento County – State and Federal Disaster Declarations from Flood (Heavy Rain and Storms) 1950-2025

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	26	1950, 1955, 1958 (twice), 1963, 1969, 1982 (twice), 1983, 1986, 1995 (twice), 1996, 1997, 1998, 2008, 2017 (three times), 2022*, 2023 (three), 2024 (twice)	18	1955, 1958, 1964, 1969, 1983, 1986, 1995 (twice), 1997, 1998, 2006, 2017 (three times), 2023 (three times)*, 2024*

Source: Cal OES, FEMA

NCDC Events

The NCDC data recorded 9 hail, 29 heavy rain, 1 lightning, and 2 winter storm weather incidents for Sacramento County since 1950. Winter weather events tend to be rain in the County.

RD 554 Events

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, has occurred in the District. This is the cause of many of the federal disaster declarations related to flooding. The District noted the following:

- Heavy rain and storm event in the District occurred in **1986, 1997, and 2006**. No significant damages occurred due to these high water events.
- **2017** HWE: Additional monitoring was initiated, but no significant damage occurred. \$50,000 of additional costs were borne by the District for excessive pumping and monitoring
- More recently, a winter storm event in **2022/2023** caused flooding in the District. This was discussed in greater detail in the Past Occurrences section of Flood: 1%/0.5%/0.2% Annual Chance above.

Climate Change and Heavy Rains and Storms

It is likely that climate change will increase the chance of future occurrence as well as future impacts from heavy rains and storms. More information on future impacts to the District can be found in the Future Conditions/Future Development section of the Vulnerability Assessment below.

According to the 2024 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 Sacramento County and the RD 554. The amount of lightning is not projected to change.

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. Cal-Adapt modeled scenarios are shown in Section 4.3.4 of the Base Plan.

According to the 2024 CAP, the County is projected to experience a steady increase in average annual precipitation through the end of the century, with much of that precipitation likely to occur during extreme precipitation events, which can lead to flood impacts. According to Cal-Adapt, the historic average annual precipitation in Sacramento County is 18.3 inches, and the historic average annual number of extreme precipitation events is four. As shown in Section 4.3.4 of the Base Plan, the average annual precipitation across the County may rise upwards of 22 inches, with the number of extreme precipitation events potentially exceeding 7 per year by the end of the century, depending on the level of current and future GHG emissions.

June 2025 Delta Adapts Adaptation Plan noted that climate change will affect heavy rains and storms in the Delta. By mid-century, climate models show a reduction in the total number of rainy days and decreases in both fall and spring precipitation. These changes will likely be accompanied by an increase in the intensity and frequency of large storm and atmospheric river events during the winter. Decreases in spring and fall precipitation may impact freshwater availability, increase competition for limited water supply, and shift the phenology of species who are dependent on seasonal rainfall for reproduction, growth, and survival (Mauger et al. 2015). Although the ecosystem response to changes in intra- and inter-annual precipitation variability remains uncertain, data suggests that increased variability in precipitation will likely favor less diverse species assemblages and invasion of non-native species (Liu et al. 2020, Parton et al. 2012).

Vulnerability to Heavy Rain and Storms

Heavy rain and severe storms are among the most frequent type of severe weather occurrences in the District. These events can cause both significant and localized flooding. Flooding can be worse during times where the ground is already saturated. Wind often accompanies these storms and has caused damage in the past. Hail and lightning are rare in the District, but also can cause damage, with lightning occasionally igniting wildfires.

The whole of the District is at some measure of vulnerability to heavy rain and storms. An assessment of a community's vulnerability to heavy rains and storms begins with an understanding of local exposure to heavy rain and storms. This is included in the Local Concerns section below followed by a discussion of the District's Assets at Risk to this hazard.

Local Concerns

The District has specific concerns and unique vulnerabilities regarding this hazard. These concerns form a portion of the basis for the mitigation strategy and mitigation actions that seek to reduce risk and vulnerability to this hazard.

Heavy rains and storms can result in higher flood flows that could increase the hydraulic gradients within the levee section and result in seepage or if great enough, possibly overtopping. They can also increase flows and result in erosion of the waterside bank. Riparian vegetation could be lost from high flows as a result of heavy rains and large storms. The historic buildings and districts discussed above could be damaged from heavy storms due to falling trees or flooding.

