Annex E Union Sanitary District

Annex E Union Sanitary District E-1
E.1 Introduction E-1
E.2 Planning Process E-2
E.3 Community Profile E-2
E.3.1. Geography and Climate E-4
E.3.2. Background and Overview E-4
E.4 Risk Assessment E-4
E.4.1. Assets Inventory and Growth and Development Trends E-5
E.4.2. Hazard Identification E-18
E.4.3. Hazard Profiles and Vulnerability to Specific Hazards E-20
E.5 Capability Assessment E-218
E.5.1. Regulatory Mitigation Capabilities E-218
E.5.2. Administrative/Technical Mitigation Capabilities E-221
E.5.3. Fiscal Mitigation Capabilities E-222
E.5.4. Mitigation Education, Outreach, and Partnerships E-223
E.5.5. Other Mitigation Efforts E-223
E.6 Mitigation Strategy E-224
E.6.1. Mitigation Goals and Objectives E-224
E.6.2. Mitigation Actions E-224

E.1 Introduction

This Annex details the hazard mitigation planning elements specific to the Union Sanitary District (USD or District), a previously participating jurisdiction of the 2017 Newark/Union City Multi-Jurisdictional Hazard Mitigation Plan (LHMP or Plan) 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 USD, with a focus on providing additional details on the risk assessment and mitigation strategy for this jurisdiction.

E.2 Planning Process

The District participated in the common planning process with all of the other jurisdictions to create the Tri-City Planning Committee. This is discussed in detail in Section 3.2.1 of the Base Plan. In addition to providing representation on the Tri-City Planning Committee, the District formulated their own internal planning team to support the broader planning process requirements. Internal planning participants, their positions, and how they participated in the planning process are shown in Table E-1. Additional details on Plan participation and USD representatives are included in Appendix A.

Table E-1 Union Sanitary District – Planning Team

Name	Position/Title	How Participated
Karoline Terrazas	Organizational Performance Manager	USD LHMP Planning Committee Member and Point of Contact, Liaison, information oversight and editing.
Jose Rodrigues	Collection Services Manager	Point of Contact, Liaison, Data Contributor, Review/Editing.
Raymond Chau	Technical Services Manager	Data contributor, Review/Editing
Curtis Bosick	CIP Coach	Data contributor

Coordination with other community planning efforts is paramount to the successful implementation of this LHMP Update. This section provides information on how the USD integrated the previously approved 2017 Plan into existing planning mechanisms and programs. Specifically, the District incorporated into or implemented the 2017 LHMP through other plans and programs shown in Table E-2.

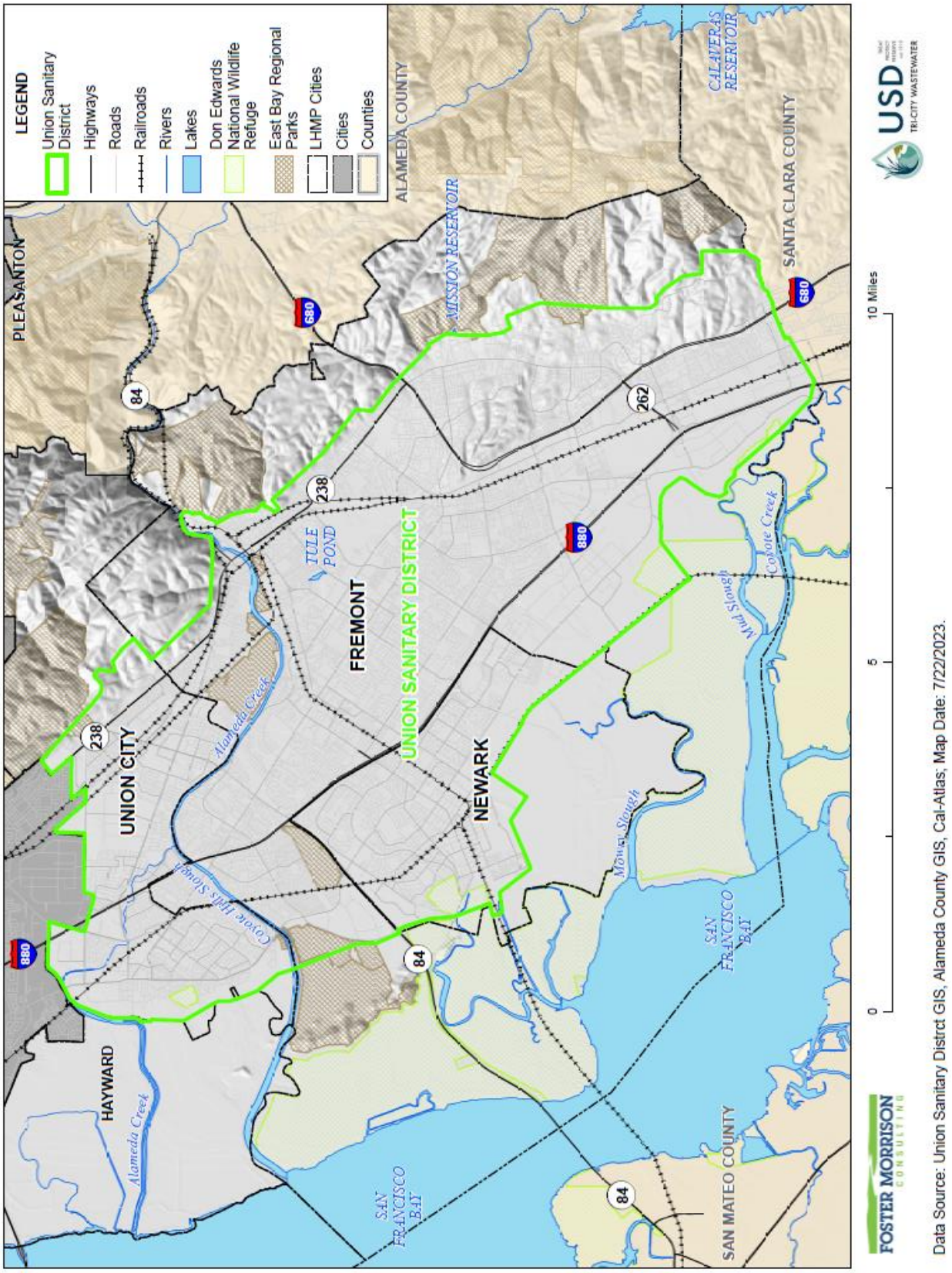
Table E-2 Union Sanitary District 2017 LHMP Incorporation

Planning Mechanism 2017 LHMP Was Incorporated/Implemented In	Details: How was it incorporated?
2017-Notice of Interest Submitted based on severe storm declaration	2 NOI's submitted for shovel ready projects when declaration was made. The cost benefit analysis prevented USD from submitting application for FEMA funding.
2022	LHMP information provided to consultant supporting ETSU Project for review of grant eligibility.
Throughout	Studies on infrastructure completed with additional review of natural disasters, projects included in capacity and condition assessments as appropriate.

E.3 Community Profile

The community profile for the USD is detailed in the following sections. Figure E-1 displays the location of the USD within the Tri-City Planning Area. The area serviced by USD is referred to as the District Service Territory throughout this Annex.

Figure E-1 Union Sanitary District



E.3.1. Geography and Climate

The District is in the San Francisco Bay Hydrologic Region as defined by the California Department of Water Resources (CA DWR). Most of the District area is relatively flat with an average elevation of approximately 20-50 feet above mean sea level (msl). The highest elevations occur on the eastern boundary of the District, along the easterly slopes of the Diablo Range. The mean annual precipitation within the District is geographically variable due to the Diablo Range on the eastern boundary of the District. However, rainfall generally averages approximately 25 inches in the District. The precipitation in the area is highly seasonal with over 75% of the rainfall occurring in the winter months between November and March. The climate in Alameda County is characterized by warm, dry summers and mild, wet winters. Average temperatures in the District area range from the low 50s in the winter to the mid-60s in the summer months.

E.3.2. Background and Overview

Union Sanitary District is an independent special district which provides wastewater collection, treatment and disposal services to the residents and businesses of the cities of Newark, Union City and Fremont in southern Alameda County, California. As an independent special district, Union Sanitary District was voted into existence by the citizens served and is sanctioned under California law to perform specific local government functions within certain boundaries. The District was formed in 1918 and reorganized under the Sanitary District Act of 1923.

The District derives its authority in the California Health & Safety Code (Sections 6400-6830). The District is governed by an elected Board of 5 Directors which are accountable to the public and employs 145 staff. The District recovers the cost of their service delivery through rates imposed on users of the services.

Union Sanitary District currently operates a 33-acre wastewater treatment facility in Union City, California and maintains over 839 miles of underground pipeline in its 60.2 square mile service area. It includes the following:

- Number of businesses within the Service Area: 3,116
- Number of permitted industries: 89 (Including Tesla Motors, Inc., Lam Research Corp., Western Digital Technologies, U.S. Pipe & Foundry)
- Number of Pump Stations: 7
- Number of Siphons: 6
- Estimated total miles of easements within our Service Area: 172
- Structures diverting stormwater to the sewer system: 0
- Number of service connections: 118,973
- Number of manholes: 17,300

E.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 USD 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 to hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

Building on the District's Community Profile above, a risk assessment was performed for the District. This includes the following sections:

- E.4.1 Assets Inventory and Growth and Development Trends
- E.4.2 Hazard Identification
- E.4.3 Hazard Profiles and Vulnerability to Specific Hazards

E.4.1. Assets Inventory and Growth and Development Trends

This section provides an inventory of the District'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 USD's total assets, including the people and populations: structures; critical facilities and infrastructure, and 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 E.4.3 Hazard Profiles and Vulnerability to Specific Hazards.
- **Growth and Development Trends** – A discussion of growth and development trends in the USD, both current and future, is presented.

Asset Inventory

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

- People and Populations
- Structures
- Critical Facilities and Infrastructure, and 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 E.4.3.

People and Populations

The District employs 145 employees that support 5 workgroups. The treatment plant has various construction projects currently underway and planned. These projects will have contractors and their employees onsite.

The most important asset within any community are the people and populations that reside in the community. For USD, the District's jurisdictional boundary (or Service Territory) includes the City of

Fremont, the City of Union City, the City of Newark, and the southern portion of the City of Hayward. The District provides wastewater collection, treatment, and discharge services to a population of approximately 343,680. That service territory includes vulnerable and underserved populations discussed in more detail in Section 4.2.1 of the Base Plan, as well as in the City annexes that the District serves. These vulnerable populations include those who are economically challenged and may have difficulty paying their bills for District services.

Structures

The analysis for structures in USD is separated out into two separate analyses:

- **USD Facility Assets** – These are the facilities, structures, and other assets which USD owns and maintains operational control.
- **Service Territory Structures** – This is comprised of the parcels and structures associated with the residents and businesses located within USD's Service Territory who use the wastewater services provided by USD.

USD Facility Assets

This analysis captures the values associated with USD owned assets. The data provided by USD represents best available data and provides information as to which USD assets are potentially at risk and vulnerable to the damaging effects of natural hazards.

Methodology

USD provided both point assets and linear assets. Point assets include nine facilities that were mapped and had their values quantified:

- Alvarado Treatment Plant
- East Bay Dischargers Pump Station
- Newark Pump Station
- Irvington Pump Station
- Irvington Storage Basin
- Cherry Pump Station
- Fremont Lift Station
- Boyce Lift Station
- Paseo Padre Lift Station

The District also provided linear asset (sewer force main and sewer collection pipes) that were mapped and had their values quantified. This includes 27 miles of pressurized sewer force main transport pipes, as well as 814 miles of gravity flowpipes for sewer collection.

Union Sanitary District Facility Asset Analysis Results

USD Facility Assets were inventoried and summed in order to determine total values at risk associated with USD owned assets. USD Facility Assets are shown on Figure E-2 and detailed on Table E-3. This details the primary USD Facility Assets, which include property values and asset replacement values, analyzed for

this Plan Update. An inventory of USD linear assets is shown on Figure E-3 and detailed in Table E-4. It should be noted that all USD owned assets shown in the two asset datasets are potentially vulnerable to hazard events occurring within the Tri-City Planning Area. Further, all of these USD owned assets are considered to be critical facilities and infrastructure as defined by this Tri-City LHMP Update.

Figure E-2 Union Sanitary District – District Facility Assets

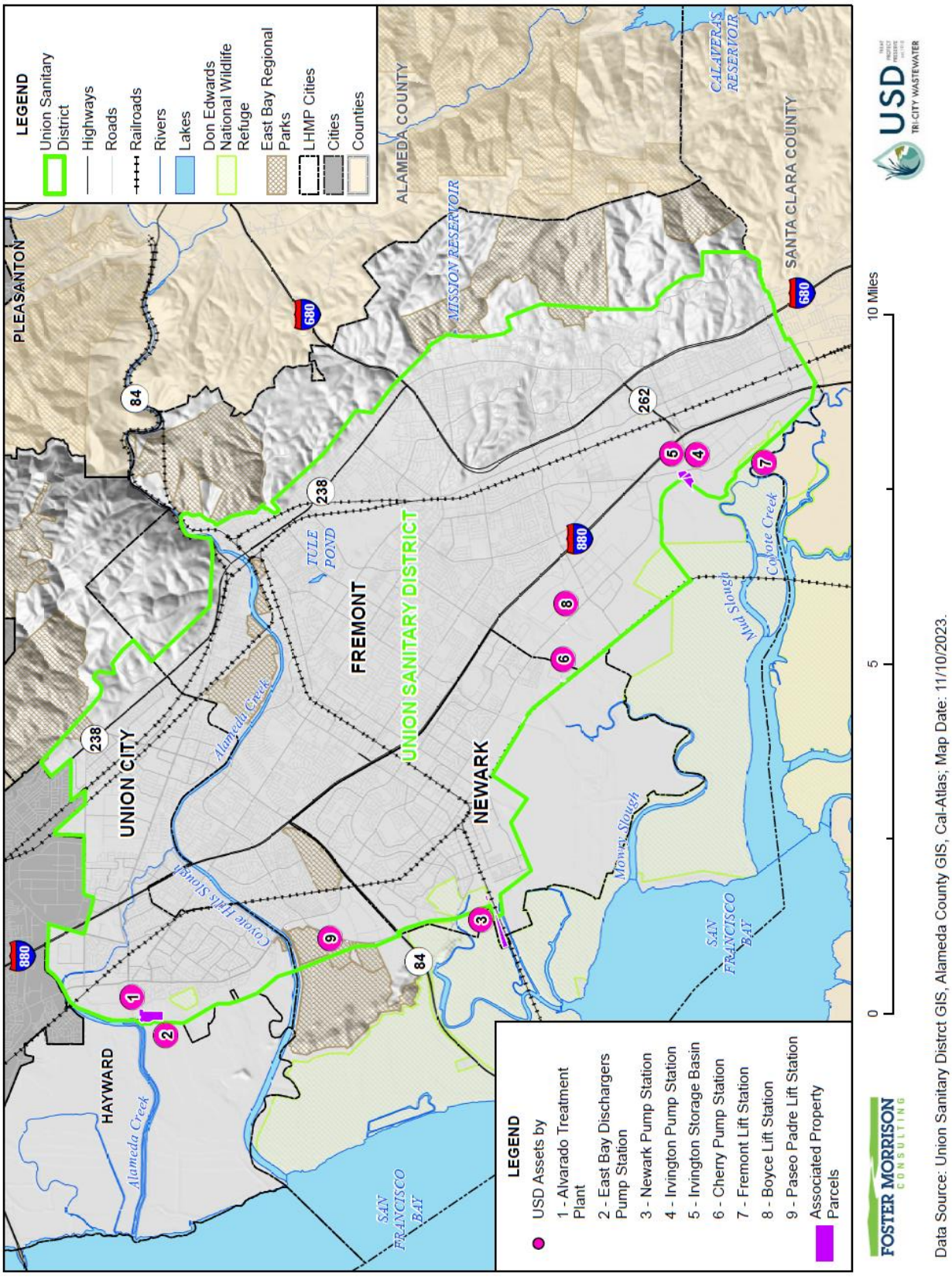


Table E-3 Union Sanitary District – District Facility Assets

Site Number	Site Location / Name	Asset Type	Parcel Count	Total Acres	Asset Value	Property Value	Total Value
1	Alvarado Treatment Plant	Water Treatment Plant	2	32.84	$247,303,953	$66,060,000	$313,363,953
2	Final Effluent PS	Pump Station	1	0.16	$14,932,627	–*	$14,932,627
3	Newark PS	Pump Station	5	18.76	$18,721,354	$37,520,000	$56,241,354
4	Irvington PS	Pump Station	4	22.04	$10,511,794	$45,040,000	$55,551,794
5	Irvington SB	Storage Basin	–**	–	$7,983,280	–***	$7,983,280
6	Cherry PS	Lift Station	1	0.79	$315,705	$1,580,000	$1,895,705
7	Fremont LS	Lift Station	3	0.44	$1,086,324	$880,000	$1,966,324
8	Boyce LS	Lift Station	2	0.16	$4,497,365	$340,000	$4,837,365
9	Paseo Padre LS	Lift Station	3	0.94	$1,020,348	$1,880,000	$2,900,348
Grand Total			**21**	**76.12**	**$306,372,750**	**153,300,000**	**$459,672,750**

Source: USD GIS

* The property value for the Final Effluent Pump Station is included in the Alvarado Treatment Plant property value.

** The parcel count and total acreage for Irvington Storage Basin is included in Irvington Pump Station; both sites located on the same property.

*** The property value for Irvington Storage Basin is included in the Irvington Pump Station; both sites are located on the same property.

Figure E-3 Union Sanitary District – Linear Assets

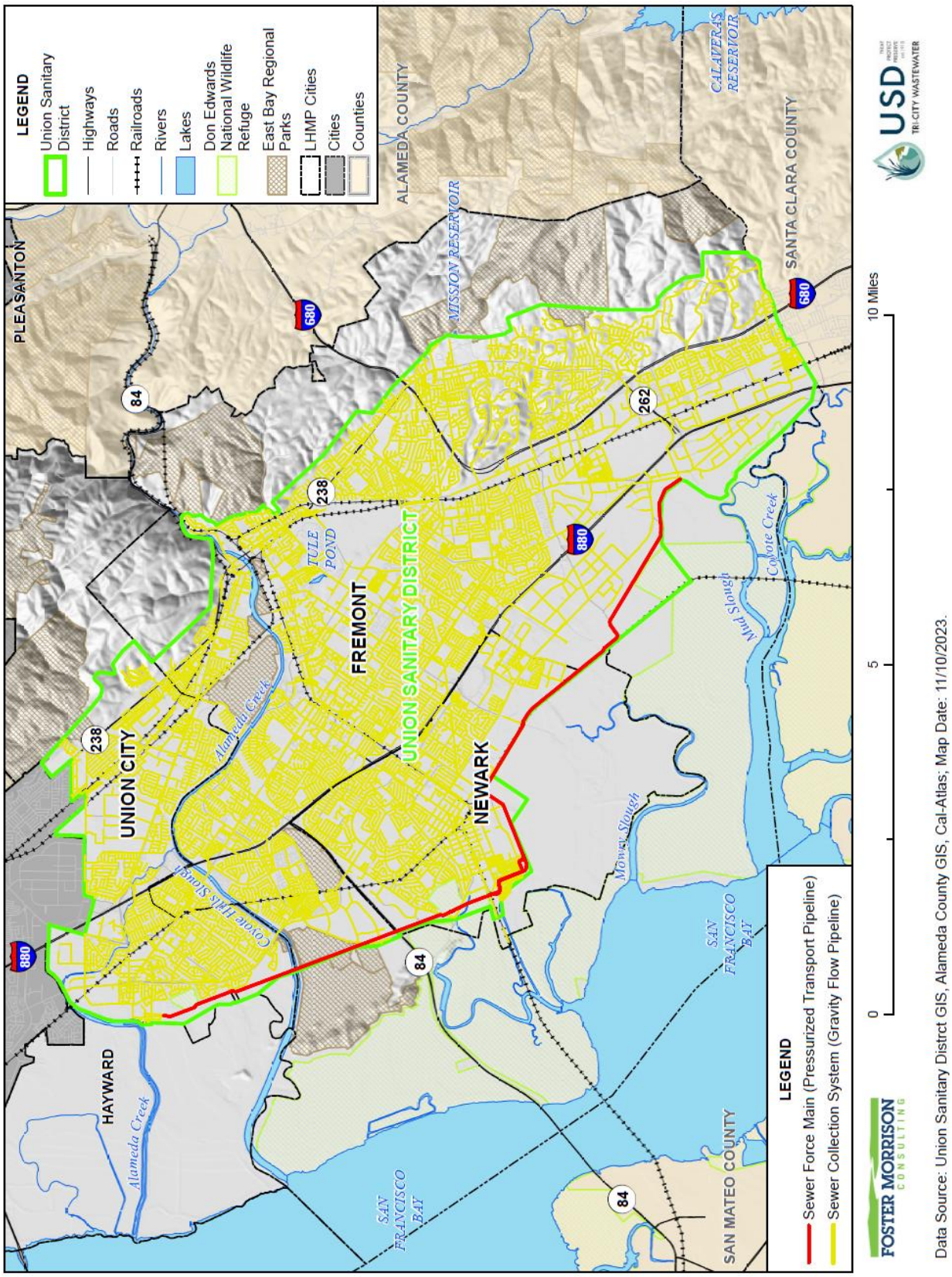


Table E-4 Union Sanitary District – Linear Assets

Asset	Asset Length (in miles)	Total Asset Value
Sewer Force Main (Pressurized Transport Pipeline)	27	$470,040,592
Sewer Collection System (Gravity Flow Pipeline)	814	$3,438,182,620
Total	**841**	**$3,908,223,212**

Source: USD GIS

USD Service Territory

The USD services a large territory that could be without wastewater services should a natural hazard befall the District. In order to inventory parcels and structures located within USD's Service Territory, the following data is derived from the Alameda County Assessor's data. The methodology used to derive property values is the same as in Section 4.2.1 of the Base Plan. This data should only be used as a guideline to overall values in the District, as the information has some limitations. The most significant limitations are created by Proposition 13 as detailed in the Base Plan. Table E-5 shows the Alameda County Parcel/Assessor Data land and structure values, and content replacement values (e.g., the values at risk) broken down by property use associated with the residents and businesses located within the service territory of the District.

Table E-5 Union Sanitary District Service Territory – Parcel and Structure Assets by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	29	7	$8,869,831	$4,301,506	$4,301,506	$17,472,843
Commercial	3,022	2,062	$3,791,992,287	$7,084,172,903	$7,084,172,903	$17,960,338,093
Government/ Institutional	2,403	163	$143,596,513	$343,413,315	$343,413,315	$830,423,143
Industrial	939	888	$2,494,986,453	$4,392,125,050	$6,588,187,553	$13,475,299,056
Recreational	22	22	$43,115,339	$70,104,407	$70,104,407	$183,324,153
Residential	110,644	107,609	$23,191,476,225	$50,025,312,042	$25,012,656,412	$98,229,444,679
Unknown	74	2	$47,127,141	$200,468	$0	$47,327,609
Utilities	393	0	$0	$0	$0	$0
Vacant	1,834	206	$1,024,036,803	$383,294,605	$0	$1,407,331,408
Union Sanitary District Total	**119,360**	**110,959**	**$30,745,200,592**	**$62,302,924,296**	**$39,102,836,096**	**$132,150,960,984**

Source: Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Critical Facilities and Infrastructure, and Community Lifelines

Beyond just buildings, it is important to identify the critical facilities and infrastructure, and community lifelines that are critical for life safety and the economy.

Critical Facilities and Infrastructure

The operation of critical facilities and infrastructure during and after a disaster is vital. Their ability to keep functioning affects both the severity of the impacts and the speed of recovery. Critical facilities and infrastructure are those buildings and infrastructure that are vital to a community. Should these be damaged, it makes it more difficult for the community to respond to and recover from a disaster. For purposes of this Plan, a critical facility is defined as:

> ***Critical infrastructure includes all public and private facilities and infrastructure that a community considers essential for the delivery of vital services and for the health, welfare, and protection of the community, and are especially important during and after a disaster or hazard event.***

Critical infrastructure is classified by the following categories: (1) Essential Services, (2) High Hazard Occupancy, (3) Hazardous Materials:

- **Essential Services Infrastructure** include, without limitation, public safety, emergency response, emergency medical, designated emergency shelters, communications, public and private utilities, and equipment, community lifelines, and government facilities and operations.
- **High Risk Occupancy Infrastructure** include, without limitation, pre-schools; public and private primary and secondary school; licensed before and after school care centers, daycare centers, group homes, and assisted living residential or congregate care facilities; and other licensed facilities that are likely to contain occupants who may not be sufficiently mobile to avoid death or injury during a hazard event or disaster.
- **Hazardous Materials Infrastructure** include, without limitation, structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic and/or water reactive material; and that if adversely impacted, could lead to a release of hazardous material(s) during a hazard event or disaster.

Note: Many of these critical facilities fall under "vulnerable facilities." These serve many at risk and vulnerable populations. This list of facilities serves to augment the discussion of "Vulnerable and Underserved Populations" as discussed in the sections above. The resulting critical facility analysis also shows an inventory of these vulnerable facilities by jurisdiction and their locations relative to mapped hazard areas.

All USD facility assets are considered to be critical facilities and infrastructure in the Tri-City Planning Area. Thus, the critical facility and infrastructure analysis is also shown on Table E-3 in the USD Facility Asset analysis above and also as depicted in Figure E-2.

Community Lifelines

Assessing the vulnerability of USD 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 or economic security. Information on lifelines include:

- Lifelines are the most fundamental services in the community that, when stabilized, enable all other aspects of society to function.
- FEMA has developed a construct 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 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

In the District, these community lifelines are all in place and functional as part of regular government operations. It should also be noted that these lifelines collectively include many of the individual components of other community assets inventoried for this LHMP including structures, critical facilities and infrastructure, natural resources, and economic assets.

Specific information on these Community Lifelines in the District and how they may be affected by a hazard event or disaster are discussed in more detail in each hazard section below.

Natural, Historic, and Cultural Resources

Assessing the vulnerability of USD to natural hazards and disasters also involves inventorying the natural, historic, and cultural assets of the area. This step is important for the following reasons:

- Environmental and natural resources add to a community's identity and quality of life. They also help the local economy through agriculture, tourism and recreation. They support ecosystem services, such as clean air and water.
- Conserving the environment may help people mitigate risk. It can also protect sensitive habitats, develop parks and trails, and build the economy.
- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.

- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Natural Resources

USD contains a variety of natural resources. Natural resources are unique to each area and are difficult to replace. Should a natural disaster occur, these natural resources and locations are at risk.