The District also noted that heavy rains and storms cause localized flooding in the District. The problem areas were discussed in the Flood: Localized Stormwater Flooding section above.

Assets at Risk

Assets at risk from heavy rain and storms include people and populations; District assets and critical facilities and infrastructure); and natural, historic, and cultural resources. These are discussed in the following sections.

People and Populations

All populations (including vulnerable populations) in the District (including District staff and those within its service area) have some measure of risk to heavy rains and storms. Those populations that work or recreate outside and unhoused individuals are more vulnerable to impacts from heavy storm events. Heavy rains and storms occur every year and do not generally cause significant adverse impacts to individuals; it is the secondary hazard, flooding, which poses the biggest impact to people. Populations at risk to flooding resulting from heavy rains and storm events include those who live in floodplains (discussed in further detail in the Flood: 1%/0.2% Annual Chance and Levee Failure section above) and those who live in and near localized flooding areas (discussed in further detail in the Flood: Localized Stormwater Flooding section above).

District Assets and Critical Facilities and Infrastructure

District assets have some risk to heavy rains and storms. Heavy rain and storms can affect critical facilities and infrastructure during large events. District structures built to modern building codes are built to withstand heavy rains and storms (including thunderstorm winds and lightning); older structures may be more vulnerable. During a heavy storm, localized flooding may cause water intrusion into buildings from the outside. Trees can be downed causing impacts to structures. Older homes and buildings may be at increased risk to heavy rains and storms. Power outages during severe storm events can occur, impacting the use of structures until the power is back online. Local roads, streets, and bridges can be impacted resulting in closures restricting traffic flow in the District. In certain areas, large storms can cause erosion and localized landslides which can impact affected facilities.

Table 8-19 RD 554 Assets: Structures, Critical Facilities and Infrastructure, and Other Facilities

Name of Asset	Facility Type	Replacement Value
Levee	Infrastructure	\$40,000,000
Cross-levee	Infrastructure	\$8,000,000
Pump Station	Infrastructure	\$1,000,000

Source: RD 554

Successive or elongated atmospheric river events increase river stage against the levee, saturate the soils, and add wind-wave erosion. Downed trees can limit access for inspection or repairs. Prolonged high water can also result in scour or increased seepage pressures can damage the levee.

Storms increase interior runoff that can over tax the system and damage the pumps. Power outages and lightning are a further risk that can shut down the pumping station making and result in increased interior flooding. Backup power will be essential.

Wind, downed trees, and power loss can slow response and disrupt operations of the fire department just as call volume rises. Backup power is important for keeping communications and equipment available.

The Jean Harvie Community Center and Walnut Grove Elementary school can act as shelters for others who may lose power during intense storms. If these shelters lose power, it could impact regional support and shelters.

Natural, Historic, and Cultural Resources

Large rain and storm events and associated flooding can affect natural, historic, and cultural resources. Silt and sediment can damage natural areas. Trees can be uprooted and downed by high winds. Extended periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. While some natural systems can be adversely impacted during these large storms, heavy rain events can also provide benefits. Groundwater and wetland areas can be recharged and water supplies replenished. Historic and cultural resources may also be affected. Generally, the impacts are associated with damage to structures affected by large storm events, but other cultural resources such as those associated with Native Americans and old tribal areas can also be disturbed, damaged, and lost during extreme rain and storm and events.

Impacts from Heavy Rain and Storms

Impacts from heavy rains and storms include damage to property, critical facilities and infrastructure, and the natural landscape. This includes: erosion; downed trees; damaged utility structures and infrastructure; power outages; road damage and blockages; and even lightning strikes to critical infrastructure and people. Lightning can also cause wildfires and urban fires to occur. Landsliding and erosion occur when the soil on slopes becomes oversaturated and fails. Climate change may cause these impacts to worsen.

Actual damage associated with the primary effects of severe storms and heavy rains has been somewhat limited. It is the secondary hazards caused by these severe weather events, such as floods, landslides, and erosion that would likely have the greatest impact.

Impacts to identified assets at risk to this hazard and the overall vulnerability of the District may be affected in the future by climate change (which was discussed in the hazard profile section above), changes in population patterns, and changes in land use and development. The influencing effects of these factors on this hazard are discussed further in the Future Conditions/Future Development discussion below.