USD is bounded by San Francisco Bay on the west, by the hills of the Diablo Range on the east, by the District boundary to the north and by Coyote Creek Slough to the south. The western portion of the District area (adjacent to San Francisco Bay) consists primarily of salt evaporation ponds and saltwater marshes. These ponds and marshes extend from one to four miles inland and cover an area of approximately 35 square miles.

Since the District's boundaries cover most of the Tri-City Planning Area, natural resources in the cities of Fremont, Newark, and Union City fall inside USD boundaries. More information can be found in each city's respective annex.

Historic and Cultural Resources

Historic and cultural resources are difficult to replace. Should a natural disaster occur, these properties and locations can be at risk. To inventory these resources, the District collected information from a number of sources. The California Department of Parks and Recreation Office of Historic Preservation (OHP) was the primary source of information. OHP administers the National Register of Historic Places, the California Register of Historical Resources, California Historical Landmarks, and the California Points of Historical Interest programs. Each program has different eligibility criteria and procedural requirements. These requirements are detailed in Section 4.2.1 of the Base Plan.

Since the District's boundaries cover most of the Tri-City Planning Area, economic assets include those found in the larger Planning Area. These historic and cultural assets are discussed in each city's jurisdictional annexes.

Economic Assets and Community Activities of Value

Assessing the overall vulnerability of USD to natural hazards and disasters also involves inventorying the economic assets and community activities of value in the Tri-City Planning Area.

Economic Assets

After a disaster, economic resiliency is one of the major drivers of a speedy recovery. Each community has specific economic drivers. These include:

- Primary Economic Sectors
- Major employers

- Commercial Centers

Since the District's boundaries cover most of the Tri-City Planning Area, economic assets include those found in the larger Planning Area. These economic assets are discussed in each city's jurisdictional annexes.

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 sporting event. Some areas rely on seasonal industries to sustain them throughout the year. Many of these activities also provide economic benefits to the District. A hazard event that cancels or shortens these can affect a community's livelihood and can make disaster recovery more difficult or prolonged. This includes activities such as:

- Festivals and Fairs
- Sporting Events
- Tourism

Since the District's boundaries cover most of the Tri-City Planning Area, community activities of value include those found in the larger Planning Area. These community activities of value are discussed in each city's jurisdictional annexes.

Growth and Development Trends

As part of the planning process, USD 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.

Development since 2017 Plan

The District noted no development changes since 2017 specific to District-owned facilities.

Population Trends and Projections

The District employs 145 employees that support 5 workgroups. The treatment plant has various construction projects currently underway and planned. These projects will have contractors and their employees onsite.

USD's Service Territory is expected to continue to increase in population. The District has no control over the population increases in the future. The District noted that the cities of Fremont, Newark, and Union City are expected to see future growth as outlined in their respective annexes to this Plan Update.

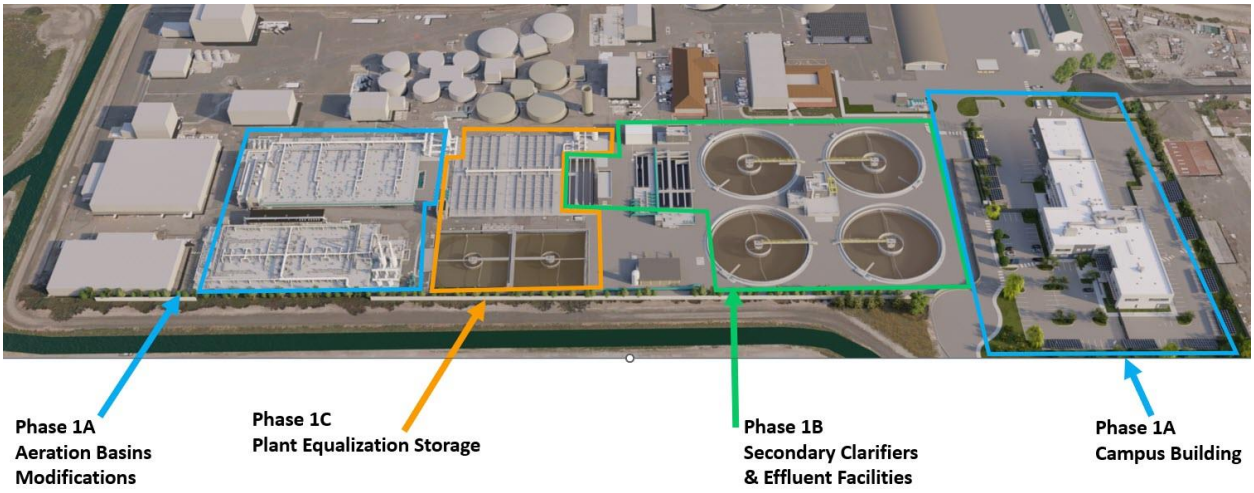
Future Development

The largest capital improvement program in USD's history is underway at the Union City wastewater treatment facility. The District's Enhanced Treatment and Site Upgrade (ETSU) Program Phase 1 projects

began construction in late 2021, launching a program that will support the next 40 years of reliable and cost-effective service to the Tri-Cities. The projects will renew and replace aging infrastructure, improve water quality in the San Francisco Bay through enhanced wastewater treatment processes and nutrient removal, and increase the facility's resiliency to extreme wet-weather events and climate change. The aerial image below (Figure E-4) shows what the treatment plant is anticipated to look like upon completion of the program. The major phases of the program highlight which portions of the treatment plant are included in each phase.

Outside of this, there are no plans in the next 5 years to acquire land or build new infrastructure off property.

Figure E-4 Union Sanitary District – ETSU Project Improvements



With respect to the USD Service Territory, the District noted that it has no control over future development within the cities served by USD. Future development of the USD Service Territory falls under the purview of the cities in the Tri-City Planning Area served by USD and is included in the cities' jurisdictional annexes.

GIS Analysis

Union Sanitary District provided GIS data for the ETSU project described above. It should be noted that all future development sites are located on the same parcel, located in Union City, and within USD boundary. A detailed map of this is shown on Figure E-5 and detailed on Table E-28. Structures are broken out into existing and new structures.

Figure E-5 Union Sanitary District – Future Development Areas

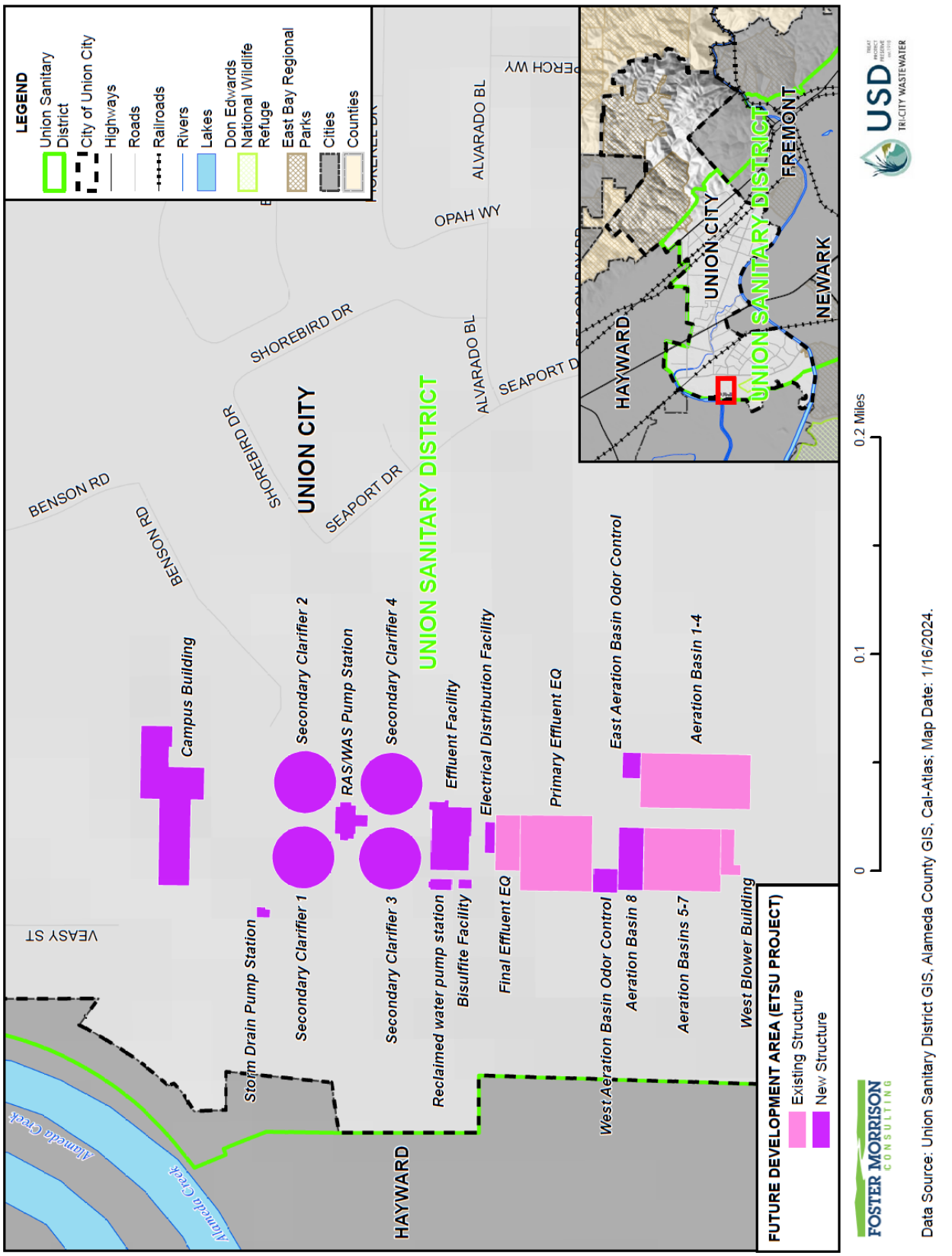


Table E-6 Union Sanitary District – Future Development Area Structure Names and Site Counts

Future Development Area (ETSU Project) Type	Future Development Structure Name	Site Count
Existing Structure	Aeration Basin 1-4	1
	Aeration Basins 5-7	1
	Final Effluent EQ	1
	Primary Effluent EQ	1
	West Blower Building	1
	Total	**5**
New Structure	Aeration Basin 8	1
	Bisulfite Facility	1
	Campus Building	1
	East Aeration Basin Odor Control	1
	Effluent Facility	1
	Electrical Distribution Facility	1
	RAS/WAS Pump Station	1
	Reclaimed water pump station	1
	Secondary Clarifier 1	1
	Secondary Clarifier 2	1
	Secondary Clarifier 3	1
	Secondary Clarifier 4	1
	Storm Drain Pump Station	1
	West Aeration Basin Odor Control	1
	Total	**14**
Grand Total		**19**

Source: Union Sanitary District

E.4.2. Hazard Identification

USD identified the hazards that affect the District and summarized their location, extent, likelihood of future occurrence, potential magnitude, and significance specific to USD (see Table E-7).

Table E-7 Union Sanitary District—Hazard Identification Assessment

Hazard	Geographic Extent	Likelihood of Future Occurrences	Magnitude/ Severity	Significance	Climate Change Influence
Climate Change	Extensive	Highly Likely	Limited/ Critical	Medium	–
Coastal Flooding and Sea Level Rise	Extensive	Highly Likely	Limited	High	High
Dam Failure	Extensive	Unlikely	Catastrophic	Low	Medium
Drought & Water Shortage	Extensive	Likely	Critical	High	High
Earthquake	Extensive	Likely	Catastrophic	High	Low
Flood: 1%/0.2% annual chance	Significant	Occasional	Critical	Low	High
Flood: Localized/Stormwater Flooding	Extensive	Highly Likely	Limited	Medium	Medium
Landslide	Limited	Likely	Critical	Low	Medium
Levee Failure	Limited	Unlikely	Limited	Low	Medium
Severe Weather: Extreme Cold and Freeze	Extensive	Highly Likely	Negligible	Low	Medium
Severe Weather: Extreme Heat	Extensive	Highly Likely	Limited	Low	High
Severe Weather: Heavy Rain and Storms	Extensive	Highly Likely	Limited	Medium	Medium
Severe Weather: High Winds and Tornadoes	Extensive	Highly Likely	Limited	Low	Medium
Subsidence	Extensive	Likely	Catastrophic	High	Low
Tsunami	Limited	Unlikely	Negligible	Low	Low
Wildfire	Limited	Highly Likely	Limited	Low	Medium

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 (*Medium or High Significance=Priority Hazard*)
Low: Minimal potential impact
Medium: Moderate potential impact
High: Widespread potential impact

Climate Change Influence
Low: Minimal potential impact
Medium: Moderate potential impact
High: Widespread potential impact

E.4.3. Hazard Profiles and Vulnerability to Specific Hazards

This section includes the hazard profiles and vulnerability assessment for hazards ranked of medium or high significance specific to the District (as identified in the Significance column of Table E-7), which represent the priority hazards for the City, which are profiled below and are a priority hazards for the mitigation actions in Section E.6.3. This section also includes a hazard profile and vulnerability assessment to the four primary hazards to the State of California: dam failure, earthquake, flood, and wildfire, regardless of the significance ranking by the District. Chapter 4 of the Base Plan provides more detailed information about these hazards and their impacts on the Tri-City Planning Area. Methodologies for evaluating vulnerabilities and calculating loss estimates are the same as those described in Section 4.3 of the Base Plan.

Hazard Profiles and Vulnerability Assessment Format

Each hazard specific section below begins with a summary of the Likelihood of Future Occurrence (from Table E-7) and the District's overall Vulnerability ranking. 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.

This is followed by the following sections:

- **Hazard Profile and Problem Description** – A hazard profile is included for each hazard. This includes information on:
  - ✓ A general discussion of the hazard and related issues.
  - ✓ **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. Data specific to the District follows the disaster declarations for each hazard.
- **Vulnerability Assessment** – A vulnerability assessment for each hazard is presented specific to the City. This includes information on:

- ✓ A general discussion of hazard vulnerabilities.
- ✓ **Local Concerns** – The City 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 format as in Section E.4.1 above. This includes sections on: People and Populations; Structures; Critical Facilities and Infrastructure, and Community Lifelines; Natural, Historic, and Cultural Resources, and Economic Assets and Community Activities of Value. These are discussed in specific terms for mapped hazards, and in more general terms for those hazards that are unmapped.

- ➢ **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. Impacts are also affected by the community's ability to mitigate, prepare for, respond to, and recover from an event.
- ➢ **Future Development** – A discussion of how future development will be affected by the hazard is also included. This is discussed specifically for mapped hazards, and in more general terms for those hazards that are unmapped.

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

An impact of almost all hazards below 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 Department of Energy, major blackouts are on the upswing. Incredibly, over the past two decades, blackouts impacting at least 50,000 customers have increased 124 percent. The electric power industry does not have a universal agreement for classifying disruptions. Nevertheless, it is important to recognize that different types of outages are possible so that plans may be made to handle them effectively. In addition to blackouts, brownouts can occur. A brownout is an intentional or unintentional drop in voltage in an electrical power supply system. Intentional brownouts are used for load reduction in an emergency. Electric power disruptions can be generally grouped into two categories: intentional and unintentional. More information on types of power disruptions can be found in Section 4.3 of the Base Plan.

Public Safety Power Shutoff (PSPS)

A new intentional disruption type of power shortage/failure event has recently occurred in California. In recent years, several wildfires have started as a result of downed power lines or electrical equipment. This was the case for the Camp Fire in 2018. As a result, California's three largest energy companies (including PG&E), at the direction of the California Public Utilities Commission (CPUC), are coordinating to prepare all Californians for the threat of wildfires and power outages during times of extreme weather. To help protect customers and communities during extreme weather events, electric power may be shut off for public safety in an effort to prevent a wildfire. This is called a PSPS. More information on PSPS criteria can be found in Section 4.3 of the Base Plan.

It was noted that PG&E is working to enhance its power network with Enhanced Powerline Safety Settings (EPSS) capable lines. EPSS are advanced safety settings. They allow PG&E powerlines to automatically turn off power within one-tenth of a second. This can happen when there's a hazard, like a tree branch falling into a powerline, which can cause a fire. These settings are in high fire-risk and surrounding areas.

These have not yet been installed in and near the Tri-City area, as PG&E focuses on other very high fire hazard areas in its service territory first. It is thought these EPSS capable lines will eventually come to the Tri-City Planning Area.

Local Concerns

While power outages and PSPS events are a concern of the District, they have redundant power systems in place to further reduce the risk of power failure. There were no past occurrences of power outages reported that affected District operations.

Climate Change

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Climate change adaptation is a key priority of the State of California. The 2023 State of California Multi-Hazard Mitigation Plan noted that climate change is already affecting California. Sea levels have risen by as much as seven inches along the California coast over the last century, increasing erosion and pressure on the State's infrastructure, water supplies, and natural resources. The State has also seen increased average temperatures, more extreme hot days, fewer cold nights, a lengthening of the growing season, shifts in the water cycle with less winter precipitation falling as snow, and earlier runoff of both snowmelt and rainwater in the year. In addition to changes in average temperatures, sea level, and precipitation patterns, the intensity of extreme weather events is also changing.

California's Adaptation Planning Guide: Understanding Regional Characteristics (from 2017) has divided California into 11 different regions based on political boundaries, projected climate impacts, existing environmental setting, socioeconomic factors and regional designations. The District falls in the Bay Area Region. Climate projections for this region are shown in Section 4.3.6 of the Base Plan and include an increase in temperatures, moderate changes in rainfall, and increased sea level rise.

Location and Extent

Climate change is a global phenomenon. It is expected to affect the whole of the USD, the Tri-City Planning area, surrounding counties, and State of California. There is no scale to measure the extent of climate change. Climate change exacerbates other hazards, such as drought, extreme heat, flooding, wildfire, and others. The speed of onset of climate change is very slow. The duration of climate change is not yet known but is feared to be tens to hundreds of years.

Past Occurrences

Disaster Declarations

Climate change has never been directly linked to any declared disasters.

USD Events

While the District noted that climate change is of concern, no specific impacts of climate change could be recalled. The District noted that the strength of storms does seem to be increasing and the temperatures are getting hotter. USD also noted that over the last 5 years the District has seen increased sustained winds and high winds along with years of drought followed by heavy rains and flooding.

Vulnerability to Climate Change

The whole of the District is at some measure of vulnerability to climate change. The District Planning team has concerns that District vulnerability to climate change will increase in the future. An assessment of a community's vulnerability to climate change begins with an understanding of local exposure to climate change. 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

USD recognizes that climate change poses a potential threat to the community and to the environment. Locally, the forecasted changes accompanying climate change could dramatically reduce the availability of hydro-generated electricity, increase the incidence of forest fires, and lead to a rise in the level of San Francisco Bay that could impact lower elevation land in the District. The District's concerns with sea level rise are discussed in the next hazard profile below.

Assets at Risk

Assets at risk from climate change include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value.

People and Populations

Climate change affects people and populations within a community, especially those climate change issues related to increases in temperature over time. While all populations can be affected by temperature extremes, populations particularly vulnerable include the very old and very young, medically fragile people, people without means of shelter (and air conditioning) or transportation, people who are socially isolated and other socially vulnerable or underserved populations (as shown in Special Populations discussion in each respective city's annex to this Plan Update). Acclimatization to heat may help reduce risks from heat waves in the healthy general population but may not be sufficient to protect those with underlying medical conditions.

The District employs 145 employees that support 5 workgroups. The treatment plant has various construction projects currently underway and planned. These projects will have contractors and their employees onsite. These groups are not expected to be greatly impacted by climate change.

Structures

Climate change, on its own, does not generally impact structures. However, USD facilities in areas of increased wildfire, sea level rise, or flood areas exacerbated by the effects of climate change would be at increased risk, as described throughout this LHMP. More information on how structures may be affected by climate change can be found in Section 4.3.6 of the Base Plan.

Critical Facilities and Infrastructure, and Community Lifelines

As with structures, critical facilities and infrastructure in areas of increased wildfire, sea level rise, or flood areas due to the effects of climate change would be at increased risk. Climate change is expected to increase the vulnerability of critical facilities and infrastructure to natural hazards.

Due to the slow onset of climate change, community lifelines in the District are expected to adapt over time to new climate normal. It is thought that community lifelines in the District would not be overwhelmed by climate change.

Natural, Historic, and Cultural Resources

San Francisco Bay and the associated estuarine ecosystem sit at the center of the region and serve as the outlet for the Sacramento and San Joaquin rivers. This estuary supports rich biodiversity, including many special-status species. These are all at risk from the effects of climate change. In addition to coastal areas, if heat changes wildfire patterns, all areas (on land) of the USD are at increased risk from fire – including natural, historic, and cultural resources. Coastal areas are subject to the possibility of additional flooding, which is discussed in the Coastal Flooding and Sea Level Rise Section below. More information on how natural, historic, and cultural resources may be affected by climate change can be found in Section 4.3.6 of the Base Plan.

Economic Assets and Community Activities of Value

Economic assets and community activities in the USD's Service Territory generally have a limited vulnerability to climate change. Those assets and activities that have vulnerability are discussed in each city's respective annex to this Plan Update.

Impacts from Climate Change

The California APG: Understanding Regional Characteristics identified the following impacts specific to the Bay Area region in which the Tri-City Planning Area is part of:

- Increased temperatures
- Reduced precipitation
- Sea level rise – coastal inundation and erosion
- Public health – heat and air pollution
- Reduced agricultural productivity (e.g., wine grapes)
- Inland flooding
- Reduced tourism

In addition to these sources, the 2023 State of California Hazard Mitigation Plan noted that according to California's Fourth Climate Change Assessment, the state will experience the following climate impacts:

- Annual average daily high temperatures are expected to rise by 2.7 °F by 2040, 5.8°F by 2070, and 8.8°F by 2100 compared to observed and modeled historical conditions. These changes are statewide averages.
- Heat waves are projected to become longer, more intense, and more frequent.
- Warming temperatures are expected to increase soil moisture loss and lead to drier conditions. Summer dryness may become prolonged, with soil drying beginning earlier in the spring and lasting longer into the fall and winter.
- Droughts are likely to become more frequent and persistent through 2100.
- The strength of the most intense precipitation and storm events affecting California is expected to increase.
- Snowpack levels are projected to decline significantly by 2100 due to reduced snowfall and faster snowmelt.
- Marine layer clouds are projected to decrease.
- Extreme wildfires (i.e., fires larger than 24,710 acres) would occur 50 percent more frequently. The maximum area burned statewide may increase 178 percent by the end of the century.
- Sea level rise is expected to continue to increase beach, cliff, and bluff erosion.

Climate change will continue to influence natural hazards and play a role in the nature and extent of natural hazards and their impacts on District assets. In general, changes in population patterns and land use (neither of which are under the District's control) will also be a factor in the extent by which climate change is an issue over time. Thus, any changes in population patterns and land use and development would likely increase the impacts associated with climate change on District assets.

Future Development

Climate change can influence development in the District over time. USD could see population fluctuations in their service territory as a result of climate impacts relative to those experienced in other regions, and these fluctuations are expected to impact demand for housing and other development. While there are currently no formal studies of specific migration patterns expected to impact the USD and Tri-City Planning Area, climate-induced migration was recognized within the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties Paris Agreement of 2015 and is expected to be the focus of future studies. The District is not aware of any significant changes to population. Low lying coastal areas where the USD has assets may also be affected in the future.

Coastal Flooding and Sea Level Rise

Likelihood of Future Occurrence–Highly Likely
Vulnerability–High

Hazard Profile and Problem Description

Historically, cities, towns and villages were often settled around ports and waterways along the nation's coastlines. 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. The continued increase in coastal population leads to increased coastal development, which places greater numbers of people and structures at risk from coastal hazards. Coastal flooding can result from a variety of different causes including storm surges created by tidal influences; storms like hurricanes and tropical cyclones, heavy rain and windstorm events; rising sea levels due to climate change; and to a much lesser extent by possible tsunamis events.

In the past decade, there have been groundbreaking studies and an increased public awareness on the worldwide effects of climate change associated with global warming. Studies continue to document that global warming is continuing at progressive rates, which has been demonstrated by warmer and colder seasonal temperatures and patterns of more severe seasonal storm events, including coastal flooding. Sea level rise has accelerated in recent decades due, in part, to increasing ice loss in the world's polar regions. Latest data from the World Meteorological Organization shows that global mean sea level reached a new record high in 2021 (the latest year for which reporting data has been analyzed), rising an average of 4.5 millimeters per year over the period 2013 to 2021. It is projected that sea levels will continue to rise as precipitation continues to increase and ice caps continue to melt.

King Tides

Coastal flooding and sea level rise are exacerbated during periods of extreme tides. Tides are long-period waves that roll around the planet as the ocean is "pulled" back and forth by the gravitational pull of the moon and the sun as these bodies interact with the Earth in their monthly and yearly orbits. According to NOAA, during full or new moons—which occur when the Earth, sun, and moon are nearly in alignment—average tidal ranges are slightly larger. This occurs twice each month. The moon appears new (dark) when it is directly between the Earth and the sun. The moon appears full when the Earth is between the moon and the sun. In both cases, the gravitational pull of the sun is "added" to the gravitational pull of the moon on Earth, causing the oceans to bulge a bit more than usual. This means that high tides are a little higher and low tides are a little lower than average. These are called spring tides, a common historical term that has nothing to do with the season of spring. Rather, the term is derived from the concept of the tide "springing forth." Spring tides occur twice each lunar month all year long, without regard to the season. Spring tides are also sometimes called (non-scientifically) king tides.

Location and Extent

The coastal areas of the USD at risk to coastal flooding will also be affected by sea level rise (especially during periods of extreme tides). These include areas with low-lying elevations (some at sea level) and areas that are now filled and were once marshland. Coastal flooding areas in FEMA DFIRM VE zones are shown on Figure E-72 in the Flood: 1%/0.2% Annual Chance section. Duration of coastal flooding generally lasts as long as the storm that causes it and is relatively short, with a quick speed of onset. There is no scientific scale to measure coastal flooding, as floods are generally measured in depth, extent, and velocity of flooding. Coastal flooding and potential sea level rise scenarios are shown on Figure E-6, Figure E-7, and Figure E-8. Extents by scenario are detailed in Table E-8. As shown in the table, there are small amounts of the USD Service Territory in the existing conditions scenarios, while the 1-meter and 2-meter scenario show moderate and sizable amounts of the District would be affected, respectively. 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.

Figure E-6 Union Sanitary District – Sea Level Rise Existing Conditions Scenarios

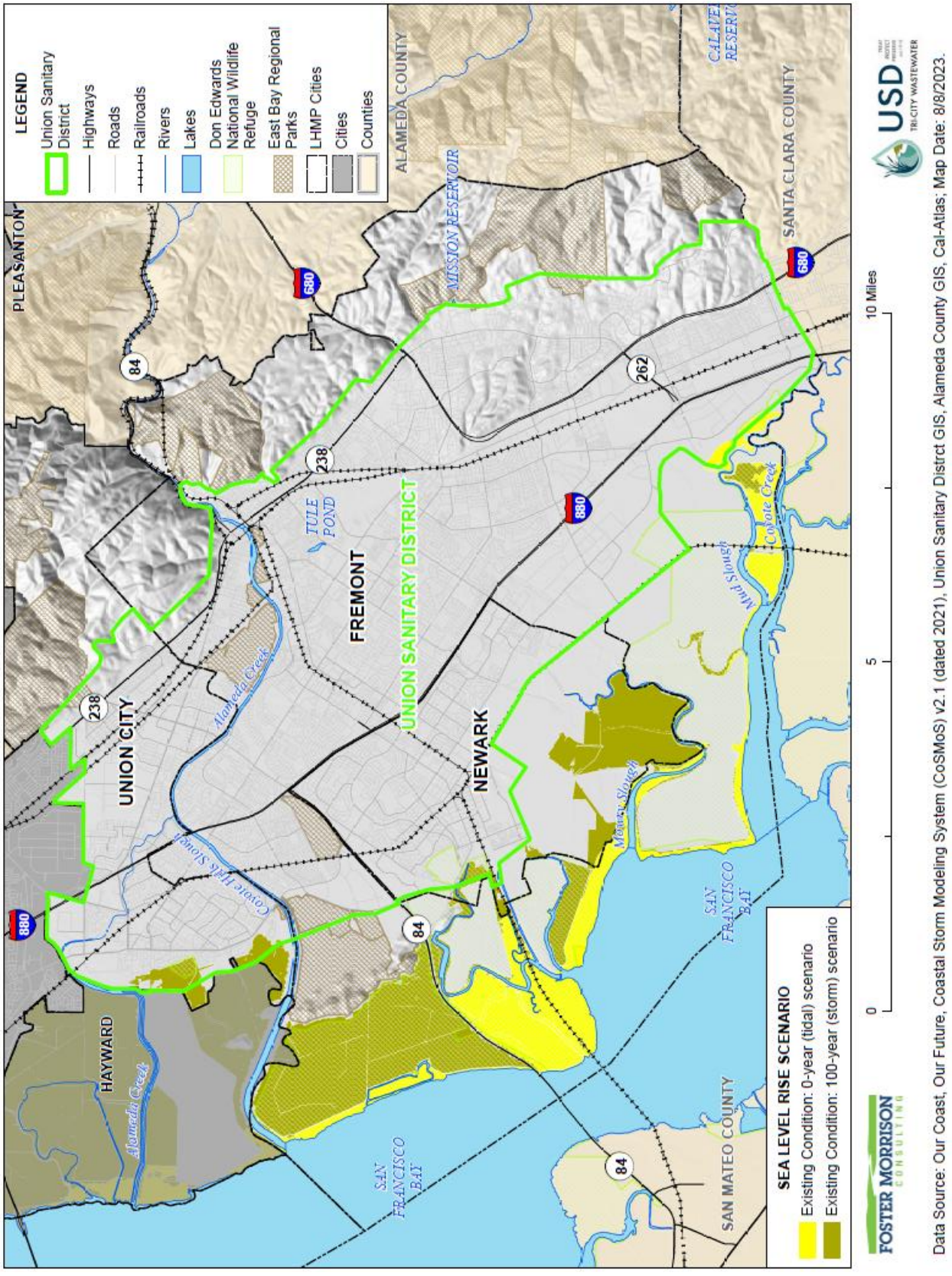


Figure E-7 Union Sanitary District – Sea Level Rise 1 Meter Scenarios

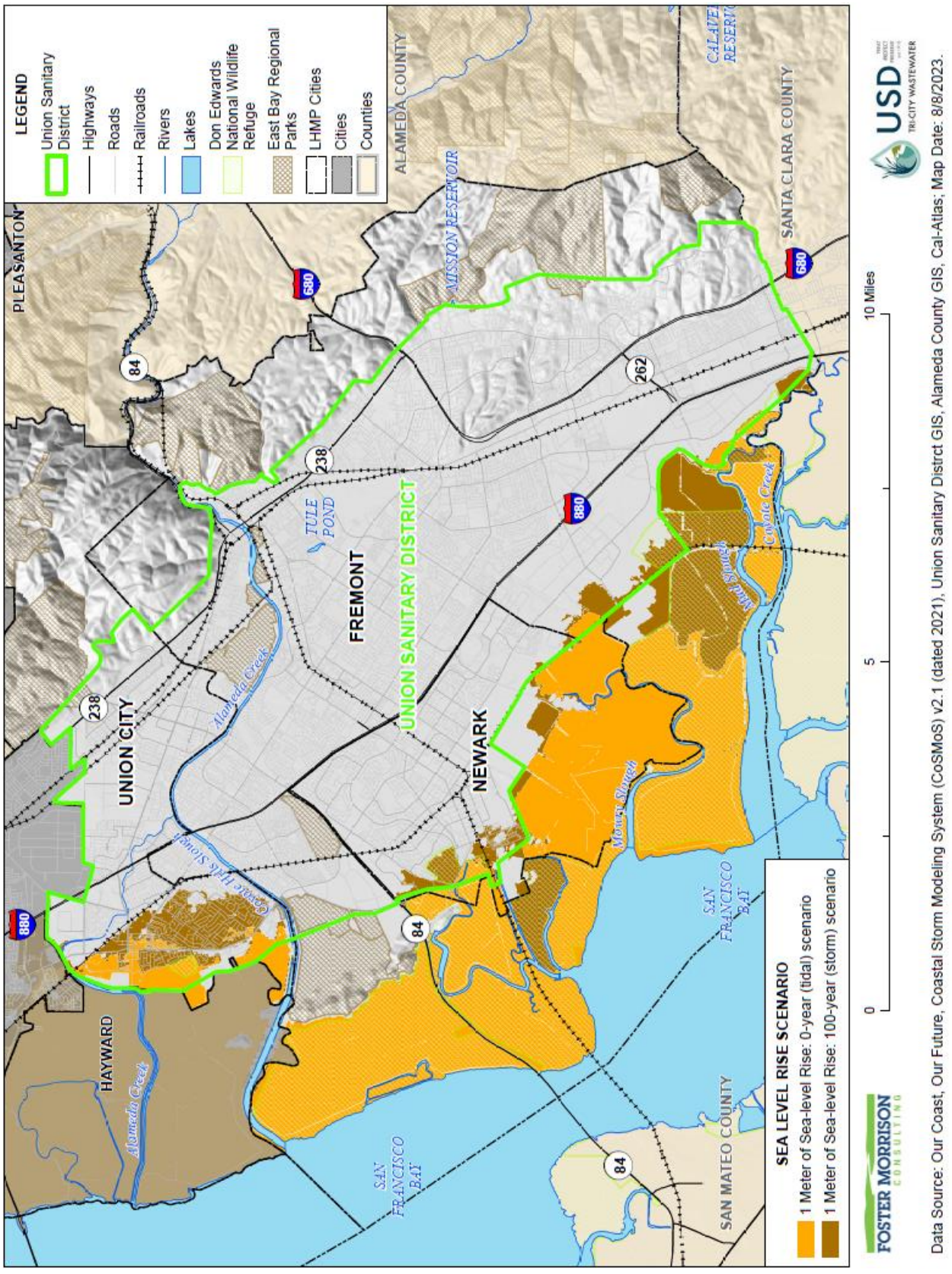


Figure E-8 Union Sanitary District – Sea Level Rise 2 Meter Scenarios

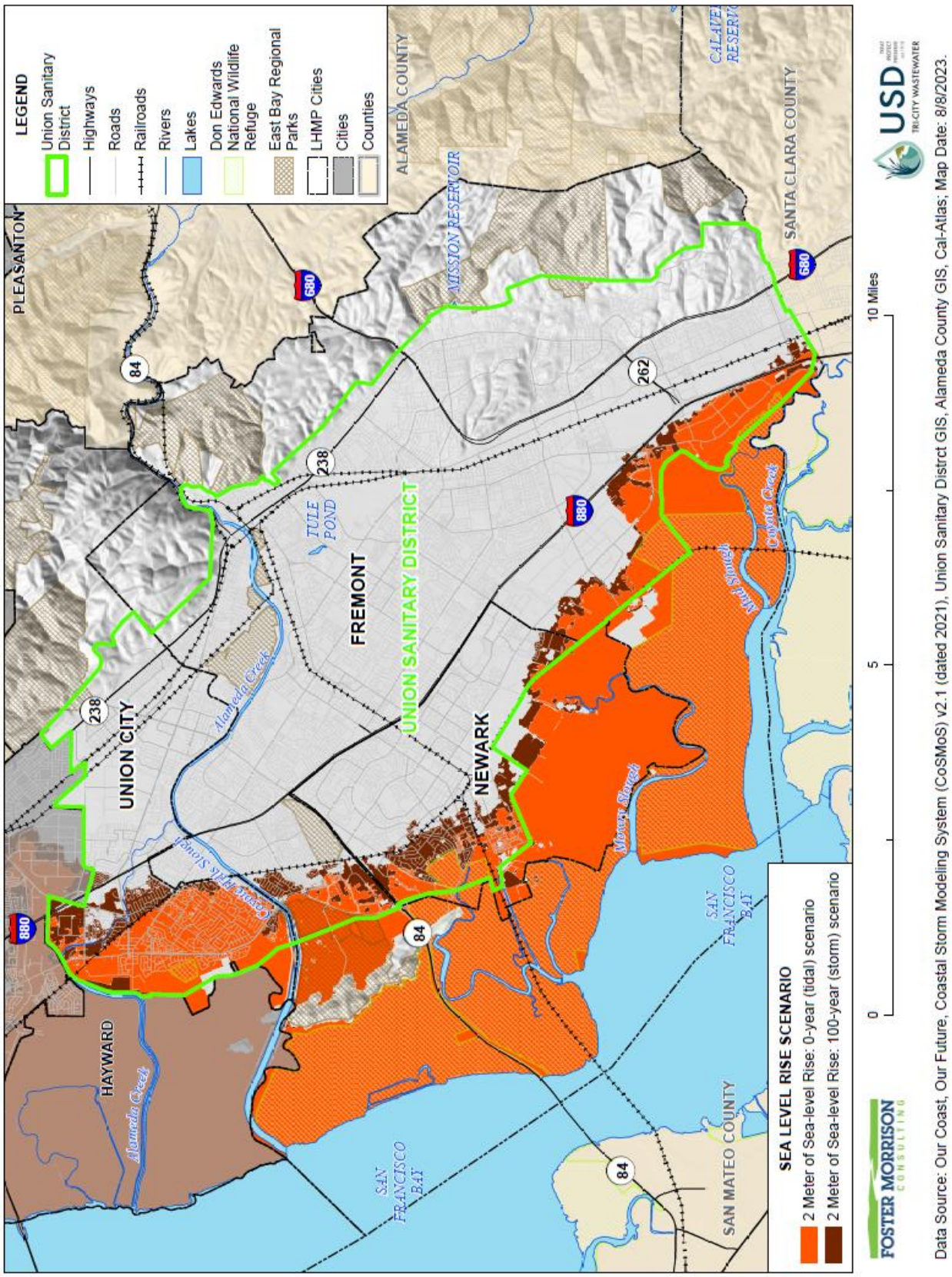


Table E-8 Union Sanitary District – Sea Level Rise Scenario Geographical Extents

Sea Level Rise Scenario	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Existing Condition: 0-year (tidal) scenario	54.17	0.07%	0	0.00%	54.17	0.38%
Existing Condition: 100-year (storm) scenario	356.18	0.46%	2.19	0.00%	353.98	2.50%
1 Meter (3.1 feet) of Sea-level Rise: 0-year (tidal) scenario	712.67	0.92%	164.85	0.26%	547.81	3.87%
1 Meter (3.1 feet) of Sea-level Rise: 100-year (storm) scenario	4,093.19	5.28%	2,628.53	4.15%	1,464.66	10.34%
2 Meter (6.2 feet) of Sea-level Rise: 0-year (tidal) scenario	7,390.77	9.54%	4,824.69	7.62%	2,566.08	18.12%
2 Meter (6.2 feet) of Sea-level Rise: 100-year (storm) scenario	10,227.14	13.20%	7,054.70	11.14%	3,172.44	22.41%

Source: Cosmos 2021, Cal Atlas

Past Occurrences

Disaster Declarations

There have been 19 state and 19 federal disaster declarations due to flooding and heavy rains and storms in Alameda County as shown in Table E-9. These events are known to have caused some measures of coastal flooding, as compounded by sea level rise, affecting the District. No disaster declarations have occurred specific to sea level rise.

Table E-9 Alameda County Disaster Declarations 1950-2023 from Flood (including Heavy Rains and Storms)

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	19	1950, 1955, 1957, 1958 (twice), 1962, 1963, 1970, 1982, 1983 (twice), 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	19	1955, 1958, 1962 (twice), 1970, 1982, 1983, 1986, 1995 (twice), 1997, 1998, 2005, 2006, 2017 (three), 2023 (twice)

Source: Cal OES, FEMA

USD Events

The USD noted no past events where damage to the District could be recalled.

Vulnerability to Coastal Flood and Sea Level Rise

Coastal flooding compounded by sea level rise will flood areas not previously prone to flooding. In addition, as riverine and coastal waters come together at river mouths, coastal lagoons, and estuaries, higher water levels at the coast may cause water to back up and increase upstream flooding. Drainage systems

that discharge close to sea level are expected to have similar problems, and inland areas may become flooded if outfall pipes back up with saltwater. Coastal areas of the USD are at risk to coastal flooding and sea level rise (especially during periods of extreme tides).

According to the 2021 *Critical Infrastructure at Risk – Sea Level Rise Planning Guidance for California's Coastal Zone* by the California Coastal Commission, other climate change impacts such as increases in the amount of precipitation falling as rain rather than snow will add to river flooding in some areas, as will predicted increases in the intensities of rainfall events. Wildfire damage in coastal watersheds can also increase flooding risks to our shorelines.

As seas rise, waves and tides will force water further and further inland, particularly during coastal storms, triggering consequences including both episodic and increased shoreline erosion, as well as damage to shoreline development. Erosion rates along coastal bluffs, beaches, and dunes are expected to increase with rising sea levels and are likely to further increase if waves, storms, and coastal flooding increase in size and intensity or become more frequent. Large sections of the California coast consist of coastal bluffs that are often highly susceptible to erosion. Fire damage in coastal locations could also result in significant erosion of exposed slopes that have lost vegetation. As sea level rises, the amount of time that these bluffs are exposed to wave attack and ocean waters will increase, causing further erosion. This, in turn, could trigger landslides and the loss of structural and geologic stability of bluffs. Signs of these effects are already becoming evident along various portions of the shoreline.

In addition to storm flooding and coastal erosion, sea level rise will also impact tidal flooding. As the ocean migrates inland, new lands will become tidally influenced and more areas will become permanently submerged. Bathymetry, built structures, and the natural coastline configuration will influence how rising seas will translate into encroaching tidal footprints.

Research also indicates that sea level rise is likely to raise groundwater levels and push saltwater into fresh groundwater; however, the degree of impact will vary greatly depending on local conditions. When a low-lying coastal area has shallow groundwater with subsurface connections to the ocean, sea level rise can cause groundwater levels to rise and emerge at the surface, contributing to chronic flooding.

Additionally, even if groundwater is relatively deep in a low-lying area, existing lower groundwater can rise to shallow elevations, increasing the need for pumping to protect infrastructure from inundation. Sea level rise may also drive seawater intrusion into freshwater aquifers, increasing the salinity of groundwater and leading to potential impacts to infrastructure and water supplies. Generally, the most vulnerable areas will be where groundwater is shallow, where aquifers are unconfined along low-lying coasts, or where aquifers have already experienced overdraft and saltwater intrusion.

An assessment of a community's vulnerability to climate change begins with an understanding of local exposure to coastal flooding and 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 East Bay Dischargers Authority Climate Ready Final Report (August 2015) noted that USD currently discharges treated wastewater effluent into San Francisco Bay through a deep water combined outfall;

however, this infrastructure is aging and vulnerable to rising sea levels. It also noted that historically, freshwater interfaced with the baylands through creek connections and more diffusely via groundwater and surface runoff. These freshwater inputs were an important component of the baylands ecosystem, creating salinity gradients that added physical and ecological diversity to the baylands landscape as well as facilitating rapid vertical marsh growth. Today, the extent, magnitude, and seasonality of freshwater to the baylands has been greatly altered.

The USD Preliminary Study on the Effect of Sea Level Rise on District Infrastructure (June 2013) noted that the South San Francisco Bay shoreline is vulnerable to inundation from coastal flooding, primarily due to a combination of tides, storm surges, wave run-up and storm water runoff. Accelerated sea level rise will lead to increased total water levels (tides plus storm surges) in the Bay and increased wave run-up on structures. In light of this, infrastructure along the Bay will become increasingly vulnerable.

A majority of USD's infrastructure assets are located along the shoreline, with the exception of its collection systems which were not part of the 2013 study. These infrastructure assets will be exposed to increased coastal flooding. There are also a significant number of flood control channels that traverse the District's assets, and these are all likely to be impacted by backwater effects due to rising sea levels. Finally, much of the District's assets are located in low lying areas that may experience increased groundwater levels due to increased tidal fluctuations and rising sea levels. Higher groundwater levels have the potential to increase buoyant forces on buildings and other structures.

Assets at Risk

Assets at risk from coastal flood and sea level rise include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections.

People and Populations

District Populations

The District employs 145 employees that support 5 workgroups. The treatment plant has various construction projects currently underway and planned. These projects will have contractors and their employees onsite. Some of these areas would possibly be affected by coastal flooding and sea level rise.

Service Territory Populations

All people and populations in the USD Service Territory located in areas subject to coastal flooding and sea level rise are at some risk to these hazards. This includes those that reside and recreate in coastal areas, including FEMA DFIRM VE Zones and within areas inundated by the CoSMoS sea level rise scenarios. Certain vulnerable populations located within areas prone to coastal flooding and sea level rise 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.

To further evaluate the impact to the USD Service Territory residential populations located in these hazard areas, the CoSMoS sea level rise scenarios were overlayed on the Alameda County parcel layer. Those residential parcel centroids that intersect the scenario areas were counted and multiplied by the 2020 Census Bureau average household factors for USD – 3.22. Analysis results are shown in Table E-10.

Table E-10 Union Sanitary District Service Territory – Improved Residential Parcels and Population by Sea Level Rise Scenario

Sea Level Rise Scenario/Jurisdiction	Improved Residential Parcels	Population at Risk
Existing Conditions –0-year (tidal) scenario		
Union Sanitary District Service Territory	0	0
Existing Conditions – 100-year Scenario		
Union Sanitary District Service Territory	2	6
1 Meter (3.1 feet) of Sea Level Rise: 0-year (tidal) scenario		
Union Sanitary District Service Territory	569	1,918
1 Meter (3.1 feet) of Sea Level Rise: 100-year scenario		
Union Sanitary District Service Territory	5,915	19,896
2 Meter (6.2 feet) of Sea Level Rise: 0-year (tidal) scenario		
Union Sanitary District Service Territory	6,947	23,360
2 Meter (6.2 feet) of Sea Level Rise: 100-year scenario		
Union Sanitary District Service Territory	11,621	38,712

Source: Cosmos 2021, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023), US Census Bureau

Structures

The analysis for structures in the District is separated out into two separate analyses:

- **USD Facility Assets** – These are the facilities, structures, and other assets which USD owns and maintains operational control.
- **Service Territory Structures** – This is comprised of the parcels and structures associated with the residents and businesses located within USD's Service Territory who use the wastewater services provided by USD.

USD Facility Assets

The District owns assets, including facilities and structures, that may be at risk to coastal flooding and sea level rise and primarily include those structures located in areas prone to coastal flooding and sea level rise as shown in the CoSMoS scenarios, (and the FEMA DFIRM VE flood zones which are discussed in more

detail in the Flood: 1%/0.2% Annual Chance section below). Analysis by each of the six CoSMoS sea level scenarios follows. GIS was used to determine the possible impacts of sea level rise on USD structure assets. The methodology described in Section 4.3.7 of the Base Plan was followed in determining parcels and structures at risk to the six sea level rise scenarios. The methodology described in Section E.4.1 (in the Structures section) above was followed in determining USD structures at risk to sea level rise. Figure E-9 shows USD facility assets in the existing conditions sea level rise scenarios. Figure E-10 shows USD facility assets in the 1-meter rise sea level rise scenarios. Figure E-11 shows USD facility assets in the 2-meter rise sea level rise scenarios. Table E-11 details how each sea level rise scenario will affect USD facility assets, while Table E-12 summarizes the linear assets that may be affected by each sea level rise scenario.

Figure E-9 Union Sanitary District – Assets in Sea Level Rise Existing Conditions Scenarios

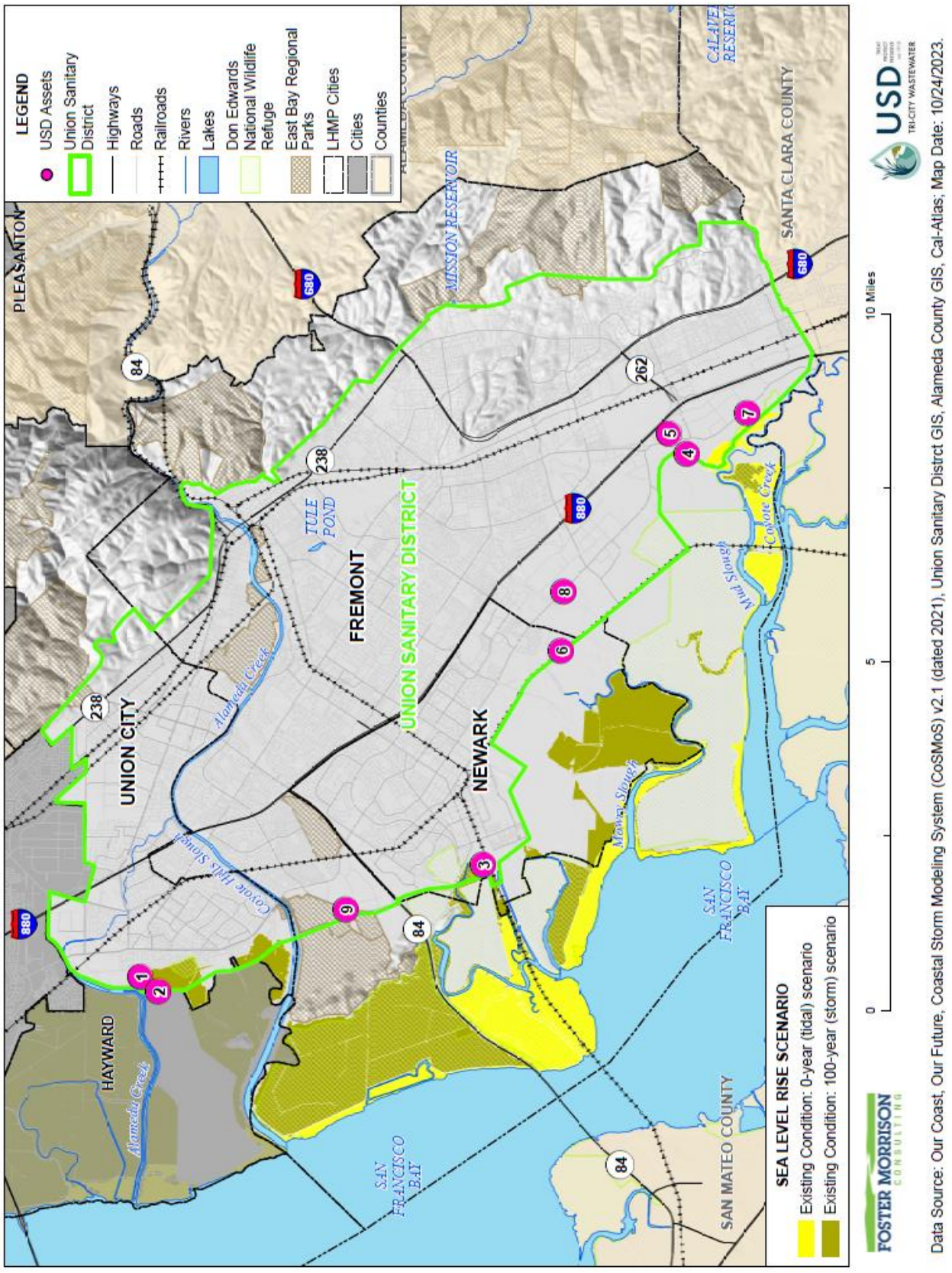


Figure E-10 Union Sanitary District – Assets in Sea Level Rise 1-meter Rise Scenarios