Future Conditions/Future Development

This section provides a discussion of how future conditions will influence or affect the hazard over time and also discusses future development relative to each hazard.

Future Conditions

Future conditions may be affected by climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Findings on this for the District include the following:

- Climate change is likely to exacerbate future heavy rain and storm conditions and associated impacts and vulnerability of the District to flooding. This was discussed in greater detail in the Climate Change and Heavy Rains and Storms section of the Hazard Profile above.
- Population projections within the jurisdictional boundaries of the District show the population to be flat or slightly declining. It is unknown how population patterns and demographics will change in the near future. The District may add staff, but this number would be small. The District noted that it has no control over population changes within its jurisdictional boundaries. With no notable changes in populations numbers and makeup, the vulnerability of the District to this hazard is unlikely to change.
- Changes in land use and development in the District are expected to be limited in the near future and thus are not likely to affect heavy rains and storm and associated impacts to the District. In addition, adherence to protective building codes for new development will assist in limiting future impacts and associated vulnerabilities of the District to this hazard.

Future Development

Building codes in the District ensure that new development is built to current building standards, which should reduce the risk to future development in the District from heavy rains and storms. New critical facilities such should be built to withstand hail damage, lightning, and thunderstorm winds. New and existing critical facilities and infrastructure should also consider adding backup power systems to limit impacts associated with power outages. With adherence to development standards, future losses to new development should be minimal. Changes in land use may also amplify the impacts of heavy rains and storms, as additional impervious surfaces can cause additional runoff and localized flooding throughout the District.

8.5 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.

8.5.1. Regulatory Mitigation Capabilities

Table 8-20 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 554.

Note: The District does not have the authority to regulate land use and development within its jurisdiction. Authority for promulgating and enforcing zoning, land use, and development requirements falls to counties and incorporated communities. As such development within the District’s jurisdictional boundaries will conform to the zoning and land use development ordinances and building codes of the county or incorporated community in which the District is located.

Table 8-20 RD 554’s Regulatory Mitigation Capabilities

Plans	In Place Y/N	Does the plan address hazards? Can the plan be used to carry out mitigation actions? When was it last updated??
Capital Improvements Plan	N	
Climate Change Adaptation Plan	N	
Community Wildfire Protection Plan	N	
General Plan/Comprehensive Plan/Master Plan	N	
Continuity of Operations Plan	N	
Economic Development Plan	N	
Land Use Plan	N	
Local Emergency Operations Plan	Y	An emergency operations plan and flood contingency map for RD 554.
Stormwater Management Plan	N	
Transportation Plan	N	
Other	Y	Draft Flood Risk Reduction Feasibility Study for Delta Legacy Community of Locke, CA
Land Use Planning and Ordinances	Y/N	Is the ordinance an effective way to reduce hazard impacts? Is the ordinance adequately administered and enforced?
Acquisition of land for open space and public recreation use	N	District depends on County for this.
Building code	N	District depends on County for this.

Flood insurance rate maps	Y	Covered by the unincorporated County DFIRMs.
Floodplain ordinance	N	District depends on County for this.
Natural hazard-specific ordinance (stormwater, steep slope, wildfire)	Y	While not a formal District program, CA DWR conducts semi-annual levee inspections of levee conditions.
Subdivision ordinance	N	District depends on County for this.
Zoning ordinance	N	District depends on County for this.
Other	Y	Improvements near levees: Pursuant to Sacramento County General Plan Safety Element Policies, SA-18a&b, written approval must be obtained from the applicable Reclamation District to build any structure or grade any soil within 300 feet of the land side toe of levee. This applies to anyone who wants to fill, excavate, or construct a structure within 50 feet of the toe of a Sacramento County river levee and anyone who wants to develop land within 300 feet of the toe. To ensure this requirement is met, every parcel located near a levee is tagged in the building department database.
How can these capabilities be expanded and improved to reduce risk?		
Pursuant to Sacramento County General Plan Safety Element Policies, SA-18a&b, written approval must be obtained from the applicable Reclamation District to build any structure or grade any soil within 300 feet of the land side toe of levee. This applies to anyone who wants to fill, excavate, or construct a structure within 50 feet of the toe of a Sacramento County river levee and anyone who wants to develop land within 300 feet of the toe. To ensure this requirement is met, every parcel located near a levee is tagged in the building department database. RD 554 needs to identify viable funding mechanisms to assist in the evaluation/development/implementation of hazard related studies and plans.		

Source: RD 554

8.5.2. Administrative/Technical Mitigation Capabilities

Table 8-21 identifies the District department(s) responsible for activities related to mitigation and loss prevention in the RD 554.

Table 8-21 RD 554's Administrative and Technical Mitigation Capabilities

Administration	In Place Y/N	Describe capability Is coordination effective?
Staff		Is staffing adequate to enforce regulations? Is staff trained on hazards and mitigation? Is coordination between agencies and staff effective?
Chief Building Official	N	
Civil Engineer, including dam and levee safety	N	
Community Planner	N	
Emergency Manager	N	
Floodplain Administrator	N	

GIS Coordinator	N	
Planning Commission	N	
Other	Y	The District has a board of five trustees that oversee and run the levee and drainage operations on the District. There is also a Homeowners and Merchant Association that works on community issues related to the business district and community within the portion of Walnut Grove on the east side of the river.
Technical	Y/N	Has capability been used to assess/mitigate risk in the past?
Grant writing	N	
Hazard data and information	N	
GIS analysis	N	
Mutual aid agreements	N	
Other	Y	A vegetation maintenance program is in place for the levees. This involves using goats to eat down the weeds and spraying the vegetation twice annually.
How can these capabilities be expanded and improved to reduce risk?		
RD 554 needs to identify viable funding mechanisms to assist in the ability to provide for more O&M purposes and to be able to address levee issues as they come up. A community volunteer training is currently in development to expand capacity during a natural hazard.		

Source: RD 554

8.5.3. Fiscal Mitigation Capabilities

Table 8-22 identifies financial tools or resources that the District could potentially use to help fund mitigation activities.

Table 8-22 RD 554's Fiscal Mitigation Capabilities

Funding Resource	In Place 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	
Community Development Block Grant	N	
Federal funding programs (non-FEMA)	Y	
Fees for water, sewer, gas, or electric services	N	
Impact fees for new development	N	
State funding programs	Y	
Stormwater utility fee	N	
Other		

Funding Resource	In Place 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?		
RD 554 needs to identify viable funding mechanisms to assist in all aspects of levee ownership, including operations and maintenance. The District is one of the more “urban” of the rural reclamation Districts as such it has limited land area to obtain assessments that fund District operations. There is only so much it can raise from the households. The majority of assessments come from the agricultural acreage and it only can provide a relatively small amount towards O&M relative to the actual costs. The District is part of the Delta Levee Subventions Program that helps with cost share of levee maintenance and operations but not drainage costs. The Subventions Program provides 75% reimbursed state cost share, however the District assesses by a limited land area and have a limited cost share ability particularly if they are fronting the repair costs and having to finance any projects larger than minor repairs and maintenance. An increased cost share from the State or no-cost share would vastly improve the District’s ability to make progress on deferred maintenance due to never truly being able to afford to participate in the current funding programs.		

Source: RD 554

8.5.4. Mitigation Education, Outreach, and Partnerships

Table 8-23 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 8-23 RD 554’s Mitigation Education, Outreach, and Partnerships

Program/Organization	In Place Y/N	How widespread are each of these in your community?
Community newsletters		
Hazard awareness campaigns (such as Firewise, Storm Ready, Severe Weather Awareness Week, school programs, public events)	Y	Most hazard related outreach to those who live in the Town of Locke is conducted on an informal basis as part of living in the Locke community. Outreach is done as conducted by the County and during other local projects such as for the Delta Small Communities project which covers Locke
Local news		
Organizations that interact with underserved and vulnerable communities		
Social media		
How can these capabilities be expanded and improved to reduce risk?		
Greater public outreach from State agencies to community organizations to provide information about emergency response. As a small number of people district, current planned coordination for RD 554 is consistently reviewed, implemented, and quite effective. Continuation of improving outreach programs in coordination with State agencies and neighboring RD’s may be helpful in community education about disaster related issues.		

Source: RD 554

8.5.5. Other Mitigation Efforts

The District is currently relocating the interior toe ditches to reduce potential seepage paths and eliminate opportunities for burrowing rodents like beavers to burrow into the landside slopes from the toe ditches. Moving the toe ditches will also create more room for future landside slope projects to increase landside slope stability on the Snodgrass Slough levee.