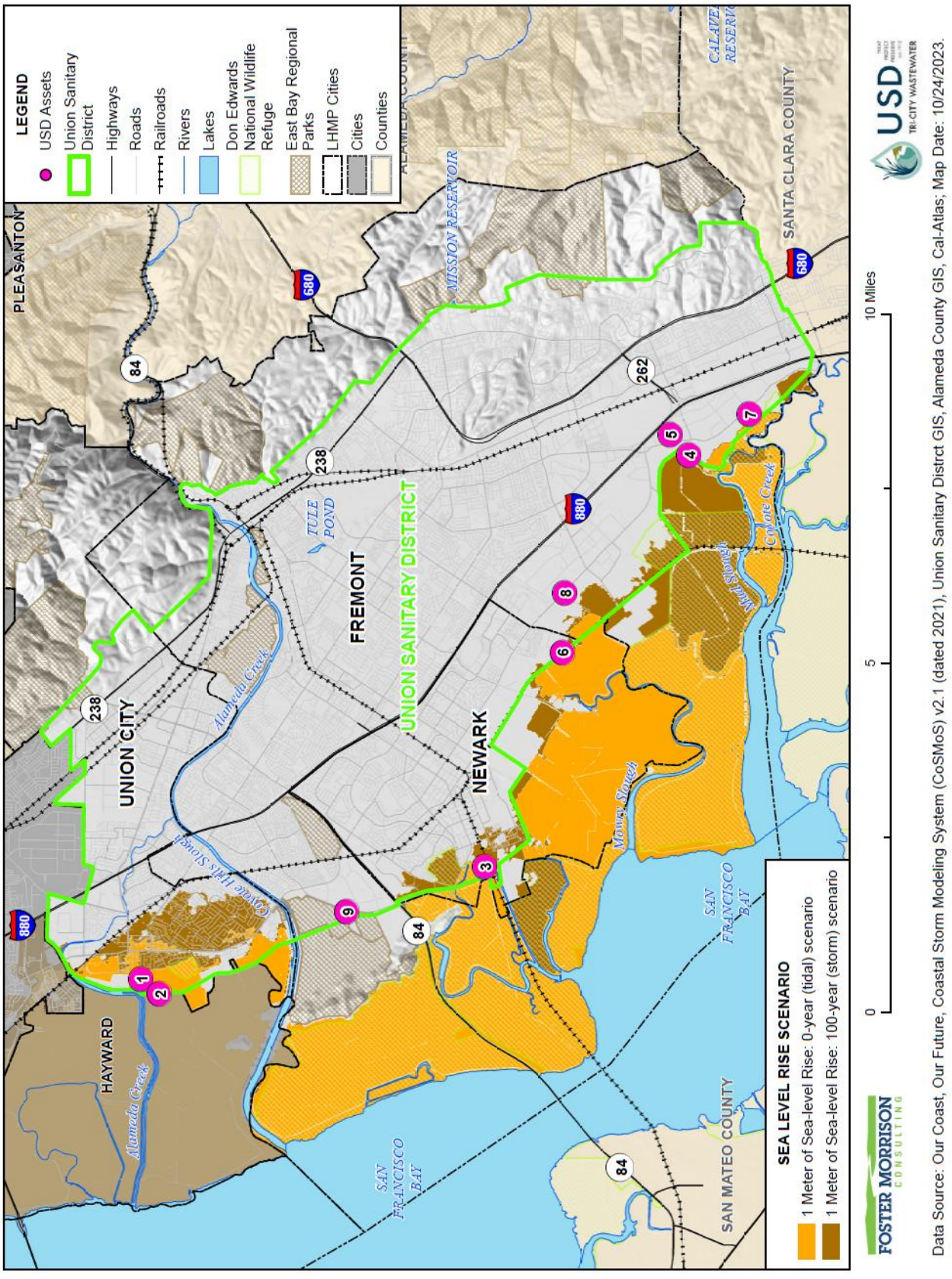


Figure E-11 Union Sanitary District – Assets in Sea Level Rise 2-meter Rise Scenarios

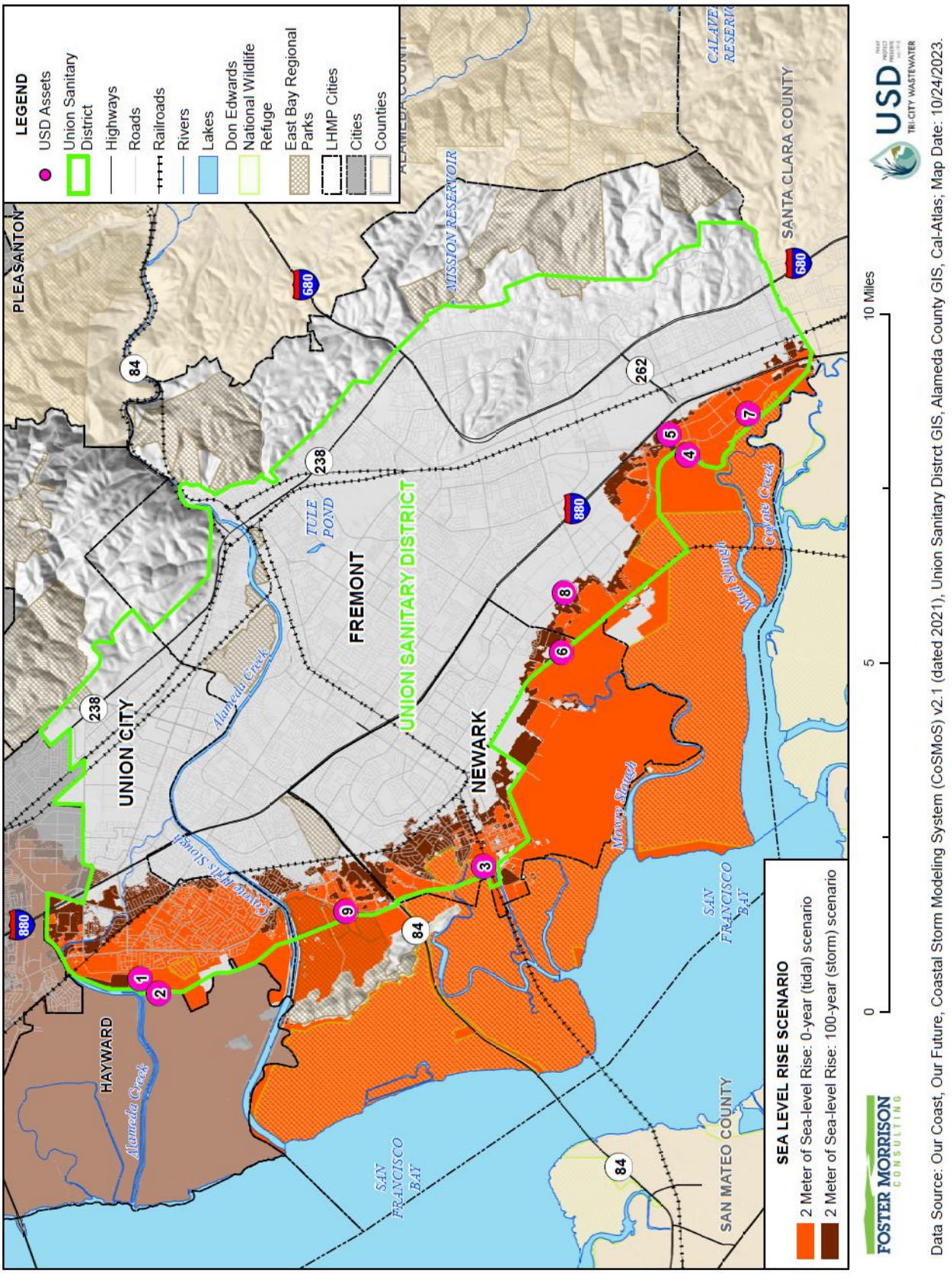


Table E-11 Union Sanitary District – Assets by Sea Level Rise Scenario

Sea Level Rise / Site Number	Site Location / Name	Asset Type	Asset Value	Property Value	Total Value
1 Meter (3.1 feet) of Sea-level Rise: 0-year (tidal) scenario					
1	Alvarado Treatment Plant	Water Treatment Plant	$247,303,953	$66,060,000	$313,363,953
2	Final Effluent Pump Station	Dischargers Pump Station	$14,932,627	$0	$14,932,627
Total			**$262,236,580**	**$66,060,000**	**$328,296,580**
1 Meter (3.1 feet) of Sea-level Rise: 100-year (storm) scenario					
1	Alvarado Treatment Plant	Water Treatment Plant	$247,303,953	$66,060,000	$313,363,953
2	Final Effluent Pump Station	Dischargers Pump Station	$14,932,627	$0	$14,932,627
3	Newark PS	Pump Station	$18,721,354	$37,520,000	$56,241,354
Total			**$280,957,934**	**$103,580,000**	**$384,537,934**
2 Meter (6.2 feet) of Sea-level Rise: 0-year (tidal) scenario					
1	Alvarado Treatment Plant	Water Treatment Plant	$247,303,953	$66,060,000	$313,363,953
2	Final Effluent Pump Station	Dischargers Pump Station	$14,932,627	$0	$14,932,627
3	Newark PS	Pump Station	$18,721,354	$37,520,000	$56,241,354
4	Irvington PS	Pump Station	$10,511,794	$45,040,000	$55,551,794
5	Irvington SB	Storage Basin	$7,983,280		$7,983,280
7	Fremont LS	Lift Station	$1,086,324	$880,000	$1,966,324
9	Paseo Padre LS	Lift Station	$1,020,348	$1,880,000	$2,900,348
Total			**$301,559,680**	**$2,760,000**	**$452,939,680**
2 Meter (6.2 feet) of Sea-level Rise: 100-year (storm) scenario					
1	Alvarado Treatment Plant	Water Treatment Plant	$247,303,953	$66,060,000	$313,363,953
2	Final Effluent Pump Station	Dischargers Pump Station	$14,932,627		$14,932,627
3	Newark PS	Pump Station	$18,721,354	$37,520,000	$56,241,354
4	Irvington PS	Pump Station	$10,511,794	$45,040,000	$55,551,794
5	Irvington SB	Storage Basin	$7,983,280		$7,983,280
6	Cherry PS	Lift Station	$315,705	$1,580,000	$1,895,705
7	Fremont LS	Lift Station	$1,086,324	$880,000	$1,966,324
9	Paseo Padre LS	Lift Station	$1,020,348	$1,880,000	$2,900,348
Total			**$301,875,385**	**$152,960,000**	**$454,835,385**

Source: CoSMoS, USD GIS

Table E-12 Union Sanitary District – Linear Assets by Sea Level Rise Scenario

Sea Level Rise Scenario	Asset Length (in miles)	Total Asset Value
Existing Condition: 100-year (tidal) scenario		
–	–	–
Existing Condition: 100-year (storm) scenario		
Total	1.783	$17,529,813
1 Meter (3.1 feet) of Sea-level Rise: 0-year (tidal) scenario		
Total	9.242	$49,034,271
1 Meter (3.1 feet) of Sea-level Rise: 100-year (storm) scenario		
Total	59.949	$377,040,969
2 Meter (6.2 feet) of Sea-level Rise: 0-year (tidal) scenario		
Total	91.746	$615,361,194
2 Meter (6.2 feet) of Sea-level Rise: 100-year (storm) scenario		
Total	140.118	$880,487,456

Source: CoSMoS, USD GIS

Service Territory Structures

Certain structures in the USD Service Territory are at risk to coastal flooding and sea level rise and primarily include those structures located in areas prone to coastal flooding and sea level rise as shown in the CoSMoS sea level rise scenarios, (and the FEMA DFIRM VE flood zones which are discussed in more detail in the Flood: 1%/0.2% Annual Chance section below). GIS was used to determine the possible impacts of coastal flooding and sea level rise on parcels and structures within the USD Service Territory. The methodology described in Section 4.3.7 of the Base Plan was followed in determining parcels and structures at risk to the six sea level rise scenarios. Table E-13 contains parcel counts, land and improved values (i.e., those with a structure improvement on the parcel), estimated content replacement values, and total values by land use in the USD Service Territory are shown for each of the six sea level rise scenarios.

Table E-13 Union Sanitary District Service Territory – Count and Value of Parcels in Sea Level Rise Scenario by Property Use

Sea Level Rise Scenario/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Existing Condition: 0-year (tidal) scenario						
Agricultural	1	0	$146,517	$0	$0	$146,517
Commercial	0	0	$0	$0	$0	$0
Government / Institutional	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0

Sea Level Rise Scenario/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Residential	0	0	$0	$0	$0	$0
Unknown	0	0	$0	$0	$0	$0
Utilities	0	0	$0	$0	$0	$0
Vacant	0	0	$0	$0	$0	$0
Existing Condition: 0-year (tidal) scenario Total	**1**	**0**	**$146,517**	**$0**	**$0**	**$146,517**
Existing Condition: 100-year (tidal) scenario						
Agricultural	6	0	$1,592,066	$0	$0	$1,592,066
Commercial	0	0	$0	$0	$0	$0
Government / Institutional	13	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0
Residential	2	2	$342,464	$799,083	$399,542	$1,541,089
Unknown	1	0	$0	$0	$0	$0
Utilities	0	0	$0	$0	$0	$0
Vacant	3	0	$988,760	$0	$0	$988,760
Existing Condition: 100-year (tidal) scenario Total	**25**	**2**	**$2,923,290**	**$799,083**	**$399,542**	**$4,121,915**
1 Meter (3.1 feet) of Sea-level Rise: 0-year (tidal) scenario						
Agricultural	7	0	$1,592,066	$0	$0	$1,592,066
Commercial	27	27	$35,332,029	$83,004,011	$83,004,011	$201,340,051
Government / Institutional	49	3	$1,214,961	$744,656	$744,656	$2,704,273
Industrial	4	3	$2,780,078	$3,812,149	$5,718,224	$12,310,451
Recreational	0	0	$0	$0	$0	$0
Residential	579	569	$78,432,260	$179,998,369	$89,999,178	$348,429,807
Unknown	1	0	$0	$0	$0	$0
Utilities	6	0	$0	$0	$0	$0
Vacant	45	4	$13,121,940	$393,537	$0	$13,515,477

Sea Level Rise Scenario/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1 Meter (3.1 feet) of Sea-level Rise: 0-year (tidal) scenario Total	**718**	**606**	**$132,473,334**	**$267,952,722**	**$179,466,069**	**$579,892,125**
1 Meter (3.1 feet) of Sea-level Rise: 100-year (tidal) scenario						
Agricultural	9	0	$1,610,899	$0	$0	$1,610,899
Commercial	83	77	$89,583,373	$168,839,989	$168,839,989	$427,263,351
Government / Institutional	150	6	$1,966,366	$8,653,075	$8,653,075	$19,272,516
Industrial	20	15	$67,733,311	$144,173,546	$216,260,321	$428,167,178
Recreational	0	0	$0	$0	$0	$0
Residential	6,073	5,906	$1,082,021,215	$2,504,557,357	$1,252,278,663	$4,838,857,235
Unknown	3	0	$0	$0	$0	$0
Utilities	18	0	$0	$0	$0	$0
Vacant	252	18	$92,868,093	$12,033,149	$0	$104,901,242
1 Meter (3.1 feet) of Sea-level Rise: 100-year (tidal) scenario Total	**6,608**	**6,022**	**$1,335,783,257**	**$2,838,257,116**	**$1,646,032,048**	**$5,820,072,421**
2 Meter (6.2 feet) of Sea-level Rise: 0-year (tidal) scenario						
Agricultural	9	0	$1,610,899	$0	$0	$1,610,899
Commercial	164	149	$263,027,297	$565,494,106	$565,494,106	$1,394,015,509
Government / Institutional	231	6	$1,966,366	$8,653,075	$8,653,075	$19,272,516
Industrial	197	179	$722,648,087	$1,320,517,706	$1,980,776,554	$4,023,942,347
Recreational	0	0	$0	$0	$0	$0
Residential	7,403	7,202	$1,374,471,551	$3,180,959,059	$1,590,479,520	$6,145,910,130
Unknown	5	0	$0	$0	$0	$0
Utilities	35	0	$0	$0	$0	$0
Vacant	311	20	$232,845,300	$13,106,129	$0	$245,951,429
2 Meter (6.2 feet) of Sea-level Rise: 0-year (tidal) scenario Total	**8,355**	**7,556**	**$2,596,569,500**	**$5,088,730,075**	**$4,145,403,255**	**$11,830,702,830**

Sea Level Rise Scenario/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
2 Meter (6.2 feet) of Sea-level Rise: 100-year (tidal) scenario						
Agricultural	10	0	$1,648,573	$0	$0	$1,648,573
Commercial	343	275	$611,078,034	$1,295,895,138	$1,295,895,138	$3,202,868,310
Government / Institutional	320	7	$18,729,824	$11,441,825	$11,441,825	$41,613,474
Industrial	381	355	$1,209,931,878	$2,445,802,896	$3,668,704,337	$7,324,439,111
Recreational	1	1	$12,614,040	$19,972,230	$19,972,230	$52,558,500
Residential	11,905	11,600	$2,371,091,630	$5,405,580,771	$2,702,790,342	$10,479,462,743
Unknown	6	0	$0	$0	$0	$0
Utilities	75	0	$0	$0	$0	$0
Vacant	400	22	$290,702,456	$13,413,255	$0	$304,115,711
2 Meter (6.2 feet) of Sea-level Rise: 100-year (tidal) scenario Total	**13,441**	**12,260**	**$4,515,796,435**	**$9,192,106,115**	**$7,698,803,872**	**$21,406,706,422**

Source: Cosmos 2021, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Critical Facilities and Infrastructure, and Community Lifelines

Coastal flooding and sea level rise presents a threat to critical facilities and infrastructure, and community lifelines. Critical infrastructure (like that owned by the USD) plays an immensely important role in our communities. According to the 2021 *Critical Infrastructure at Risk – Sea Level Rise Planning Guidance for California's Coastal Zone* by the California Coastal Commission, communities rely on roads, rail corridors, and related biking and pedestrian routes for transportation, and on water infrastructure for drinking water, wastewater service, and draining streets of rainwater. 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.

The following GIS analysis identifies critical facilities and infrastructure at risk to coastal flooding and sea level rise, followed by a discussion on vulnerability of community lifelines.

Critical Facilities and Infrastructure

As mentioned above, all USD facilities and assets are considered to be critical facilities. This analysis was shown on Table E-11 in the structure analysis above.

Community Lifelines

Coastal flooding and sea level rise present a threat to life and property, including community lifelines in the District and the USD Service Territory. Community lifelines that would be vulnerable to coastal flooding and sea level rise include:

- **Safety and Security** – District personnel may be called on to perform riskier duties during times of coastal flooding. This would be true in a coastal flood event.
- **Food, Hydration, Shelter** – Public health can also be at risk from flooding. Floodwater is often contaminated with sewage, which can lead to illness and affect clean drinking water**.**
- **Health and Medical** – There may be injuries and deaths from a coastal flood. Patient movement from accident scenes by EMS may also have to be rerouted.
- **Energy** – Coastal flooding and sea level rise could impact large areas of electric infrastructure, causing widespread power outages.
- **Communications** – Communication infrastructure can be inundated by a coastal flood event or sea level rise causing damage and an interruption in service. District messaging systems need to be deployed during these times to let the public know about road and lane closures, washouts, debris on roads, or other issues.
- **Transportation** – Highways and local roads may see extensive flooding. This can cause lane and road closures. These closures can affect District personnel as well as cause additional traffic issues for residents and impact evacuation routes.
- **Hazardous Material** – Hazardous material facilities can be affected by flooding. Releases during these times can be comingled with flood waters, contaminate drinking water, as well as create additional exposures to the environment.
- **Water Systems** – Any water (and wastewater) system located close to the coast may be affected by coastal flooding and sea level rise. Saltwater intrusion can cause significant impacts to these systems.

Generally, coastal flooding events are temporary events with flood waters receding back to pre-storm levels at the conclusion of the storm. Given the limited areas within the District prone to coastal flooding and the short duration of these events, community lifelines are not likely to be overwhelmed. However, sea level rise can create a permanent impact (or reduction) to the built environment causing many coastal areas to be uninhabitable as the water levels rise over time. Given the slow nature of sea level rise and limited areas prone to this hazard, the District should be able to address these concerns proactively ensuring that these community lifelines are not overwhelmed and remain operational.

Natural, Historic, and Cultural Resources

According to sealevelrise.org, 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. A major coastal flood event could have a devastating impact on the District. Large flood events can affect natural, historic, and cultural resources. Any of these that fall in the CoSMoS sea level rise scenarios shown on Figure E-6, Figure E-7, and Figure E-8 would be vulnerable. Specific natural, historic, and cultural resources at risk can be found in the respective city annexes to this Plan Update

Economic Assets and Community Activities of Value

Any economic asset located within areas prone to coastal flooding and sea level rise could be affected. While impacts to these assets may be more limited or short term during a coastal flood event, sea level rise can create a permanent impact (or reduction) to the built environment causing many coastal areas to be uninhabitable as the water levels rise over time. This could cause those businesses and economic assets within these areas to close or relocate. Community activities of value located in coastal areas may also have to be canceled or rescheduled. Specific economic assets and community activities of value at risk can be found in the respective city annexes to this Plan Update.

Impacts from Coastal Flood and Sea Level Rise

Coastal floods, sea level rise, and their impacts vary by timing (i.e., during extreme tide events), location, and severity of any given event. Based on the hazard analysis, it is evident that coastal flooding and sea level rise can significantly impact the low-lying coastal areas of the USD. The U.S. Environmental Protection Agency (EPA) noted specific impacts to water and wastewater utilities from floods:

- Infrastructure damage that can interrupt service.
- Breaks in pipes that result in sewage spills and low water pressure.
- Water intakes blocked by debris.
- Combined sewer overflows.
- Quality issues with source water and treated effluents.
- Power outages and communication loss.
- Limited or no access to facilities and water testing capabilities.
- Loss of power
- Costly repairs
- Dangerous conditions for personnel

These impacts may be exacerbated by the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

As discussed in the hazard profile section, climate change is anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no control over population changes, it merely reacts to them by providing additional (or reduced) services. Regarding land use, the District has no authority over how the cities it serves choose to develop land. It is unknown how changes in land use and development will affect coastal flooding and sea level rise in the District's service territory.

Future Development

Future development along coastal areas prone to coastal flooding and sea level rise are subject to the City's land use and development considerations, including development in hazard areas such as the City's floodplain ordinance (especially those in FEMA V and VE Zones). Over time, sea level rise may limit or prevent future development altogether in the coastal areas of the City. The District's new and future

infrastructure development takes into account sea level rise. ETSU project will renew and replace aging infrastructure, improve water quality in the San Francisco Bay through enhanced wastewater treatment processes and nutrient removal, and increase the facility's resiliency to extreme wet-weather events and climate change.

GIS Analysis

The District provided the ETSU future development area which was used as the basis for the inventory of future development areas for the District. Figure E-12, Figure E-13, and Figure E-14 show the locations of the future development areas overlayed on the CoSMoS Sea Level Rise Scenarios. Table E-14 shows the counts of each future development area in the City by Sea Level Rise Scenario. It should be noted that no facility falls in the Existing Conditions (Tidal) Sea Level Rise Scenario.

Figure E-12 Union Sanitary District – Future Development in Sea Level Rise Existing Conditions Scenarios

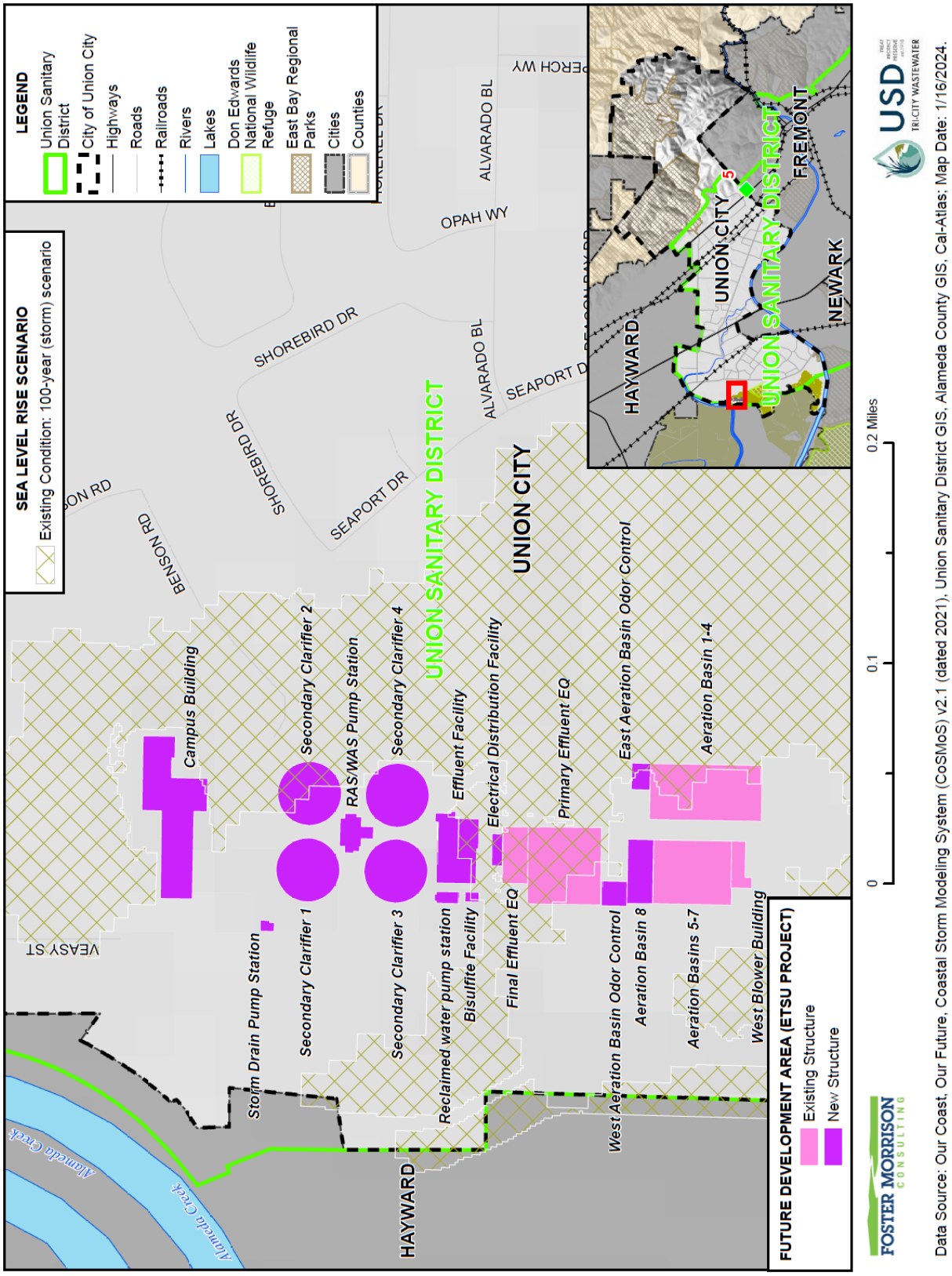


Figure E-13 Union Sanitary District – Future Development in Sea Level Rise 1-Meter Scenarios

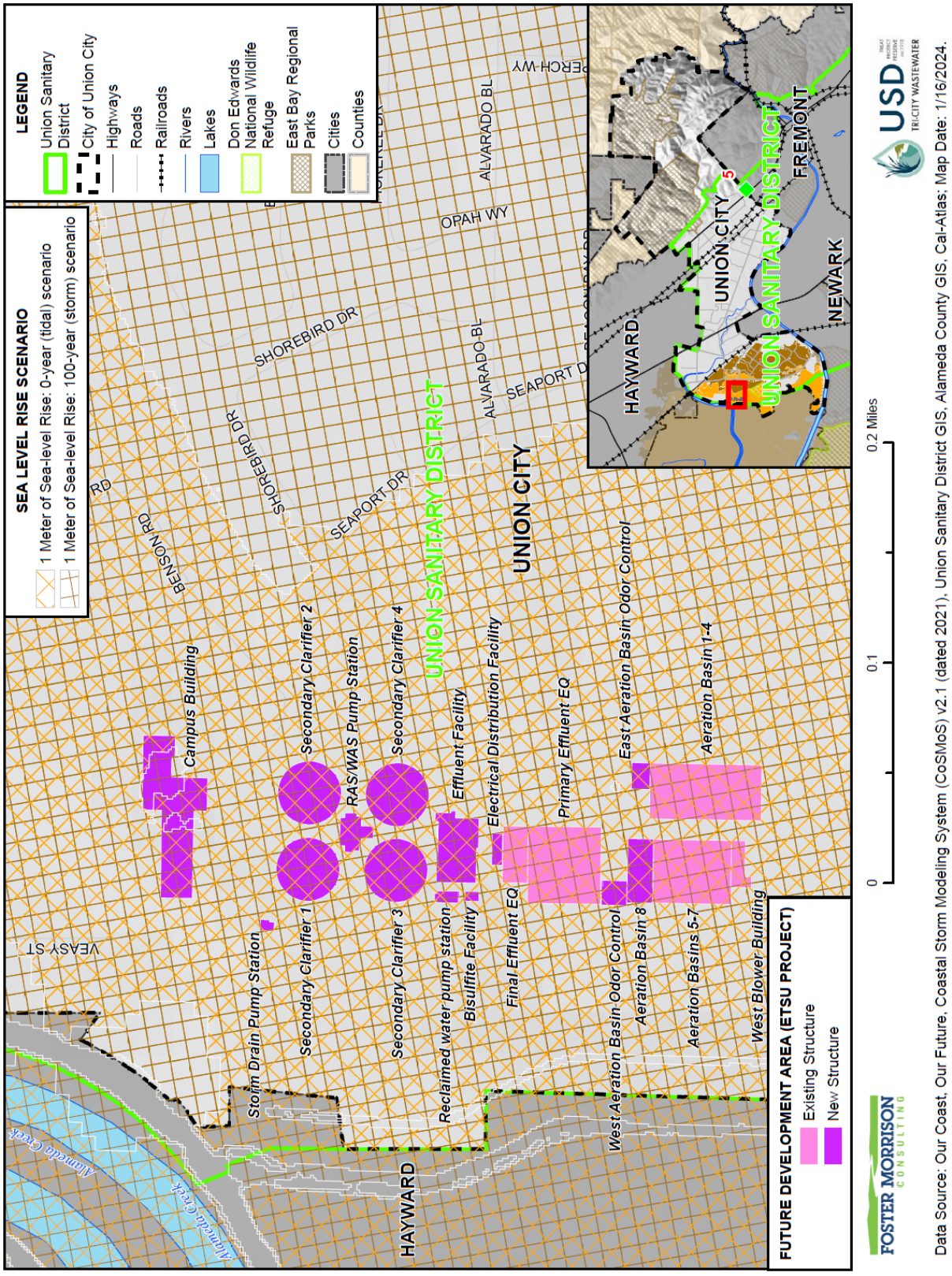


Figure E-14 Union Sanitary District – Future Development in Sea Level Rise 2-Meter Scenarios

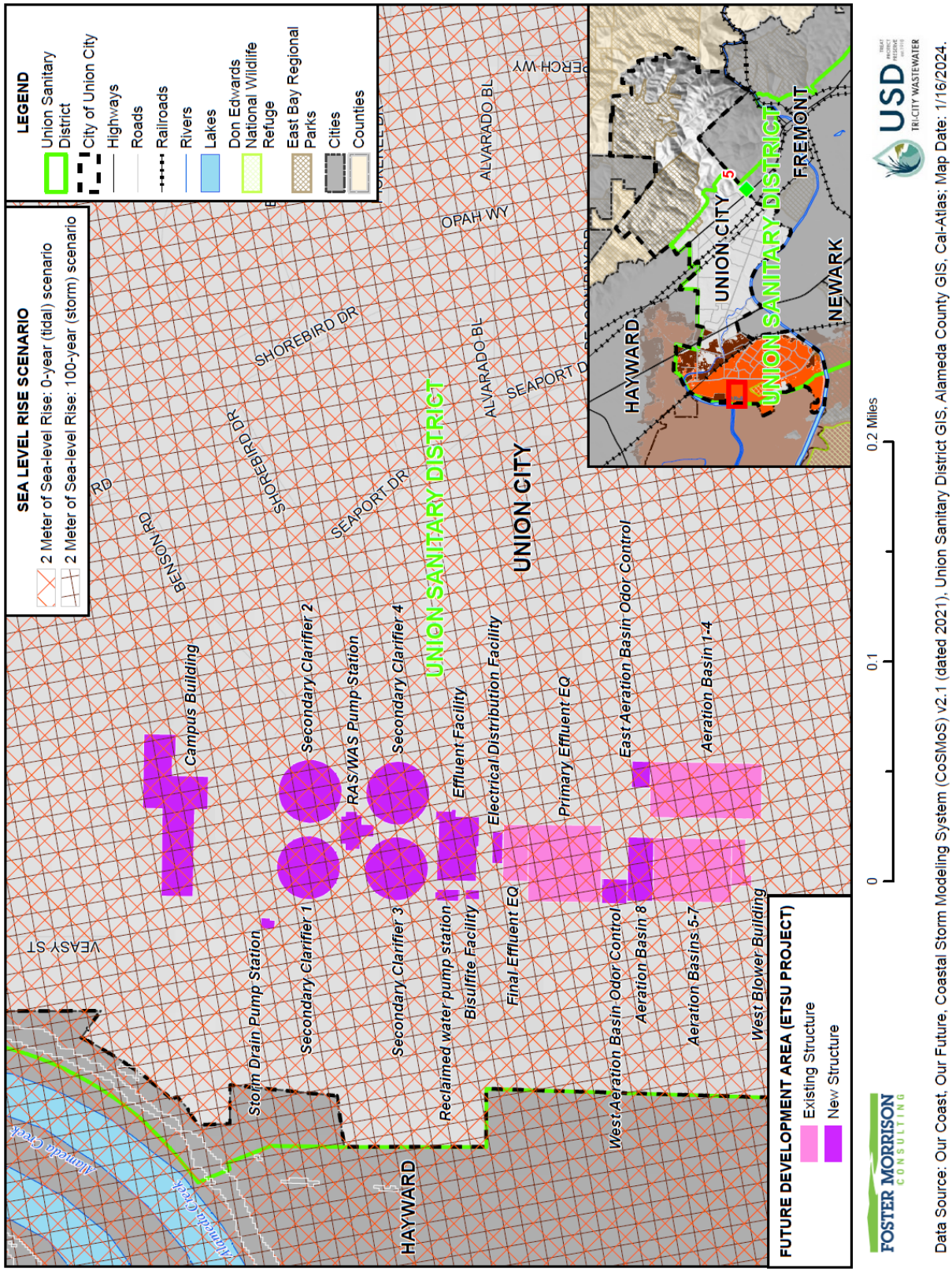


Table E-14 Union Sanitary District – Future Development Structure Names and Site Counts in Sea Level Rise Scenarios

Sea Level Rise / Future Development Area (ETSU Project) Type	Future Development Structure Name	Site Count
Existing Condition: 100-year (storm) scenario		
Existing Structure	Final Effluent EQ	1
	Primary Effluent EQ	1
	Total	**2**
New Structure	Bisulfite Facility	1
	Electrical Distribution Facility	1
	Total	**2**
Existing Condition: 100-year (storm) scenario Total		**4**
1 Meter (3.1 feet) of Sea-level Rise: 0-year (tidal) scenario		
Existing Structure	Aeration Basin 1-4	1
	Aeration Basins 5-7	1
	Final Effluent EQ	1
	Primary Effluent EQ	1
	West Blower Building	1
	Total	**5**
New Structure	Aeration Basin 8	1
	Bisulfite Facility	1
	Campus Building	1
	East Aeration Basin Odor Control	1
	Effluent Facility	1
	Electrical Distribution Facility	1
	RAS/WAS Pump Station	1
	Reclaimed water pump station	1
	Secondary Clarifier 1	1
	Secondary Clarifier 2	1
	Secondary Clarifier 3	1
	Secondary Clarifier 4	1
	Storm Drain Pump Station	1
	West Aeration Basin Odor Control	1
	Total	**14**
1 Meter (3.1 feet) of Sea-level Rise: 0-year (tidal) scenario Total		**19**
1 Meter (3.1 feet) of Sea-level Rise: 100-year (storm) scenario		
Existing Structure	Aeration Basin 1-4	1
	Aeration Basins 5-7	1

Sea Level Rise / Future Development Area (ETSU Project) Type	Future Development Structure Name	Site Count
	Final Effluent EQ	1
	Primary Effluent EQ	1
	West Blower Building	1
	Total	**5**
New Structure	Aeration Basin 8	1
	Bisulfite Facility	1
	Campus Building	1
	East Aeration Basin Odor Control	1
	Effluent Facility	1
	Electrical Distribution Facility	1
	RAS/WAS Pump Station	1
	Reclaimed water pump station	1
	Secondary Clarifier 1	1
	Secondary Clarifier 2	1
	Secondary Clarifier 3	1
	Secondary Clarifier 4	1
	Storm Drain Pump Station	1
	West Aeration Basin Odor Control	1
	Total	**14**
1 Meter (3.1 feet) of Sea-level Rise: 100-year (storm) scenario Total		**19**
2 Meter (6.2 feet) of Sea-level Rise: 0-year (tidal) scenario		
Existing Structure	Aeration Basin 1-4	1
	Aeration Basins 5-7	1
	Final Effluent EQ	1
	Primary Effluent EQ	1
	West Blower Building	1
	Total	**5**
New Structure	Aeration Basin 8	1
	Bisulfite Facility	1
	Campus Building	1
	East Aeration Basin Odor Control	1
	Effluent Facility	1
	Electrical Distribution Facility	1
	RAS/WAS Pump Station	1
	Reclaimed water pump station	1
	Secondary Clarifier 1	1

Sea Level Rise / Future Development Area (ETSU Project) Type	Future Development Structure Name	Site Count
	Secondary Clarifier 2	1
	Secondary Clarifier 3	1
	Secondary Clarifier 4	1
	Storm Drain Pump Station	1
	West Aeration Basin Odor Control	1
	Total	**14**
2 Meter (6.2 feet) of Sea-level Rise: 0-year (tidal) scenario Total		**19**
2 Meter (6.2 feet) of Sea-level Rise: 100-year (storm) scenario		
Existing Structure	Aeration Basin 1-4	1
	Aeration Basins 5-7	1
	Final Effluent EQ	1
	Primary Effluent EQ	1
	West Blower Building	1
	Total	**5**
New Structure	Aeration Basin 8	1
	Bisulfite Facility	1
	Campus Building	1
	East Aeration Basin Odor Control	1
	Effluent Facility	1
	Electrical Distribution Facility	1
	RAS/WAS Pump Station	1
	Reclaimed water pump station	1
	Secondary Clarifier 1	1
	Secondary Clarifier 2	1
	Secondary Clarifier 3	1
	Secondary Clarifier 4	1
	Storm Drain Pump Station	1
	West Aeration Basin Odor Control	1
	Total	14
2 Meter (6.2 feet) of Sea-level Rise: 100-year (storm) scenario Total		**19**

Source: CoSMoS 2021, Union Sanitary District

Dam Failure

Likelihood of Future Occurrence–Unlikely
Vulnerability–Low

Note: Though considered a low priority hazard by the District, due to its importance in California and Alameda County, dam failure is profiled here. It is not considered a priority hazard for USD for mitigation planning purposes.

Hazard Profile and Problem Description

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

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 Alameda County was shown in Section 4.3.8 in the Base Plan. There is no scale with which to measure dam failure. However, CA DWR Division of Safety of Dams (DSOD) assigns hazard ratings to dams within the State that provides information on the potential impact should a dam fail. The following two factors are considered when assigning hazard ratings: existing land use and land use controls (zoning) downstream of the dam. Dams are classified in four categories that identify the potential hazard to life and property: Low, Significant, High, and Extremely High. These were discussed in more detail in Section 4.3.8 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 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 DWR DSOD and California Office of Emergency Services (Cal OES) dam inundation areas for the District is shown on Figure E-15, Figure E-16, Figure E-17, and Figure E-18. Based on available data, the District falls within the inundation areas of multiple dams as detailed in Table E-15.

Figure E-15 Union Sanitary District – Extremely High Hazard Dam Inundation Areas from Dams Originating Outside the Tri-City Planning Area

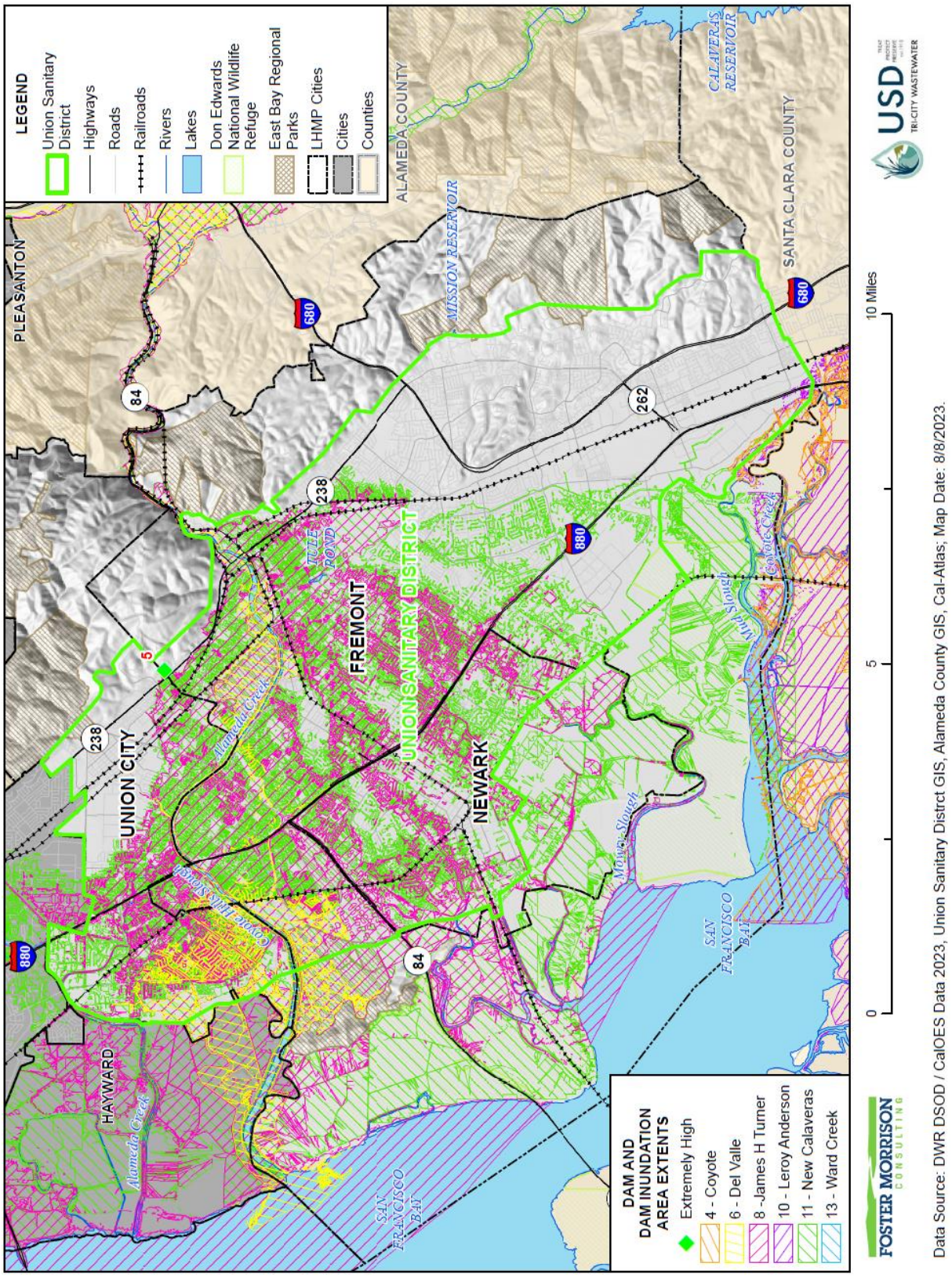


Figure E-16 Union Sanitary District – Extremely High Hazard Dam Inundation Areas from Dams Originating Inside the Tri-City Planning Area

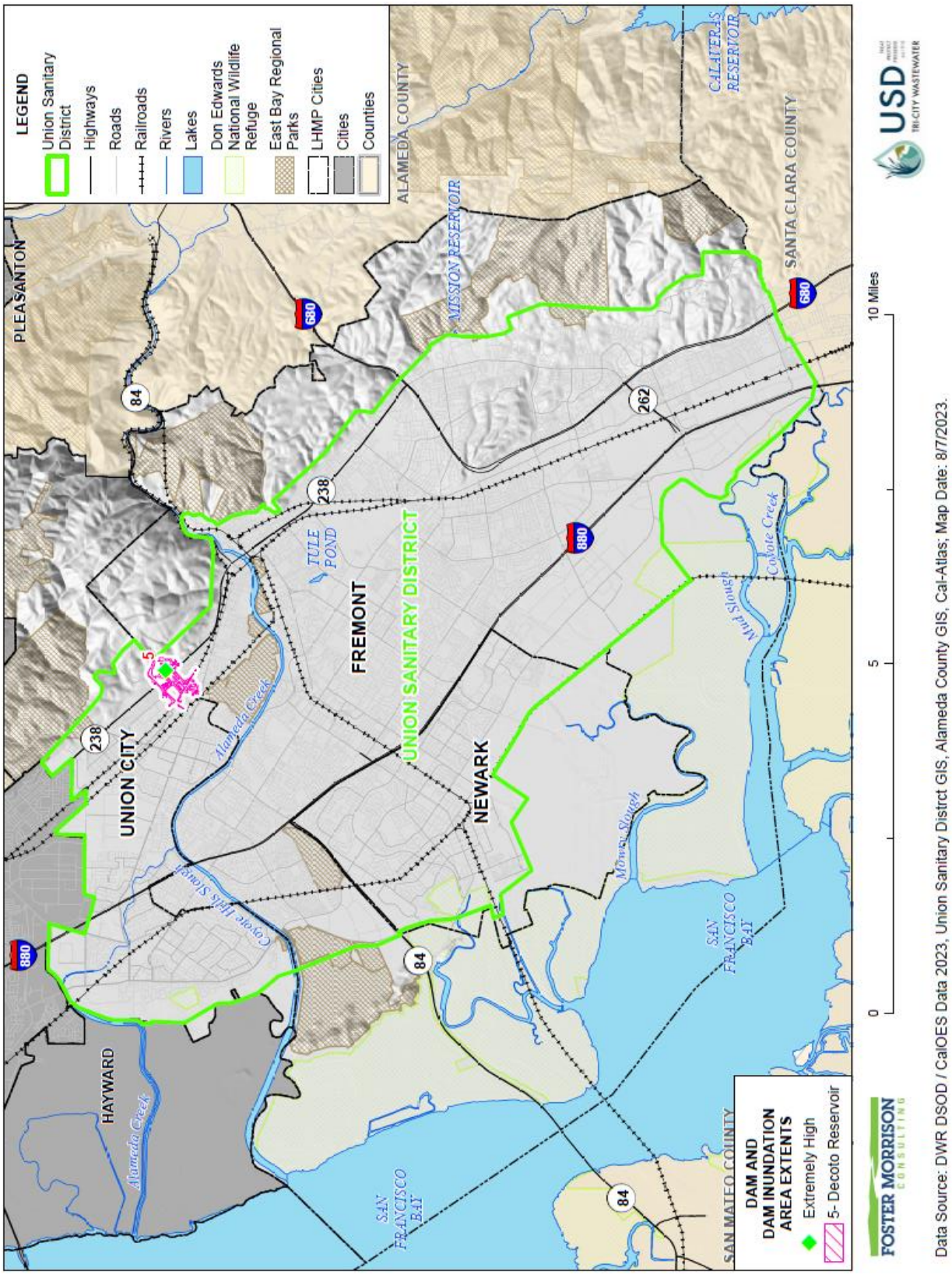


Figure E-17 Union Sanitary District – High Hazard Dam Inundation Areas from Dams Originating Inside the Tri-City Planning Area

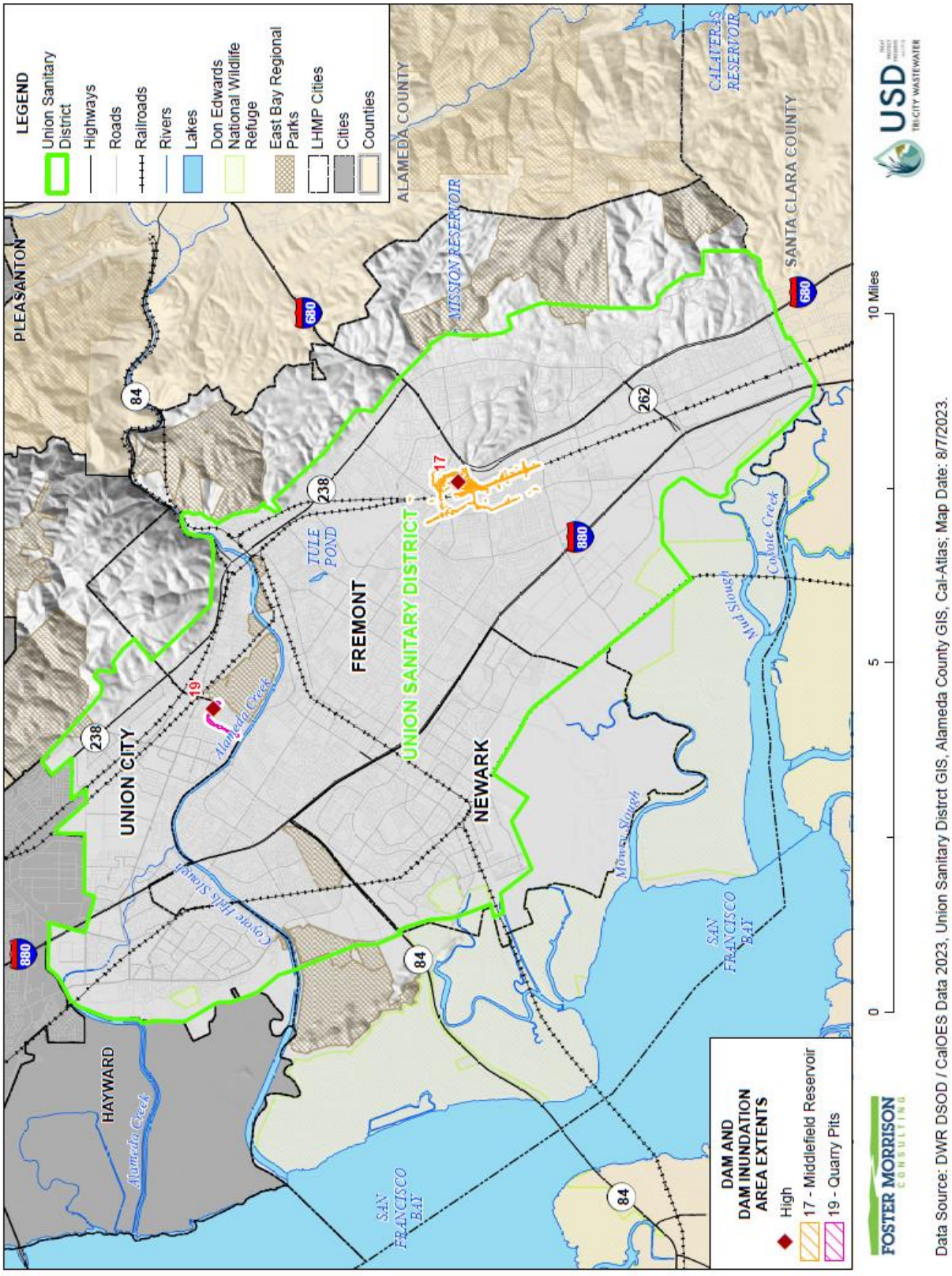


Figure E-18 Union Sanitary District – Significant Hazard Dam Inundation Areas from Dams Originating Inside the Tri-City Planning Area

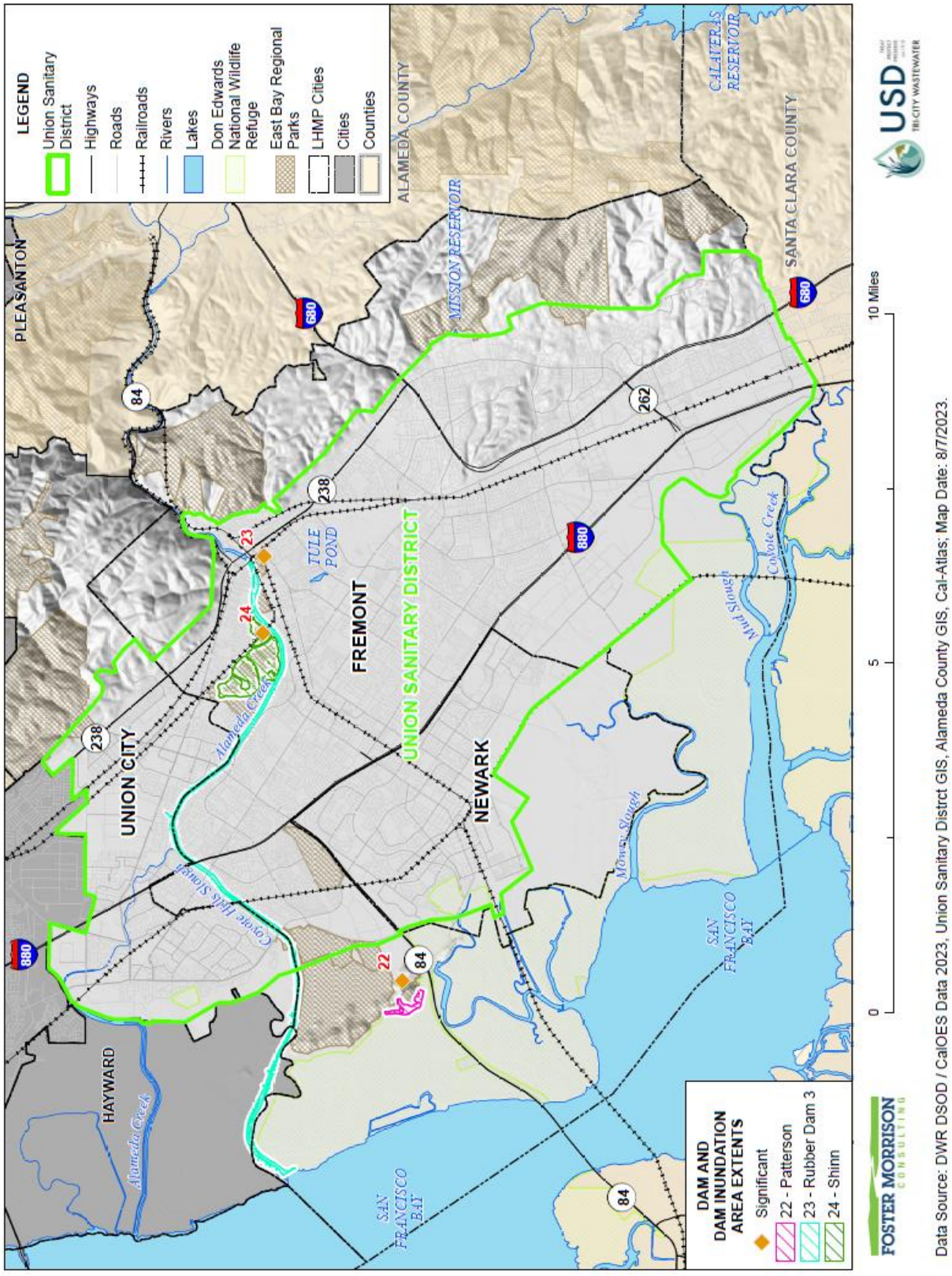


Table E-15 Union Sanitary District – Geographical Dam Inundation Extents

Dam Inundation Area	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Extremely High Hazard Dams						
Coyote	119.73	0.15%	3.51	0.01%	116.22	0.82%
Decoto Reservoir	64.56	0.08%	41.71	0.07%	22.84	0.16%
Del Valle	1,416.19	1.83%	220.27	0.35%	1,195.93	8.45%
James H Turner	29,783.26	38.43%	24,309.06	38.38%	5,474.21	38.66%
Leroy Anderson	150.75	0.19%	10.52	0.02%	140.23	0.99%
New Calaveras	31,348.54	40.45%	24,661.21	38.93%	6,687.33	47.23%
Ward Creek	1.45	0.00%	1.16	0.00%	0.29	0.00%
High Hazard Dams						
Middlefield Res	72.16	0.07%	58.66	0.09%	13.5	0.03%
Quarry Pits	14.43	0.01%	0	0.00%	14.43	0.04%

Source: Cal OES, DSOD, Cal Atlas

Past Occurrences

Disaster Declarations

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

USD Events

USD noted no past events of dam failure.