8.6 Mitigation Strategy

8.6.1. Mitigation Goals and Objectives

The RD 554 adopts the hazard mitigation goals and objectives developed by the HMPC and described in Chapter 5 Mitigation Strategy.

8.6.2. NFIP Mitigation Strategy

The District does not participate in the NFIP, as it is not an eligible participant. Many of the District's projects work to reduce impacts from flooding thus furthering the objectives of the NFIP.

8.6.3. Mitigation Actions

The Planning Team for the RD 554 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, and timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Dam Failure
- Flood: 1%/0.5%/0.2% annual chance
- Flood: Localized Stormwater
- Levee Failure
- Sea Level Rise
- Severe Weather: Heavy Rains and Storms (Hail, Lightning, Wind)

Low priority hazards for mitigation planning include:

- Aquatic Nuisance Species (plant/animal)
- Climate Change
- Drought & Water Shortage (w/tree mortality)
- Earthquake (w/subhazards)
- Landslide, Mudslide, Debris Flow Severe Weather: Extreme Cold and Freeze
- Severe Weather: Extreme Heat
- Severe Weather: High Winds and Tornadoes
- Subsidence
- Wildfire (with smoke and air quality)

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 and jurisdictions regardless of hazard priority. Collectively, this LHMP's 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 each jurisdiction has focused on identifying those mitigation actions and projects to address their priority hazards, which are both realistic and reasonable for them to implement for this 5-year planning process, and would like to preserve their right to modify hazard priorities should future projects be identified where the implementing jurisdiction has the future capacity to implement. The participating jurisdictions are not obligated by this document to implement any or all of these projects. Rather this mitigation strategy represents the desires of the jurisdictions 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.

Mitigation Actions

The District has put forward the actions as shown in Table 8-24. Details of the actions can be found below the table.

Table 8-24 RD 554 Mitigation Actions

Action Title	New Action/ Previous Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 1. Levee Improvement Projects	Previous Action	Y	Y	N	Prevention Property Protection Structural Projects Natural Resource Protection
Action 2. Rock Slope Protection	Previous Action	Y	Y	N	Prevention Property Protection Structural Projects Natural Resource Protection
Action 3. Backup Power Project	New Action	Y	Y	N	Prevention Property Protection Natural Resource Protection
Action 4. Repairs to Existing Pumping Station	New Action	Y	Y	N	Prevention Property Protection Structural Projects Natural Resource Protection
Action 5. Address Unsafe Encroachments	Previous Action	Y	Y	N	Prevention Property Protection Natural Resource Protection

Action Title	New Action/ Previous Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 6. Interior Drainage Improvements	Previous Action	Y	Y	N	Prevention Property Protection Structural Projects Natural Resource Protection
Action 7. Cross Levee Protection	New Action	Y	Y	N	Prevention Property Protection Natural Resource Protection

Action 1. Levee Improvement Project (Seepage & Geometry Deficiencies)

Hazards Addressed: Dam Failure, Levee Failure; Flood: 1%/0.5%/0.2% annual chance; Sea Level Rise

Goals Addressed: 1, 2, 3, 5, 6, 7

Issue/Background (Problem Statement): Sections of the District's levee system exhibit known seepage and substandard geometry (crown width, slope ratios) that increase the risk of underseepage, slope instability, and levee failure during high-water events.

Project Description: Design and construct levee improvements to correct identified seepage pathways (e.g., seepage berms, cutoff walls, relief wells as warranted by geotechnical analysis) and ensure levee sections meet geometric design standards, while preserving existing riparian habitat corridors where feasible.

Other Alternatives: No action (accept continued risk of seepage-induced failure); levee setback/realignment in lieu of in-place improvement although this alternative would require relocation of structures and residences adjacent to the levee; interim monitoring and emergency response planning only.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Reclamation District 554 Five-Year Plan; Delta Levees Investment Strategy; Central Valley Flood Protection Plan;

Responsible Office/Partners: District Board and District Engineer; California Department of Water Resources (Delta Levees Program); U.S. Army Corps of Engineers; Central Valley Flood Protection Board.

Benefits (Losses Avoided): Reduced risk of catastrophic levee breach, avoided flood damage to agricultural land, structures, and infrastructure within the District, and avoided significant emergency response and recovery costs.

Potential Funding (Local Budgets, Grant Funds, etc.): District assessments/local budget; DWR Delta Levees Maintenance/Special Projects and Subventions Program; FEMA HMGP/BRIC; Proposition 4 bond funds.

Timeline: Long-term (5 to 20 years, dependent on geotechnical investigation and funding availability).

Project Priority (High, Medium, Low): High

Action 2. *Rock Slope Protection Project (Sacramento River, Georgiana, and Snodgrass Sloughs)*

Hazards Addressed: Dam Failure, Levee Failure; Flood: 1%/0.5%/0.2% annual chance; Sea Level Rise; Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 5, 6, 7

Issue/Background (Problem Statement): Waterside slopes along the Sacramento River, Georgiana and Snodgrass Slough slopes are subject to ongoing erosion from river currents and wave action, progressively reducing levee prism width and threatening long-term levee integrity.

Project Description: Design and install rock slope protection (RSP) at identified erosion-critical reaches along the Sacramento River, Georgiana and Snodgrass Sloughs to armor the waterside levee slope and arrest further erosion, sized and detailed per DWR/USACE RSP design criteria.

Other Alternatives: Bioengineered bank stabilization in lower-energy reaches; continued monitoring with reactive/emergency repairs; levee setback in severely eroded areas.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Reclamation District 554 Five-Year Plan; Delta Levees Special Flood Control Projects Program; District O&M/SWIF program.

Responsible Office/Partners: District Board and District Engineer; DWR Delta Levees Program; U.S. Army Corps of Engineers (Section 408/404 permitting); California Department of Fish and Wildlife (habitat coordination).

Benefits (Losses Avoided): Prevents progressive loss of levee prism and slope failure, protects levee crown and landside improvements, protects important riparian corridor habitats, reduces likelihood of unplanned emergency erosion repairs.

Potential Funding (Local Budgets, Grant Funds, etc.): DWR Delta Levees Special Projects and Subventions Program; FEMA HMGP/BRIC; District local budget/assessments.

Timeline: Short- to long-term (5 to 15 years).

Project Priority (High, Medium, Low): High

Action 3. *Backup Power Project (Solar)*

Hazards Addressed: Flood: Localized Stormwater; Levee Failure; Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3,, 5, 6, 7

Issue/Background (Problem Statement): District pump stations rely on grid power with no independent backup, so a power outage during a storm or flood event, precisely when pumping capacity is most needed, leaves the District unable to remove interior drainage, increasing localized flood risk.

Project Description: Design and install solar-based backup power generation (with battery storage) at District pump station(s) to maintain pumping capability during grid outages, sized to critical pump load.

Other Alternatives: Diesel/propane backup generators; mutual aid/mobile generator agreements with neighboring districts; grid hardening/undergrounding of service lines.

Existing Planning Mechanism(s) through which Action Will Be Implemented: District Emergency Response/O&M Plan.

Responsible Office/Partners: District Board and District Engineer; PG&E; DWR.

Benefits (Losses Avoided): Maintains interior drainage capacity during storm-related outages, reduces localized flooding of agricultural and residential areas, avoids emergency generator rental and mobilization costs.

Potential Funding (Local Budgets, Grant Funds, etc.): FEMA HMGP/BRIC; California Energy Commission resilience grants; District local budget.

Timeline: Mid-term (10 years).

Project Priority (High, Medium, Low): High

Action 4. Repairs to Existing Pumping Station

Hazards Addressed: Flood: Localized Stormwater; Levee Failure; Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 5, 6, 7

Issue/Background (Problem Statement): The District's existing pumping station has aging mechanical and electrical components that reduce reliable pumping capacity, increasing the risk of inadequate interior drainage during high-intensity rainfall or high-water events.

Project Description: Evaluate and repair/rehabilitate existing pump station infrastructure, including pumps, motors, controls, and intake/discharge structures, to restore and confirm design pumping capacity.

Other Alternatives: Full pump station replacement; construction of a new supplemental pump station; interim rental pump deployment during high-risk periods.

Existing Planning Mechanism(s) through which Action Will Be Implemented: Regular O&M plan

Responsible Office/Partners: District Board and District Engineer; DWR.

Benefits (Losses Avoided): Restores reliable interior drainage capacity, reduces localized/interior flooding, avoids more costly emergency pump failure and replacement.