Vulnerability to Dam Failure

The vulnerability of the USD to dam failure flooding would vary 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 marked this as a low significance hazard. The District has limited concerns with dam failures, and currently it is not a priority for hazard mitigation.

Assets at Risk

Assets at risk from dam failure include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources, economic assets, and community activities of value). These are discussed in the following sections.

People and Populations

District Populations

District employees (and contractors) may be affected by dams that intersect District facilities as shown below on Table E-17.

Service Territory Populations

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 unsheltered, those with limited mobility, and those that lack the resources to leave the area. District residents that live in these dam inundation areas are often 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.

To future evaluate the impact to the USD Service Territory's residential populations located in these hazard areas, a separate analysis was performed to determine residential populations in the dam inundation areas. The DSOD and Cal OES dam inundation areas were overlayed on the parcel layer. Those residential parcel centroids that intersect the dam inundation areas were counted and multiplied by the Census Bureau average household factors for each City in the Planning area. This is shown in Table E-16.

Table E-16 Union Sanitary District Service Territory – Improved Residential Parcels and Population by Dam Inundation Area

Hazard Rating and Location/Dam Inundation	Improved Residential Parcels	Population
Extremely High Hazard Dams Inside Planning Area		
Decoto	463	1,491
Extremely High Hazard Dams Outside Planning Area		
New Calaveras	75,470	243,013
Coyote	0	0
Del Valle	5,122	16,493
James Turner	57,422	184,899
Leroy Anderson	0	0
Ward Creek	0	0
High Hazard Dams		
Middlefield	783	2,521

Hazard Rating and Location/Dam Inundation	Improved Residential Parcels	Population
Quarry Pits	1	3
Significant Hazard Dams		
Patterson	0	0
Rubber Dam 3	0	0
Shinn	0	0

Source: Cal OES, DSOD, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023), US Census Bureau

Structures

The analysis for structures in the District is separated out into two separate analyses:

- **USD Facility Assets** – These are the facilities, structures, and other assets which USD owns and maintains operational control.
- **Service Territory Structures** – This is comprised of the parcels and structures associated with the residents and businesses located within USD's Service Territory who use the wastewater services provided by USD.

District Facility Structures

The District owns assets, including facilities and structures, which may be at risk to dam failure flooding. Structures in dam inundation areas are at risk and depending on flood depths, can range from slight damage to totally inundated. Analysis by extremely high hazard dam, high hazard, and significant hazard dam follows.

GIS was used to determine the possible impacts of dam inundation flooding on USD structure assets. The methodology described in Section E.4.1 (in the Structures section) above was followed in determining USD structures at risk to dam failure. The results are presented as follows:

- Figure E-19 shows the USD facilities and structures in the DSOD Extremely High Hazard Dam inundation areas from dams originating outside the Tri-City Planning Area. Specific facilities and structures in this inundation area are detailed in Table E-17. Table E-18 shows the linear assets that fall in all dam inundation areas.
- Figure E-20 shows the USD facilities and structures in the DSOD High Hazard Dam inundation areas from dams originating outside the Tri-City Planning Area. No USD point assets fall in this inundation area, so no tabular analysis was performed. Table E-18 shows the linear assets that fall in all dam inundation areas.
- Figure E-21 shows the USD facilities and structures in the DSOD Significant Hazard Dam inundation areas from dams originating outside the Tri-City Planning Area No USD point assets fall in this inundation area, so no tabular analysis was performed. Table E-18 shows the linear assets that fall in all dam inundation areas.

Figure E-19 Union Sanitary District – Assets in Extremely High Hazard Dam Inundation Areas from Dams Originating Outside the Tri-City Planning Area

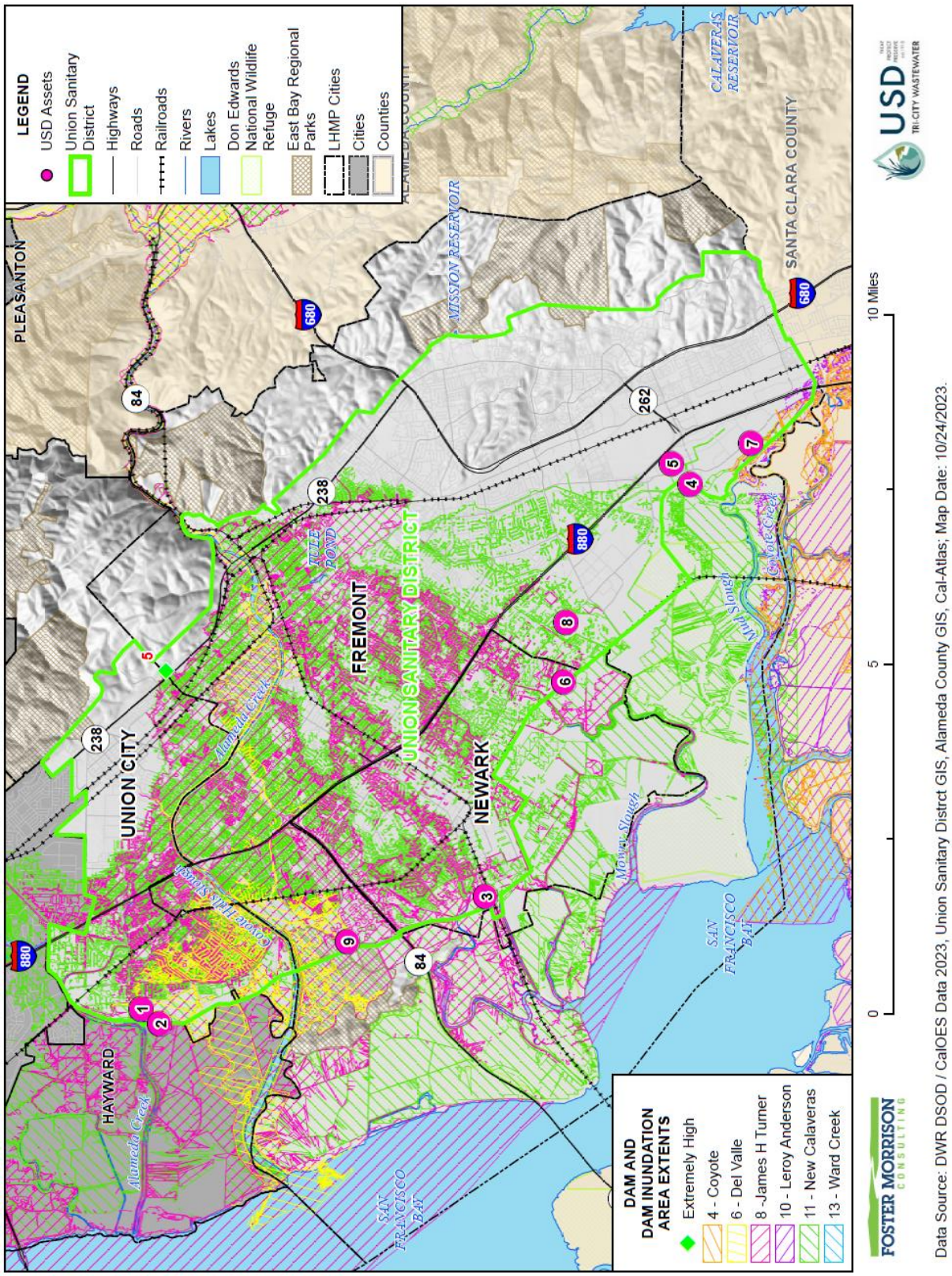


Figure E-20 Union Sanitary District – Assets in High Hazard Dam Inundation Areas from Dams Originating Inside the Planning Area

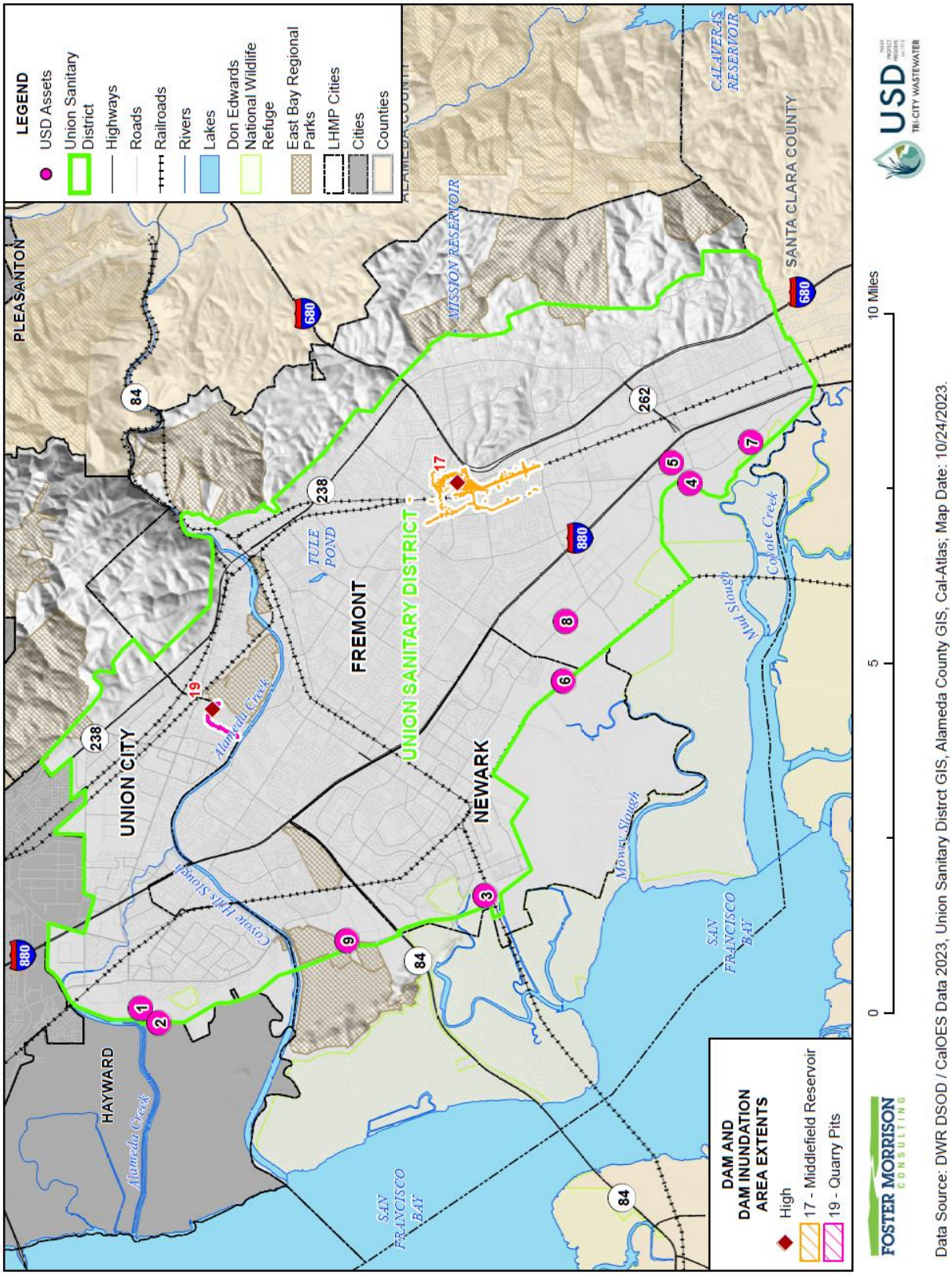


Figure E-21 Union Sanitary District – Assets in Significant Hazard Dam Inundation Areas from Dams Originating Inside the Planning Area

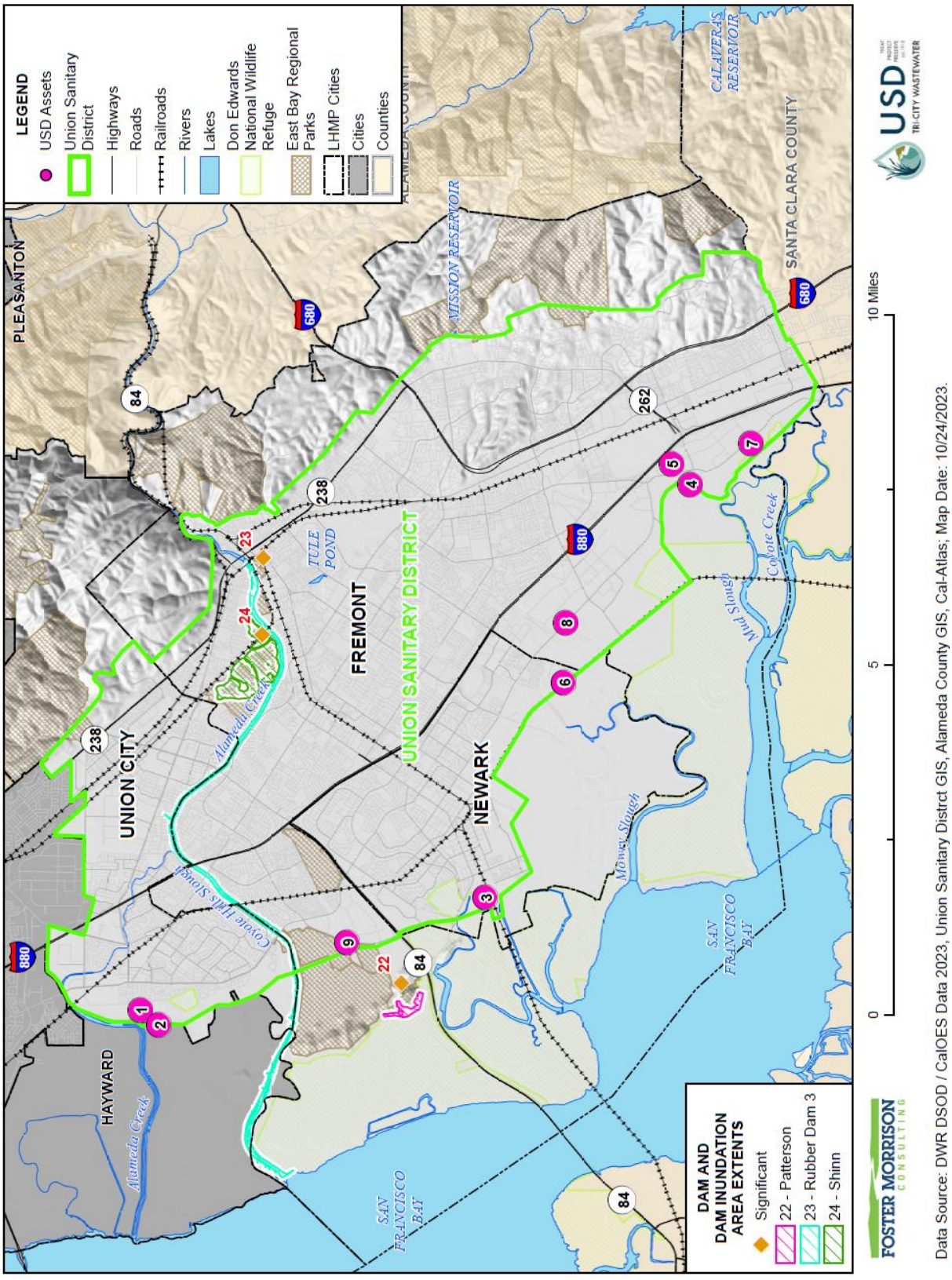


Table E-17 Union Sanitary District – Assets by USD Site in Extremely High Hazard Dam Inundation Areas from Dams Originating Outside the Tri-City Planning Area

Dam Inundation Area/ Site Number	Site Location / Name	Asset Name	Asset Value
James H Turner			
9	Paseo Padre LS	Lift Station	$2,900,348
James H Turner Total			**$2,900,348**
New Calaveras			
1	Alvarado Treatment Plant	Water Treatment Plant	$313,363,953
2	East Bay Dischargers Pump Station	Dischargers Pump Station	$14,932,627
9	Paseo Padre LS	Lift Station	$2,900,348
New Calaveras Total			**$331,196,928**

Source: Cal OES/DSOD; USD GIS

Table E-18 Union Sanitary District – Linear Assets in Dam Inundation Areas

Dam Inundation Area / Asset	Asset Length (in miles)	Total Asset Value
Coyote Dam (Extremely High Dam Inundation Area outside the Planning Area)		
Sewer Collection System (Gravity Flow Pipeline)	0.024	$99,898
Leroy Anderson Dam (Extremely High Dam Inundation Area outside the Planning Area)		
Sewer Collection System (Gravity Flow Pipeline)	0.084	$354,700
James H Turner Dam (Extremely High Dam Inundation Area outside the Planning Area)		
Sewer Force Main (Pressurized Transport Pipeline)	9.177	$159,903,989
Sewer Collection System (Gravity Flow Pipeline)	328.498	$1,387,575,456
Del Valle Dm		
Sewer Force Main (Pressurized Transport Pipeline)	3.459	$60,265,856
Sewer Collection System (Gravity Flow Pipeline)	40.519	$171,150,735
New Calaveras Dam (Extremely High Dam Inundation Area inside the Planning Area)		
Sewer Force Main (Pressurized Transport Pipeline)	16.710	$291,162,973
Sewer Collection System (Gravity Flow Pipeline)	465.506	$1,966,296,745
Decoto Reservoir (Extremely High Dam Inundation Area inside the Planning Area)		
Sewer Collection System (Gravity Flow Pipeline)	3.835	$16,198,809
Middlefield Reservoir (High Hazard Dam inside the Planning Area)		
Sewer Collection System (Gravity Flow Pipeline)	0.485	$2,048,656
Rubber Dam #3 (Significant Hazard Dam inside the Planning Area)		
Sewer Force Main (Pressurized Transport Pipeline)	0.063	$1,105,439
Sewer Collection System (Gravity Flow Pipeline)	0.056	$236,045

Source: Cal OES/DSOD; USD GIS

Service Territory Structures

Structures in the District Service Territory have some measure of risk to dam failure. Dam failure flooding can affect the built environment within the District. Structures in dam inundation areas are at risk and depending on flood depths, can range from slight damage to totally inundated. Analysis by extremely high, high, and significant hazard dam follows.

GIS was used to determine the possible impacts of dam inundation flooding within the USD. The methodology described in Section 4.3.8 of the Base Plan was followed in determining structures and values at risk to dam failure. Tables showing the property use, improved parcel count, improved values, estimated contents, and total values that fall in dam inundation areas in the District are presented below by hazard class and by dam. The results are presented below by:

- Extremely High Hazard Dams Originating Inside the Planning Area (Table E-19)
- Extremely High Hazard Dams Originating Outside the Planning Area (Table E-20, Table E-21, Table E-22, Table E-23, Table E-24, and Table E-25)
- High Hazard Dams Originating Inside the Planning Area (Table E-26 and Table E-27)
- Significant Hazard Dams Originating Inside the Planning Area

Extremely High Hazard Dams Originating Inside the Planning Area

Table E-19 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Decoto Reservoir Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	1		$0	$0	$0
Commercial	8	4	$8,191,382	$22,288,556	$30,479,938
Government / Institutional	30	0	$0	$0	$0
Industrial	0	0	$0	$0	$0
Recreational	0	0	$0	$0	$0
Residential	483	464	$119,229,585	$267,847,534	$387,077,119
Unknown	0	0	$0	$0	$0
Utilities	8	0	$0	$0	$0
Vacant	12	0	$1,416,808	$0	$1,416,808
Union Sanitary District Total	**542**	**468**	**$128,837,775**	**$290,136,090**	**$418,973,865**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Extremely High Hazard Dams Originating Outside the Planning Area

Table E-20 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in New Calaveras Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	10	0	$1,648,573		
Commercial	1,917	1,257	$2,222,754,861	$4,150,039,042	$4,150,039,042
Government / Institutional	1,555	104	$106,444,888	$215,625,871	$215,625,871
Industrial	418	394	$1,124,730,071	$2,368,593,554	$3,552,890,314
Recreational	13	13	$9,146,282	$21,316,393	$21,316,393
Residential	77,258	75,438	$14,381,846,212	$31,724,013,430	$15,862,007,105
Unknown	23	0	$2,365,132	$0	$0
Utilities	253	0	$0	$0	$0
Vacant	829	43	$564,656,741	$112,036,310	$0
Union Sanitary District Total	**82,276**	**77,249**	**$18,413,592,760**	**$38,591,624,600**	**$23,801,878,725**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Table E-21 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Coyote Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	1	0	$146,517	$0	$0
Commercial	1	1	$24,541,000	$43,504,500	$43,504,500
Government / Institutional	4	0	$0	$0	$0
Industrial	17	11	$83,611,988	$122,253,048	$183,379,571
Recreational	0	0	$0	$0	$0
Residential	0	0	$0	$0	$0
Unknown	2	0	$0	$0	$0
Utilities	0	0	$0	$0	$0
Vacant	1	0	$113,998	$0	$0
Union Sanitary District Total	**26**	**12**	**$108,413,503**	**$165,757,548**	**$226,884,071**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Table E-22 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Del Valle Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	0	0	$0	$0	$0
Commercial	55	17	$37,274,698	$169,559,033	$169,559,033
Government / Institutional	303	14	$3,751,315	$15,521,676	$15,521,676
Industrial	10	10	$83,157,764	$354,539,392	$531,809,088
Recreational	0	0	$0	$0	$0
Residential	5,197	5,122	$1,096,147,522	$2,499,533,528	$1,249,766,759
Unknown	0	0	$0	$0	$0
Utilities	30	0	$0	$0	$0
Vacant	24	2	$50,713,079	$361,166	$0
Union Sanitary District Total	**5,619**	**5,165**	**$1,271,044,378**	**$3,039,514,795**	**$1,966,656,556**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Table E-23 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in James Turner Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	9		$1,502,056	$0	$0
Commercial	1,391	871	$1,541,078,233	$3,008,862,641	$3,008,862,641
Government / Institutional	1,241	86	$90,769,538	$179,717,653	$179,717,653
Industrial	132	119	$632,706,846	$1,516,291,966	$2,274,437,947
Recreational	9	9	$8,891,450	$20,832,638	$20,832,638
Residential	58,808	57,413	$10,754,989,813	$24,223,090,174	$12,111,545,167
Unknown	19	0	$2,365,132	$0	$0
Utilities	176	0	$0	$0	$0
Vacant	434	22	$285,387,660	$94,115,108	$0
Union Sanitary District Total	**62,219**	**58,520**	**$13,317,690,728**	**$29,042,910,180**	**$17,595,396,046**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Table E-24 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Leroy Anderson Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	1	0	$146,517	$0	$0
Commercial	11	10	$64,573,712	$99,590,682	$99,590,682

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Government / Institutional	38	0	$0	$0	$0
Industrial	18	12	$66,450,832	$101,317,605	$151,976,407
Recreational	0	0	$0	$0	$0
Residential	0	0	$0	$0	$0
Unknown	4	0	$0	$0	$0
Utilities	3	0	$0	$0	$0
Vacant	6	0	$363,998	$0	$0
Union Sanitary District Total	**81**	**22**	**$131,535,059**	**$200,908,287**	**$251,567,089**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Table E-25 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Ward Creek Dam Inundation Area by Property Use

Jurisdiction/ Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	0	0	$0	$0	$0
Commercial	4	4	$5,281,147	$1,905,723	$7,186,870
Government / Institutional	1	0	$0	$0	$0
Industrial	0	0	$0	$0	$0
Recreational	0	0	$0	$0	$0
Residential	0	0	$0	$0	$0
Unknown	0	0	$0	$0	$0
Utilities	0	0	$0	$0	$0
Vacant	0	0	$0	$0	$0
Union Sanitary District Total	**5**	**4**	**$5,281,147**	**$1,905,723**	**$7,186,870**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

High Hazard Dams Originating Inside the Planning Area

Table E-26 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Middlefield Reservoir Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	0	0	$0	$0	$0
Commercial	42	37	$52,719,071	$97,409,831	$150,128,902
Government / Institutional	51	4	$1,916,614	$13,094,447	$15,011,061

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Industrial	30	27	$17,773,201	$17,559,152	$35,332,353
Recreational	0	0	$0	$0	$0
Residential	195	183	$57,051,193	$101,297,237	$158,348,430
Unknown	1	0	$0	$0	$0
Utilities	6	0	$0	$0	$0
Vacant	99	84	$11,093,754	$21,717,730	$32,811,484
Union Sanitary District Total	**424**	**335**	**$140,553,833**	**$251,078,397**	**$391,632,230**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Table E-27 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Quarry Pits Dam Inundation Area by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Total Value
Agricultural	0	0	$0	$0	$0
Commercial	0	0	$0	$0	$0
Government / Institutional	16	0	$0	$0	$0
Industrial	0	0	$0	$0	$0
Recreational	0	0	$0	$0	$0
Residential	1	1	$417,376	$973,879	$486,940
Unknown	0	0	$0	$0	$0
Utilities	0	0	$0	$0	$0
Vacant	0	0	$0	$0	$0
Union Sanitary District Total	**17**	**1**	**$417,376**	**$973,879**	**$486,940**

Source: DSOD, Cal OES, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Significant Hazard Dams Originating Inside the Planning Area

After a review of significant hazard dams and their risk to the USD Service Territory, it was found that no improved parcels are affected by the significant hazard dam inundation areas. Only 5 unimproved parcels with no associated values fell in this area. Therefore, no tabular analysis was performed.

Critical Facilities and Infrastructure, and Community Lifelines

Dam failure presents a threat to critical facilities and infrastructure, and community lifelines. The following analysis discusses critical facilities and infrastructure, followed by community lifelines.

Critical Facilities and Infrastructure

As mentioned above, all USD facility assets are considered to be critical facilities. This analysis was shown on Table E-17 in the dam failure structure analysis above.

Community Lifelines

Dam failure flooding presents a threat to life and property, including lifelines in the District. A catastrophic dam failure could challenge local response capabilities and require evacuations to save lives. Community lifelines that would be at risk to dam failure flooding include:

- **Safety and Security** – District personnel may be called on to perform riskier duties during times of heavy rains and flooding. This would be especially true in a dam failure event.
- **Food, Hydration, Shelter** – Public health can also be at risk from flooding. Floodwater is often contaminated with sewage, which can lead to illness and affect clean drinking water.
- **Health and Medical** – There will likely be multiple injuries and deaths from a dam failure. Patient movement from accident scenes by EMS may have to be rerouted. Public health can be at risk from flooding caused by dam failure.
- **Energy** – dam failure could impact large areas of above ground electric infrastructure, causing widespread power outages.
- **Communications** – an influx of service calls to dispatch centers for reporting of flooding, power outages, downed trees, or other issues can occur. Messaging systems need to be deployed during these times to let the public know about inundated areas, road and lane closures, washouts, and debris on roads.
- **Transportation** – highways and local roads may see extensive flooding. This can cause lane closures or road closures. These closures can affect District response personnel as they travel to District sites.
- **Hazardous Material** – hazardous material facilities can be affected by flooding. Spills during these times can cause incidents to drinking water, as well as additional exposure to the environment.
- **Water Systems** – Any water system located in a dam inundation area may be affected by dam failure flooding. This is true of USD's collection system.

A large dam failure event could overwhelm many facilities in the District, as well as its Service Territory. As shown on the maps and tables above, there are multiple dams that would affect large swaths of the USD Service Territory. A failure of these dams may be able to temporarily overwhelm the community lifelines in place in the District.

Natural, Historic, and Cultural Resources

A major dam failure event and associated flooding could have a devastating impact on the District including its Service Territory. 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 flood events. Specific natural, historic, and cultural facilities at risk can be found in the respective city annexes to this Plan Update.

Economic Assets and Community Activities of Value

As shown on the maps and tables above, there are multiple dams that would affect large swaths of the District. Most economic assets of the District's service territory would be at least temporarily disrupted. Many of these would come back online relatively quickly after a dam failure flood event, but some would take longer to re-engage in business. Some economic assets would be damaged to the point where the business or area would no longer be economically viable to continue to operate. Depending on the dam that failed, most community activities of value would be affected if they occurred during dam failure flooding. More information on these economic assets and community activities of value can be found in the respective city annexes to this Plan Update.

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 and associated economic losses can also be significant.

Other impacts associated with dam failure are 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.

The EPA noted specific impacts to water and wastewater utilities from dam failures and floods:

- Infrastructure damage that can interrupt service.
- Breaks in pipes that result in sewage spills and low water pressure.
- Water intakes blocked by debris.
- Combined sewer overflows.
- Quality issues with source water and treated effluents.
- Power outages and communication loss.
- Limited or no access to facilities and water testing capabilities.
- Loss of power
- Costly repairs
- Dangerous conditions for personnel

These impacts may be exacerbated by the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

As discussed in the hazard profile section, climate change is anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no control over population changes, it merely reacts to them by providing additional (or reduced) services. Regarding land use, the District has no authority over how the cities it serves choose to develop land. It is unknown how changes in land use and development will affect dam failure in the District's service territory.

Future Development

The District has no control over future development that occurs downstream of its dams.

GIS Analysis

The District provided the ETSU future development area which was used as the basis for the inventory of future development areas for the District. Figure E-22 show the locations of the future development areas overlayed on the dam inundation areas that intersect the future development areas (only the Extremely High Hazard dams from outside the County affect District future development areas). Table E-28 shows the future development structures and counts and which dam inundation area they fall in.

Figure E-22 Union Sanitary District – Future Development in Extremely High Hazard Dam Inundation Areas from Dams Outside the Planning Area

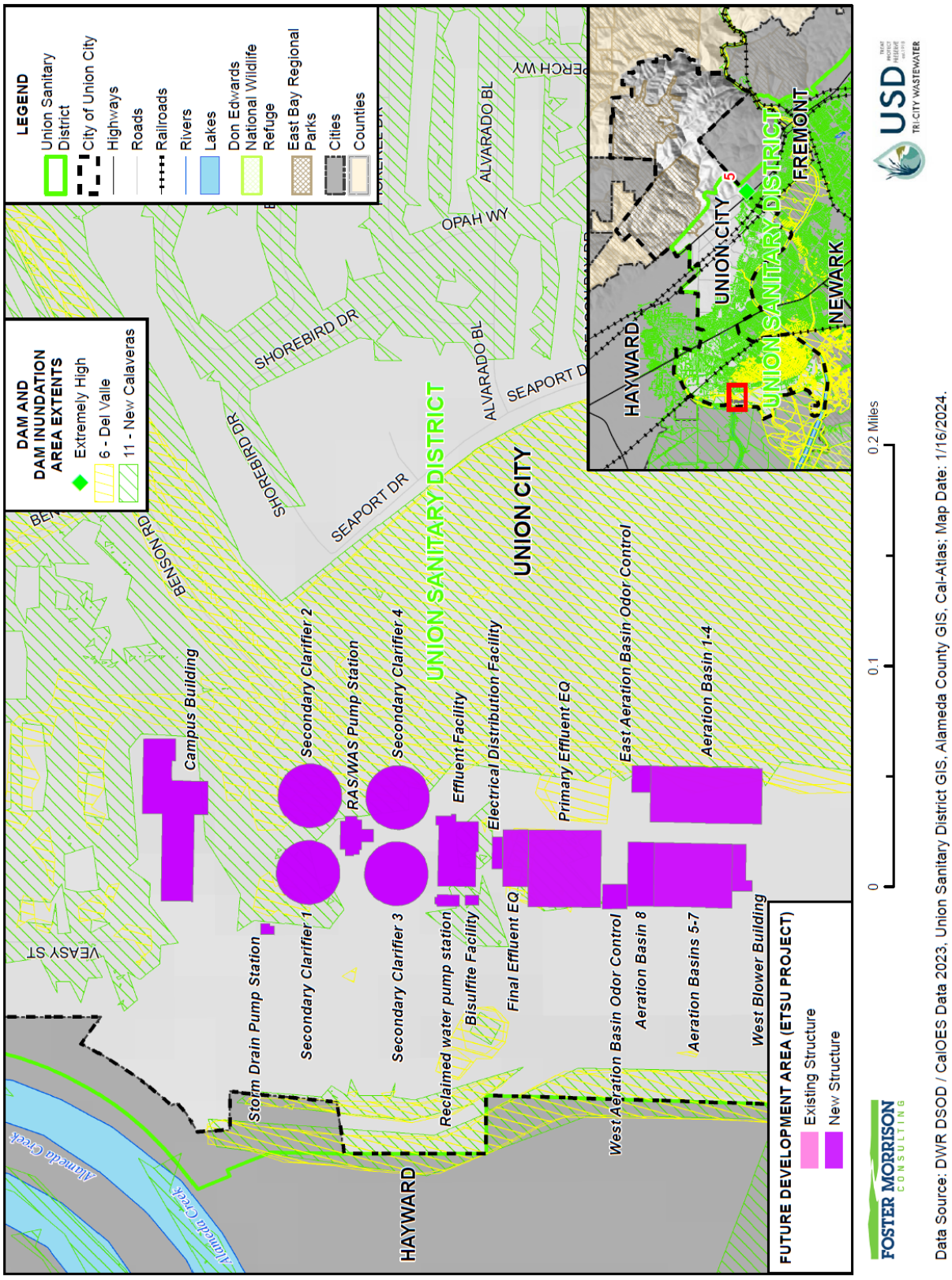


Table E-28 Union Sanitary District – Future Development Structure Names and Site Counts in Extremely High Hazard Dam Inundation Areas from Dams Outside the Planning Area

Dam Inundation Area / Future Development Area (ETSU Project) Type	Future Development Structure Name	Site Count
Del Valle		
Existing Structure	Final Effluent EQ	1
	Total	**1**
New Calaveras		
Existing Structure	Final Effluent EQ	1
	Primary Effluent EQ	1
	Total	**2**
New Structure	Secondary Clarifier 1	1
	Secondary Clarifier 2	1
	Secondary Clarifier 4	1
	Total	**3**
Total		**5**

Source: Cal OES, DSOD, Union Sanitary District

Drought & Water Shortage

Likelihood of Future Occurrence–Likely
Vulnerability–High

Hazard Profile and Problem Description

Drought is a complex issue involving many factors—it occurs when a normal amount of precipitation and snow is not available to satisfy an area's usual water-consuming activities. Drought can often be defined regionally based on its effects. Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically. Drought affects different sectors in different ways and with varying intensities. Adequate water is the most critical issue and is critical for agriculture, manufacturing, tourism, recreation, and commercial and domestic use. Drought has also affected tree mortality in the area in the past. As the population in the area continues to grow, so will the demand for water.

Location and Extent

Drought and water shortage are regional phenomena. The whole of the Tri-City Planning Area, as well as the whole of the District, is at risk. The US Drought Monitor categorizes drought conditions with the following scale:

- None
- D0 – Abnormally dry
- D1 – Moderate Drought

- D2 – Severe Drought
- D3 – Extreme drought
- D4 – Exceptional drought

Drought has a slow speed of onset and a variable duration. Drought can last for a short period of time, which does not usually affect water shortages and for longer periods. Should a drought last for a long period of time, water shortage becomes a larger issue. Current drought conditions in the District are shown in Section 4.3.9 of the Base Plan.

Past Occurrences

Disaster Declarations

There have been two state and one federal disaster declaration from drought. This can be seen in Table E-29.

Table E-29 Alameda County – State and Federal Drought Disaster Declarations 1950-2023

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Drought	2	2008, 2014	1	1977

Source: Cal OES, FEMA

USD Events

USD noted no past events that have caused damages or issues in the District.

Vulnerability to Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the District, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. The vulnerability of USD to drought may vary and include reduction in water supply, increased costs to treat water, impacts to natural resources, and an increase in dry fuels and tree dieback.

Local Concerns

Water shortages impact USD's wastewater treatment process. Water shortages can impact the cleaning process of USD sewer mains within the public areas of the District. The District noted that tree mortality and drought are minor issues. They were discussed in Section 4.3.17 of the Base Plan.

Assets at Risk

Assets at risk from drought and water shortage include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections.

People and Populations

District Populations

District staff (and contractors) are not expected to be directly affected by drought and water shortages.

Service Territory Populations

The people and populations of the USD Service Territory are not directly affected by drought; although, their turfed areas, trees, and other water dependent resources can all be affected. In extreme drought conditions, however, residents and other populations within the District's Service Territory may be vulnerability to drought and water shortage issues. Water quality can be impacted causing health problems, especially to vulnerable populations where access to clean water supplies can be more challenging. Drought and water shortage can lead to an increase in wildfires threatening District's Service Territory residents. Water shortages can have an effect on all of the population in the District's Service Territory, but often have a greater effect on the unhoused and other vulnerable populations that may be unable to access clean drinking water during shortages. During periods of drought as the costs of water usage may increase, those who are economically disadvantaged may be unable to afford the increased costs of potable water.

Structures

Structures in the District have a limited vulnerability to drought and water shortage. It is the secondary hazard of drought (wildfire) which causes risks to structures. Drought can also stress trees, causing die off. These trees may fall on structures adjacent to them.

Critical Facilities and Infrastructure, and Community Lifelines

Most critical facilities and infrastructure have a limited vulnerability to drought and water shortage. Should drought conditions be severe enough to cause water shortage reliability issues, some facilities and infrastructure may be affected. Water and wastewater systems may be impacted during times of reduced water supply and need to employ contingencies to remain functional and fully operational. Other water dependent systems may also be adversely affected. Further, the secondary hazard of drought (increased potential for spread of urban fires and wildfire) can pose a significant risk to critical facilities and infrastructure. Drought can also stress trees, causing die off. These trees may fall on critical infrastructure adjacent to them and impact power lines and other utilities.

While limited, community lifelines can have a vulnerability to drought and water shortage. This includes:

- **Safety and Security** – Agencies may need to assist in providing alternative water supplies. Agencies may also need to staff locations where water is distributed.

- **Food, Hydration, Shelter** – Drought can limit agricultural production. Additional water supplies may need to be procured.
- **Health and Medical –** Additional water supplies may be required for these facilities to remain fully operational during drought and water shortages.
- **Energy –** Sufficient water is required to generate electricity and power. Additional fuels and power may be required to move water to and from locations that need it.
- **Communications** – Most communication systems will not be affected. In extreme instances, additional messaging may be required during drought and water shortages.
- **Water Systems** – During period of drought and water shortage, additional pressure may be put on water companies to secure additional supplies. With reductions in available water, the ability of wastewater systems to effectively treat wastewater may be impacted.

It is unlikely that any of these community lifelines would be overwhelmed by drought and water shortages.

Natural, Historic, and Cultural Resources

Drought and water shortage can have a significant impact on natural resources. Historic and cultural resources have a smaller risk from drought and water shortage. The vulnerability of USD to drought may vary and include reduction in water supply, turf losses, impacts to natural resources, and an increase in dry fuels and tree dieback. All of the trees in the District are at risk to drought impacts. These trees provide a wealth of social and environmental benefits to District residents and visitors, from shade and beauty to air quality, carbon reduction and stormwater management. All of these trees are at risk to drought impacts and a reduction in water supply. Additionally, drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. It is unlikely that drought and water shortage would have a significant impact on historic and cultural resources in the District. More information on specific risk to natural, historic, and cultural resources can be found in the respective city annexes to this Plan Update.

Economic Assets and Community Activities of Value

Economic assets and community activities in the District's Service Territory generally have a limited vulnerability to drought and water shortage. Drought is a problem which predominantly affects rural small business owners such as farmers and agricultural contractors who rely on water for their crops. However, supply issues can also affect businesses such as cafes and restaurants in more urban areas. Drought impacts to the agricultural industry can affect the supply chain and increase the cost of food and water, and adversely impact businesses tied to these industries. Reduction in or interruption of the water supply could also lead to lower productivity or closure of manufacturing facilities. Other economic sectors with a heavy reliance on water (like USD) may also be affected. Depending upon how severe the conditions get and how long they last, drought can restrict recreational and community activities, all of which can stress businesses and local economies over time. More information on specific risk to economic assets and community activities of value can be found in the respective city annexes to this Plan Update.

Impacts from Drought and Water Shortage

Based on historical information, the occurrence of drought in California, including the District, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual

drought with adverse impacts can vary in duration, and the period between droughts can be extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users.

The Public Policy Institute of California has a section of their website dedicated to water and wastewater utilities. It noted that water systems and wastewater treatment plants require large intakes of water sources to be able to perform the correct functions and processes. The impact from a large-scale drought include:

- Damaged infrastructure due to loss of short-term and long-term water conservation.
- Complications to operations
- Increased costs
- The quality of the treated water
- Loss of water pressure

Drought.gov has a section of their website dedicated to water and wastewater utilities. They noted the following impacts:

- Increased demand with decreasing supply
- Depletion of aquifers to supplement

These impacts may be exacerbated by the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

As discussed in the hazard profile section, climate change is anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no control over population changes, it merely reacts to them by providing additional (or reduced) services. It is unknown how changes in land use and development will affect drought and water shortage in the District's service territory.

Future Development

The District's current future development is focused on measures to improve the quality of wastewater treatment services in the Tri-City Planning Area. The ETSU project will renew and replace aging infrastructure, improve water quality in the San Francisco Bay through enhanced wastewater treatment processes and nutrient removal, and increase the facility's resiliency to extreme wet-weather events and climate change. Additionally, the District (in one of its mitigation actions in Section E.6.2 below) is planning to construct a digester in response to drought like conditions and to increase solid waste capacity.

Earthquake

Likelihood of Future Occurrence–Likely
Vulnerability–Extremely High

Hazard Profile and Problem Description

An earthquake is caused by a sudden slip on a fault. Stresses in the earth's outer layer push the sides of the fault together. Stress builds up, and the rocks slip suddenly, releasing energy in waves that travel through the earth's crust and cause the shaking that is felt during an earthquake. Earthquakes can cause structural damage, injury, and loss of life, as well as damage to infrastructure networks, such as water, power, gas, communication, and transportation. Earthquakes may also cause collateral emergencies including dam and levee failures, seiches, hazmat incidents, fires, avalanches, and landslides. The degree of damage depends on many interrelated factors. Among these are: the magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surface deposits or bedrock, degree of consolidation of surface deposits, presence of high groundwater, topography, and the design, type, and quality of building construction.

The District is highly concerned about earthquakes (surface fault rupture and ground shaking, as well as fire following earthquake), earthquake liquefaction, earthquake-induced landslides, and fire following earthquake.

Location and Extent

Surface Fault and Ground Shaking

Since earthquakes are regional events, the whole of the USD and USD Service Territory is at risk to earthquake. The District, the Tri-City Planning Area, and surrounding areas are at elevated risk from significant seismic and geologic hazards. Faults in and around the District were shown in Section 4.3.10 of the Base Plan. The amount of energy released during an earthquake is usually expressed as a magnitude and is measured directly from the earthquake as recorded on seismographs. An earthquake's magnitude is expressed in whole numbers and decimals (e.g., 6.8). Seismologists have developed several magnitude scales, as discussed in Section 4.3.10 of the Base Plan.

Another measure of earthquake severity is intensity. Intensity is an expression of the amount of shaking at any given location on the ground surface. Seismic shaking is typically the greatest cause of losses to structures during earthquakes. The District is located in an area where earthquakes of significant magnitude occur, so both magnitude and intensity of earthquakes are expected to remain moderate. Seismic shaking maps for the area in Section 4.3.10 of the Base Plan show the Tri-City Planning Area and the District fall within a moderate to high shake risk.

Earthquake-Induced Liquefaction

When ground liquefies in an earthquake, it behaves like a liquid and may sink, spread, or erupt in sand boils. This can cause pipes to break, roads and sidewalks to buckle, and building foundations to be damaged. Liquefaction can only occur under certain circumstances. Soil that is loose, sandy, silty, or

saturated with water can result in soil liquefaction if it is shaken intensely for an extended period. More details on soils and liquefaction follows:

- **Loose Soils** – The soil must be loose, such as uncompacted or unconsolidated sand and silt without much clay. This happens most often along the Bay shoreline, near creeks or waterways, on dry creek beds, and areas of man-made fill.
- **Soggy Soils** – The sand and silt must be soggy and saturated with water due to a high water table.
- **Ground Shaking** – The ground must be shaken long and hard enough by the earthquake to trigger liquefaction.

Liquefaction accompanies an earthquake, so the speed of onset is short. Duration is similar to the length of the earthquake shake. There are mapped areas of areas susceptible to earthquake-induced liquefaction in the District from the United States Geological Survey (USGS) and California Geological Survey (CGS). These areas are shown on Figure E-23 and discussed in more detail in Table E-30. Liquefaction hazard maps express where the ground is both susceptible to liquefaction, and where the ground is likely to be shaken long and intensely in an earthquake.

Figure E-23 Union Sanitary District – Earthquake Liquefaction Susceptibility Zones

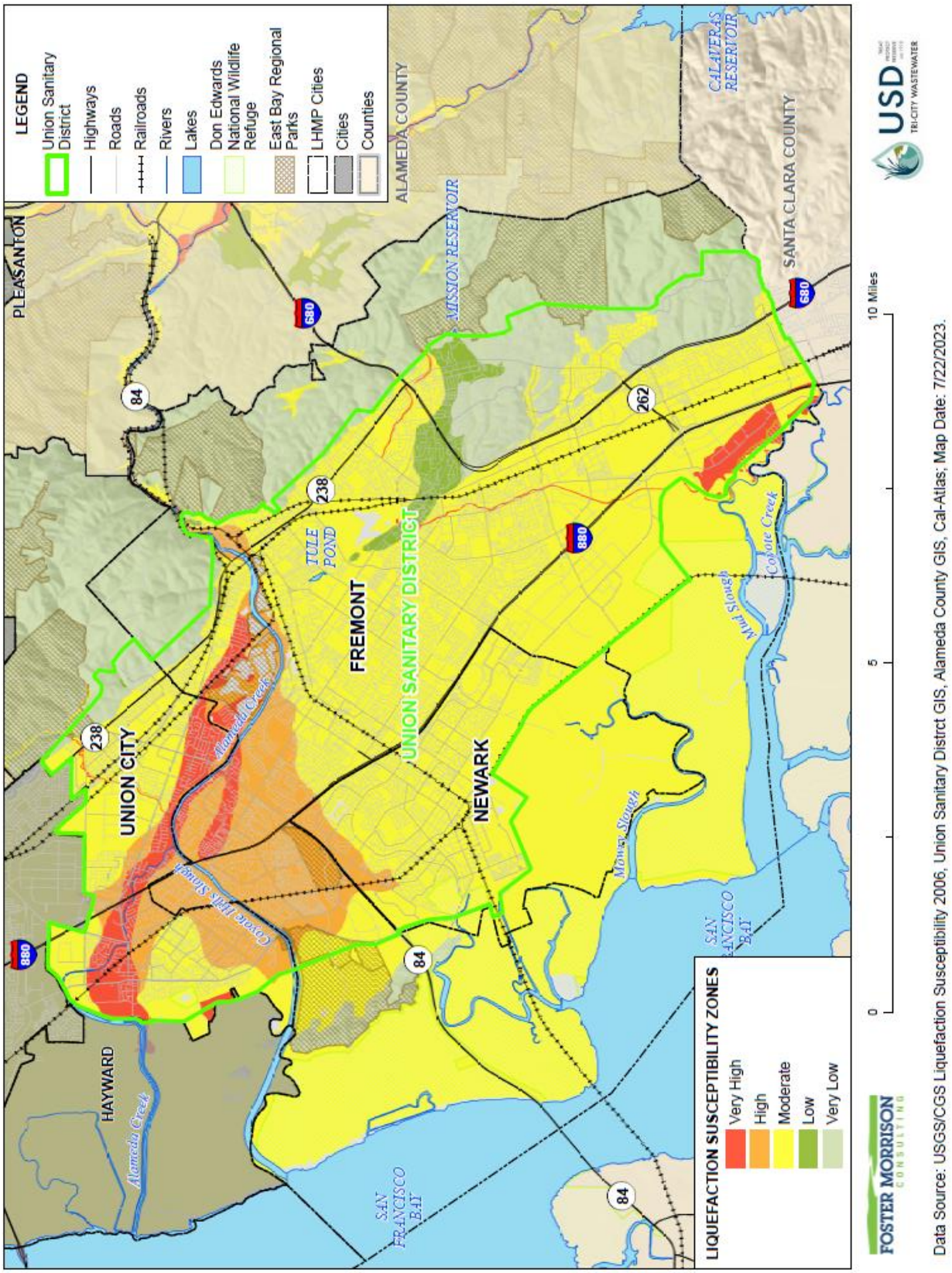


Table E-30 Union Sanitary District – Liquefaction Susceptibility Zone Geographical Extents

Liquefaction Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Very High	3,906.62	5.0%	3,077.62	4.9%	829.00	5.9%
High	11,749.56	15.2%	10,050.88	15.9%	1,698.68	12.0%
Moderate	56,831.27	73.3%	47,608.16	75.2%	9,223.11	65.1%
Low	981.78	1.3%	755.14	1.2%	226.64	1.6%
Very Low	3,615.32	4.7%	1,834.03	2.9%	1,781.29	12.6%
Water	415.78	0.5%	16.32	0.0%	399.46	2.8%
Union Sanitary District Total	**77,500.33**	**100.0%**	**63,342.14**	**100.0%**	**14,158.19**	**100.0%**

Source: USGS/CGS, Cal Atlas

Earthquake-Induced Landslide

Ground shaking can also lead to ground failure on slopes, triggering earthquake-induced landslides. Landslides tend to occur in weak soil and rock on sloping terrain. Most sloping ground has some potential for landslides simply due to the effects of gravity. An earthquake can be one factor that will cause an unstable hillside to fail. When a landslide occurs, creeks and streams below the slide area may become dammed with debris and cause flooding. There are minimal areas in the District, as indicated by Figure E-24. The CGS has areas (a de facto scale) where earthquake-induced landslide is more likely. Speed of onset of these events is short, as is the duration. Clean up efforts can take days, weeks, or even months depending on the severity of the landslide. Geographic extent of CGS Earthquake-Induced Landslide Zones is shown on Table E-31.