Potential Funding (Local Budgets, Grant Funds, etc.): District local budget/assessments; FEMA HMGP/BRIC.

Timeline: Short-term (1–2 years).

Project Priority (High, Medium, Low): High

Action 5. Address Unsafe Encroachments (Pipes in Levee Section)

Hazards Addressed: Levee Failure; Flood: 1%/0.5%/0.2% annual chance

Goals Addressed: 1, 3, 5, 6, 7

Issue/Background (Problem Statement): Unpermitted or substandard encroachments, including pipes penetrating the levee section, create potential seepage pathways and structural weak points that compromise levee integrity and do not meet current Central Valley Flood Protection Board/USACE encroachment standards.

Project Description: Inventory, evaluate, and remediate unsafe encroachments within District levee sections, including removal, relocation, or reconstruction of noncompliant pipe penetrations to current encroachment permitting standards.

Other Alternatives: Enhanced monitoring of existing encroachments in lieu of remediation; phased remediation prioritized by risk ranking.

Existing Planning Mechanism(s) through which Action Will Be Implemented: District O&M/Systemwide Improvement Framework development; Central Valley Flood Protection Board encroachment permit process.

Responsible Office/Partners: District Board and District Engineer; Central Valley Flood Protection Board; U.S. Army Corps of Engineers.

Benefits (Losses Avoided): Eliminates known seepage and structural risk points in the levee, reduces likelihood of levee failure at encroachment locations, supports CVFPB compliance.

Potential Funding (Local Budgets, Grant Funds, etc.): District local budget/assessments; DWR Delta Levees Subventions; property owner cost-share where applicable.

Timeline: Short- to mid-term (1 to 10 years).

Project Priority (High, Medium, Low): Medium

Action 6. Interior Drainage Improvements

Hazards Addressed: Flood: Localized Stormwater; Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 5, 6, 7

Issue/Background (Problem Statement): Interior drainage canals need to be relocated to reduce potential seepage pathways and reduce the risk of burrowing rodents such as beavers.

Project Description: Relocating the toe ditches that help drain flood waters farther away from the levee section where feasible and effective for drainage purposes. This will also include filling the ditch adjacent to the dry cross levee.

Other Alternatives: Increased primary pump station capacity in lieu of interior canal improvements; canal realignment. Burrowing rodent control such as geotechnical grids on landside slope.

Existing Planning Mechanism(s) through which Action Will Be Implemented: District O&M/SWIF program; District Capital Improvement Plan.

Responsible Office/Partners: District Board and District Engineer

Benefits (Losses Avoided): Faster interior drainage during storm events, reduced localized flooding of agricultural land and roads, lower long-term pumping electricity costs.

Potential Funding (Local Budgets, Grant Funds, etc.): District local budget/assessments

Timeline: Short-term (1–2 years).

Project Priority (High, Medium, Low): Medium

Action 7. Flood Protection Measures for Cross Levee Breach Scenario

Hazards Addressed: Levee Failure; Flood: 1%/0.5%/0.2% annual chance; Sea Level Rise; Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 3, 5, 6, 7

Issue/Background (Problem Statement): In the event of a levee breach, the interior dry cross levee is vulnerable to secondary failure from wave wash and overtopping generated by inflowing floodwaters, which would remove the last line of protection for areas behind it.

Project Description: Design and implement targeted flood protection measures (e.g., wave berms, plastic sheeting, or crown raising) at the dry cross levee to protect it from wave wash and overtopping failure in a breach scenario, preserving it as a secondary line of defense.

Other Alternatives: Full cross levee reconstruction to primary flood-control standards; emergency response/evacuation planning as the sole mitigation measure.

Existing Planning Mechanism(s) through which Action Will Be Implemented: District Emergency Operations Plan

Responsible Office/Partners: District Board and District Engineer; Brannan-Andrus Levee Maintenance District

Benefits (Losses Avoided): Preserves the cross levee's function as a secondary flood barrier during a breach event, reduces the area and depth of flooding in a worst-case scenario, protects lives and property in a secondary flood zone.

Potential Funding (Local Budgets, Grant Funds, etc.): FEMA HMGP/BRIC; DWR Delta Levees Special Projects and Subventions Program; District local budget.

Timeline: Short-term (1–2 years).

Project Priority (High, Medium, Low): Medium