Figure E-24 Union Sanitary District – Earthquake-Induced Landslide Zones

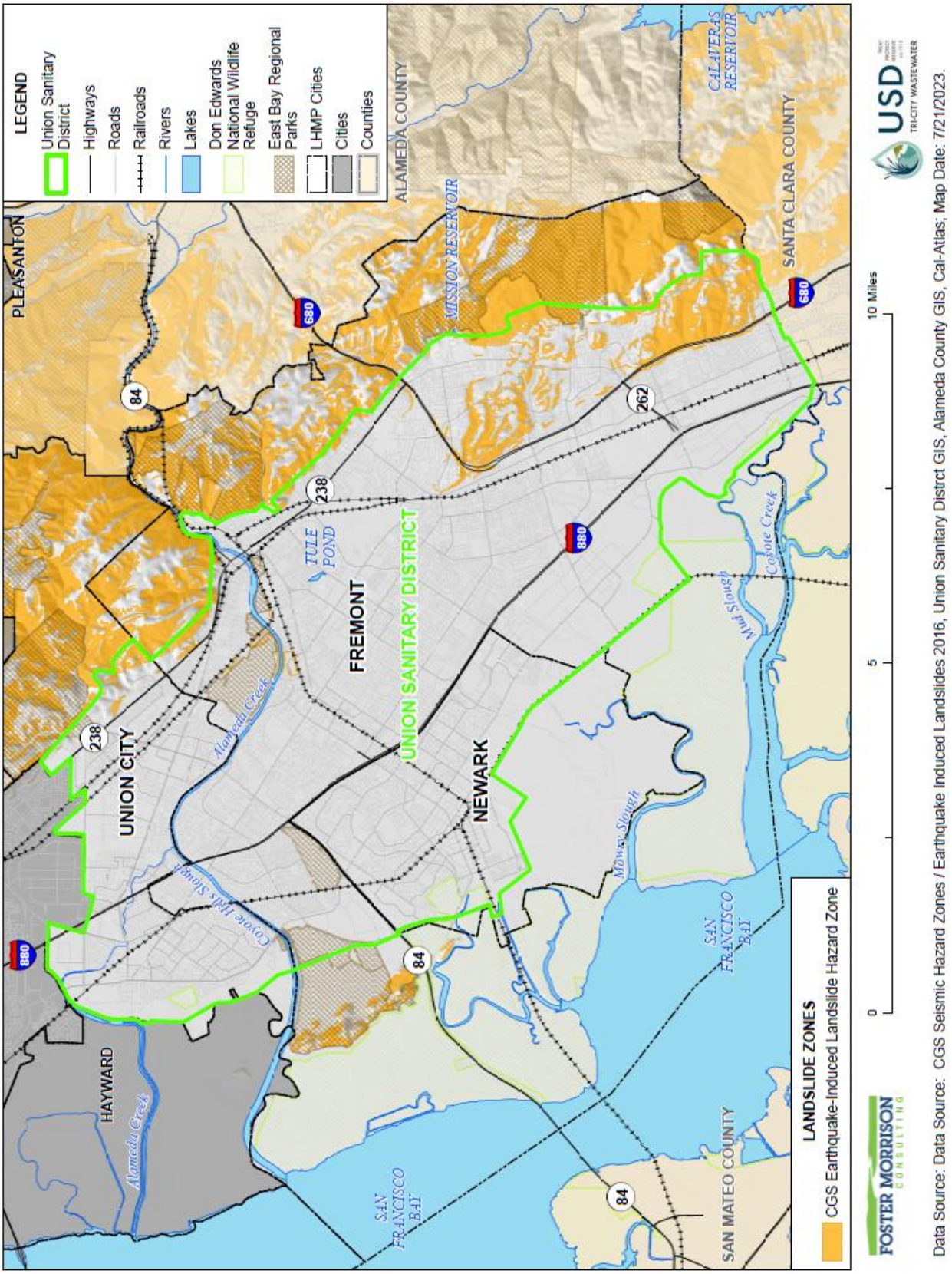


Table E-31 Union Sanitary District – Earthquake-Induced Landslide Zones Geographical Extent

Jurisdiction	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Alameda County Water District	1,752.04	2.26%	580.56	0.92%	1,171.48	8.27%

Source: CGS, Cal Atlas

Fire Following Earthquake

Fire ignitions and spread in urban regions following a major earthquake can further compound the potentially catastrophic impacts of a large earthquake event. Fire following earthquake is important in areas with a large building stock composed primarily of wood and with industrial installations. Earthquake ground shaking can result in broken piping and connections and toppled equipment when restraint or flexibility is inadequate. In addition, flammable gas or ignitable liquid releases and fire protection impairments during an event create significant post-earthquake fire hazards. Wind speeds and direction can compound the damaging effects of fire following earthquake. A moderately damaging seismic event could result in a conflagration of disastrous proportions. The single most damaging fire of the twentieth century in the United States was actually a post-earthquake fire in San Francisco, 1906. In the Loma Prieta Earthquake, 36 fires broke out in San Francisco alone but luckily were quickly contained in large part due to the abnormally calm wind that evening, and the fires' proximity to the Bay that allowed a fire boat to pump water to the fire where the water lines had failed. In the 1906 earthquake, over 3.5 square miles of San Francisco burned, representing 80 percent of San Francisco's property value at the time.

Fire following earthquake can be especially challenging, because there are often multiple ignitions at once (overwhelming fire crews), typical water supply for fighting fire might be reduced or unavailable, and maneuvering fire crews to the ignition can be difficult if streets are blocked by road damage or debris. Fire following earthquake is an issue that could impact any California community that experiences an earthquake – both urban and rural. The problem is heightened for urban environments, where many simultaneous ignitions can lead to a firestorm, and single fires can more quickly and easily move structure to structure. Fires following the 1906 San Francisco Earthquake led to more damage than was caused by ground shaking. Significant fires also occurred in San Francisco following the 1989 Loma Prieta Earthquake and in Los Angeles following the 1994 Northridge Earthquake.

According to the FM Global Insurance company, fires after earthquakes commonly initiate from electrical or fuel related sources because their use is widespread. In the US, natural gas is a factor 15 to 50 percent of the time, and electrical ignitions account for 40 percent or more of post-earthquake wildfires. Ignitable liquid spills, chemical reactions, and the contact of combustibles with heat sources have also initiated or contributed to many fires after earthquakes.

Earthquake-Induced Subsidence

Regional uplift and subsidence may accompany earthquakes caused by large displacements on shallow faults. Such changes can damage coastal facilities, canals, roads, railroads, and other structures.

Subsidence can also be caused by natural events such as earthquakes, soil compaction, glacial isostatic adjustment, erosion, sinkhole formation, and adding water to fine soils deposited by wind (a natural process known as loess deposits).

Land subsidence can occur in various ways during an earthquake. Large areas of land can subside drastically during an earthquake because of offset along fault lines. Land subsidence can also occur as a result of settling and compacting of unconsolidated sediment from the shaking of an earthquake. The Geospatial Information Authority of Japan reported immediate subsidence caused by the 2011 Tōhoku earthquake. In Northern Japan, subsidence of 1.64 ft was observed in Miyako, while near Rikuzentakata it measured 2.75 ft. In the south at Sōma, 0.95 ft was observed. The maximum amount of subsidence was 3.93 ft, coupled with horizontal diastrophism of up to 7.3 ft on the Oshika Peninsula in Miyagi Prefecture.

Past Occurrences

Disaster Declarations

There has been 1 federal disaster declaration from the 1989 Loma Prieta earthquake, as shown in Table E-32.

Table E-32 Alameda County Disaster Declarations from Earthquake 1950-2023

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Earthquake	0	–	1	1989

Source: Cal OES, FEMA

USD Events

The District could recall no significant damages from past earthquakes.

Vulnerability to Earthquake

The combination of plate tectonics and associated California coastal mountain range building geology generates earthquakes as a result of the periodic release of tectonic stresses. The 2017 LHMP noted that the San Andreas fault travels through much of the coastal area of California, traversing San Mateo County, west of the District on the San Francisco peninsula. The Hayward fault bisects the USD Service Territory and generally runs north and south and could cause major damage and displacement due to its prominent location. It branches from the Calaveras fault in the eastern part of San Jose. The Rodgers fault is located near the Hayward fault and could cause damage in the District. A seismic event on any of these major faults could cause serious damage to District facilities. In addition to large surface fault rupturing events, the Hayward fault is characterized by fault creep, the relatively slow, gradual fault displacement that has resulted in continuing damage to curbs, streets and structures in the District Service Territory.

Earthquake shaking can cause liquefaction to occur in the District. Areas with loose soil and high water tables are at risk from liquefaction. There are several areas within the USD Service Territory prone to liquefaction.

Earthquakes can also induce landslides in the District, especially if an earthquake occurs during the rainy season and soils are saturated with water. The areas prone to earthquake-induced landslides are largely the same as those areas prone to landslides in general. As with all landslides, areas of steep slopes with loose rock or soils and high water tables are most prone to earthquake-induced landslides.

The whole of the USD is at some measure of vulnerability to earthquake. An assessment of a community's vulnerability to earthquakes begins with an understanding of local exposure to earthquakes. This is included in the Local Concerns section below. After that section, assets at risk are discussed.

Local Concerns

The District provided a report titled USD – Seismic Vulnerability Assessment dated April 2016. The report discusses the vulnerability that the Union Sanitary District's major pipelines and structures have with respect to a significant seismic event, and then discusses how these seismic vulnerabilities can be mitigated. Based on the conclusions of this study, it was concluded that some of the structures and pipeline sections critical to delivering service to systems are seismically vulnerable and therefore damage could be expected following a large seismic event. This report rates structures and pipeline sections based on seismic vulnerability and relative importance to inform a targeted mitigation effort. The most critical structures to retrofit are important structures with significant occupancy and seismically vulnerable structures with pre-cast concrete roofs. The main force main pipelines are expected to perform relatively well in a seismic event except at the Alameda Creek crossing. Based on this limited preliminary study, it was estimated that a rough order of magnitude construction cost to seismically upgrade the most vulnerable structures and pipelines will be on the order of $40,000,000.

The District also noted the following vulnerabilities:

- Current administrative and field operations buildings require replacement and seismic upgrades
- There is worry about earthquake damage to the USD collection system
- Earthquake would have an immediate impact to treatment process with prevention of flow to the plant and ability to treatment and discharge wastewater
- Damage to plant, pump, and lift station infrastructure that impacts the District's ability to treat wastewater would likely occur.
- Immediate damage to the collection system would likely occur.
- Liquefaction, subsidence, earth movement that can impact the District's underground infrastructure (forcemain and collection system)

Earthquake-induced Landslide

Earthquake-induced landslides in the District (and its Service Territory are likely to occur in the Hills Area Open Space, where there are minimal improved structures.

Fire Following Earthquake

Fire following earthquake has been known to exceed the total damage due to primary earthquake effects (shaking, liquefaction, and subsidence). Examples of major urban conflagrations (i.e., block-to-block fire spread, consuming large portions of major urban environments):

- 1923 Tokyo Kanto Earthquake,
- 1906 San Francisco Earthquake and Fire,
- 1995 Kobe Earthquake

Additionally, oil/gas refinery/pipeline fires periodically occur following major earthquakes, but may not develop into conflagrations – depending on the nature of the built environment and other factors:

- 1964 Alaska Earthquake (in Valdez, AK),
- 1993 Northridge Earthquake

Factors to consider are:

- potential ignitions (due to building damage or collapse, damage to power or gas utilities, etc.),
- windspeed,
- prevailing building construction types (i. e., high inventory of wood frame buildings, regardless of the extent of modern fire protection systems – which are likely to fail following a major earthquake),
- density and prevailing distance between buildings,
- loss of water pressure in the municipal water supply system (which is almost assured, if there is extensive damage to buildings – absent mitigation measures to isolate functional from damaged water supply),
- damage to the municipal water supply systems distribution infrastructure, the ability to isolate main breaks to maintain water flow in certain areas where damage to the system is minimal, and whether there alternative water supplies that can support and firefighting operations (e. g. static sources such as open water, cisterns or swimming pools which are accessible to fire apparatus – meaning secure hard stand next to the source, with generally no more than approximately ten feet of vertical distance (22.5 feet is the theoretical maximum) and limited horizontal distance on the order to tens of feet.

Assets at Risk

Many assets in the District are at risk to surface fault and ground shaking (including liquefaction, landslide, subsidence, and fire following earthquake). Assets at risk from earthquake include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections.

People and Populations

District Populations

The District employs 145 employees that support 5 workgroups. The treatment plant has various construction projects currently underway and planned. These projects will have contractors and their employees onsite. All of these people would be at risk of earthquake.

USD Service Territory Populations

All people and populations are at risk from earthquake shaking (including fire following earthquake) and surface fault. Those at heightened risk include:

- The unsheltered
- Infants and children under age five and their caregivers
- Non-English speakers
- Elderly (65 and older)
- Individuals with disabilities
- Individuals dependent on medical equipment
- Individuals with impaired mobility

The greatest risk to people and populations from earthquake is death and injury.

Earthquake Liquefaction Susceptibility and Population Analysis

Many people are at risk to earthquake-induced liquefaction. To further evaluate the impact to the residential population within the District's Service Territory, those residential parcel centroids that intersect the USGS/CGS Earthquake Liquefaction Susceptibility zones were counted and multiplied by the 2020 Census Bureau average household factors for the USD (3.22). According to this analysis, there is a total population of 323,987 residents in USD in moderate or higher earthquake liquefaction zones. This is shown in Table E-33.

Table E-33 Union Sanitary District Service Territory – Residential Parcels and Populations in Earthquake Liquefaction Susceptibility Zones

Earthquake Liquefaction Susceptibility Zone	Improved Residential Parcels	Population
Very High	6,253	20,135
High	23,984	77,228
Moderate	70,380	226,624

Source: US Census Bureau, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Earthquake-Induced Landslide and Population Analysis

Many people are at risk from earthquake-induced landslides in these mapped hazard areas. To further evaluate the impact to the residential population within the District's Service Territory, those residential parcel centroids that intersect the CGS Earthquake-Induced Landslide zones were counted and multiplied by the 2020 Census Bureau average household factors for the USD (3.22). According to this analysis, there is a total population of 1,868 residents in USD in this zone. This is shown in Table E-34.

Table E-34 Union Sanitary District – Residential Parcels and Populations in Earthquake-Induced Landslide Zones

Earthquake - Induced Landslide Zone	Improved Residential Parcels	Population
Inside Zone	580	1,868

Source: US Census Bureau, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Structures

All structures in the District are vulnerable to earthquakes, depending on the severity and location of the shake.

Additional asset analysis for earthquake liquefaction and earthquake-induced landslide is discussed below.

Earthquake-Induced Liquefaction

The analysis for structures in the District is separated out into two separate analyses:

- **USD Facility Assets** – These are the facilities, structures, and other assets which USD owns and maintains operational control.
- **Service Territory Structures** – This is comprised of the parcels and structures associated with the residents and businesses located within USD's Service Territory who use the wastewater services provided by USD.

USD Facility Assets

The District owns facilities that may be at risk to liquefaction. Geological Information Services (GIS) was used to determine the possible impacts of earthquake liquefaction on USD facilities. The methodology described in Section E.4.1 (in the Structures section) above was followed in determining USD structures at risk to liquefaction. Figure E-25 shows the USD facilities in the USGS/CGS Liquefaction Susceptibility Zones. Specific facilities in the liquefaction zones are detailed in Table E-35 (for point assets) and Table E-36 (for linear assets).

Figure E-25 Union Sanitation District – Assets in Earthquake Liquefaction Susceptibility Zones

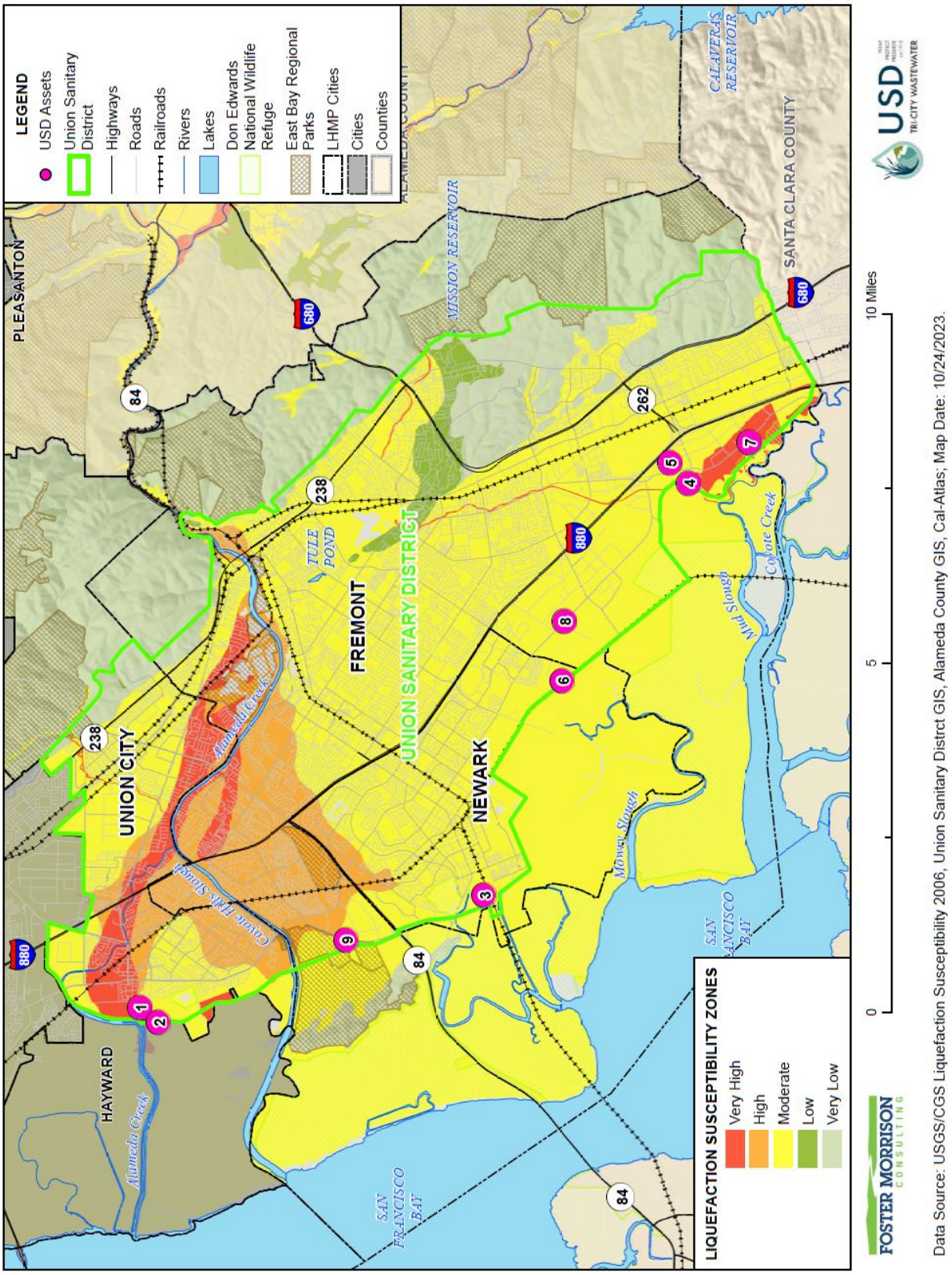


Table E-35 Union Sanitary District – Assets by USD Site in Earthquake Liquefaction Susceptibility Zones

Liquefaction Susceptibility Zone / Site Number	Site Location / Name	Asset Type	Asset Value	Property Value	Total Value
Very High					
7	Fremont LS	Lift Station	$1,086,324	$880,000	$1,966,324
Very High Total			**$1,086,324**	**$880,000**	**$1,966,324**
Moderate					
3	Newark PS	Pump Station	$18,721,354	$37,520,000	$56,241,354
4	Irvington PS	Pump Station	$10,511,794	$45,040,000	$55,551,794
5	Irvington SB	Storage Basin	$7,983,280	$0	$7,983,280
6	Cherry PS	Lift Station	$315,705	$1,580,000	$1,895,705
8	Boyce LS	Lift Station	$4,497,365	$340,000	$4,837,365
9	Paseo Padre LS	Lift Station	$1,020,348	$1,880,000	$2,900,348
Moderate Total			**$43,049,846**	**$43,049,846**	**$43,049,846**

Source: USGS/CGS, USD

Table E-36 Union Sanitary District – Linear Assets in Earthquake Liquefaction Susceptibility Zones

Liquefaction Susceptibility Zones / Asset	Asset Length (in miles)	Total Asset Value
Very High		
Sewer Force Main (Pressurized Transport Pipeline)	0.03	$471,776
Sewer Collection System (Gravity Flow Pipeline)	20.53	$86,735,345
Very High Total	**20.56**	**$87,207,121**
High		
Sewer Force Main (Pressurized Transport Pipeline)	0.73	$12,639,869
Sewer Collection System (Gravity Flow Pipeline)	130.72	$552,141,195
High Total	**131.45**	**$564,781,064**
Moderate		
Sewer Force Main (Pressurized Transport Pipeline)	25.97	$452,423,771
Sewer Collection System (Gravity Flow Pipeline)	559.38	$2,362,819,339
Moderate Total	**585.35**	**$2,815,243,110**
Low		
Sewer Force Main (Pressurized Transport Pipeline)	0	$0
Sewer Collection System (Gravity Flow Pipeline)	24.74	$104,497,511
Low Total	**24.74**	**$104,497,511**

Liquefaction Susceptibility Zones / Asset	Asset Length (in miles)	Total Asset Value
Very Low		
Sewer Force Main (Pressurized Transport Pipeline)	0	$0
Sewer Collection System (Gravity Flow Pipeline)	48.23	$203,702,664
Very Low Total	**48.23**	**$203,702,664**
Water		
Sewer Force Main (Pressurized Transport Pipeline)	0.26	$4,505,175
Sewer Collection System (Gravity Flow Pipeline)	0.04	$165,502
Water Total	**0.3**	**$4,670,677**

Source: USGS/CGS, USD

Service Territory Structures

Structures in the District's Service Territory have a measure of risk from liquefaction. The USGS/CGS Earthquake Liquefaction Susceptibility Zone layers were overlaid with the Tri-City parcel layer in GIS to obtain results. Table E-37 summarizes the potential estimated damages to the structures in the District's Service Territory from properties in the liquefaction susceptibility zones.

Table E-37 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Earthquake Liquefaction Susceptibility Zones by Property Use

Liquefaction Susceptibility Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Very High						
Agricultural	0	0	$0	$0	$0	$0
Commercial	189	106	$150,264,728	$277,559,659	$277,559,659	$705,384,046
Government/ Institutional	243	7	$4,957,054	$8,309,285	$8,309,285	$21,575,624
Industrial	54	51	$262,882,891	$400,103,080	$600,154,622	$1,263,140,593
Recreational	1	1	$46,207	$116,443	$116,443	$279,093
Residential	6,389	6,253	$1,105,945,850	$2,463,670,418	$1,231,835,158	$4,801,451,426
Unknown	3	0	$0	$0	$0	$0
Utilities	26	0	$0	$0	$0	$0
Vacant	56	6	$12,061,065	$4,413,608	$0	$16,474,673
Very High Total	**6,961**	**6,424**	**$1,536,157,795**	**$3,154,172,493**	**$2,117,975,167**	**$6,808,305,455**
High						
Agricultural	0	0	$0	$0	$0	$0
Commercial	370	142	$247,298,837	$462,224,669	$462,224,669	$1,171,748,175

Liquefaction Susceptibility Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Government/ Institutional	376	20	$14,577,591	$36,107,687	$36,107,687	$86,792,965
Industrial	10	8	$68,903,949	$201,998,896	$302,998,345	$573,901,190
Recreational	4	4	$6,030,044	$10,687,304	$10,687,304	$27,404,652
Residential	24,330	23,984	$4,286,361,946	$9,553,902,791	$4,776,951,398	$18,617,216,135
Unknown	0	0	$0	$0	$0	$0
Utilities	49	0	$0	$0	$0	$0
Vacant	72	2	$20,794,448	$1,413,200	$0	$22,207,648
High Total	**25,211**	**24,160**	**$4,643,966,815**	**$10,266,334,547**	**$5,588,969,403**	**$20,499,270,765**
Moderate						
Agricultural	12	0	$1,924,251	$0	$0	$1,924,251
Commercial	2,405	1,768	$3,322,526,192	$6,095,569,875	$6,095,569,875	$15,513,665,942
Government/ Institutional	1,567	125	$118,380,645	$248,198,666	$248,198,666	$614,777,977
Industrial	874	828	$2,162,184,797	$3,789,751,191	$5,684,626,762	$11,636,562,750
Recreational	17	17	$37,039,088	$59,300,660	$59,300,660	$155,640,408
Residential	72,652	70,374	$15,092,411,738	$32,529,318,282	$16,264,659,641	$63,886,389,661
Unknown	45	0	$13,008,206	$0	$0	$13,008,206
Utilities	308	0	$0	$0	$0	$0
Vacant	1,577	186	$920,123,684	$351,556,622	$0	$1,271,680,306
Moderate Total	**79,457**	**73,298**	**$21,667,598,601**	**$43,073,695,296**	**$28,352,355,604**	**$93,093,649,501**
Low						
Agricultural	0	0	$0	$0	$0	$0
Commercial	50	39	$42,762,804	$172,049,253	$172,049,253	$386,861,310
Government/ Institutional	63	9	$4,148,297	$50,542,787	$50,542,787	$105,233,871
Industrial	1	1	$1,014,816	$271,883	$407,824	$1,694,523
Recreational	0	0	$0	$0	$0	$0
Residential	2,928	2,834	$917,816,657	$1,773,036,690	$886,518,345	$3,577,371,692
Unknown	1	0	$0	$0	$0	$0
Utilities	5	0	$0	$0	$0	$0
Vacant	32	3	$12,340,108	$5,775,669	$0	$18,115,777
Low Total	**3,080**	**2,886**	**$978,082,682**	**$2,001,676,282**	**$1,109,518,209**	**$4,089,277,173**
Very Low						
Agricultural	17	7	$6,945,580	$4,301,506	$4,301,506	$15,548,592

Liquefaction Susceptibility Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Commercial	7	6	$19,120,307	$66,108,247	$66,108,247	$151,336,801
Government/ Institutional	112	2	$1,532,926	$254,890	$254,890	$2,042,706
Industrial	0	0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0
Residential	4,330	4,149	$1,784,715,950	$3,696,262,674	$1,848,131,278	$7,329,109,902
Unknown	25	2	$34,118,935	$200,468	$0	$34,319,403
Utilities	5	0	$0	$0	$0	$0
Vacant	97	9	$58,717,498	$20,135,506	$0	$78,853,004
Very Low Total	**4,593**	**4,175**	**$1,905,151,196**	**$3,787,263,291**	**$1,918,795,921**	**$7,611,210,408**
Water						
Agricultural	0	0	$0	$0	$0	$0
Commercial	1	1	$10,019,419	$10,661,200	$10,661,200	$31,341,819
Government/ Institutional	42	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0
Residential	15	15	$4,224,084	$9,121,187	$4,560,592	$17,905,863
Unknown	0	0	$0	$0	$0	$0
Utilities	0	0	$0	$0	$0	$0
Vacant	0	0	$0	$0	$0	$0
Water Total	**58**	**16**	**$14,243,503**	**$19,782,387**	**$15,221,792**	**$49,247,682**
Union Sanitary District Total	**119,360**	**110,959**	**$30,745,200,592**	**$62,302,924,296**	**$39,102,836,096**	**$132,150,960,984**

Source: USGS/CGS, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Earthquake-Induced Landslides

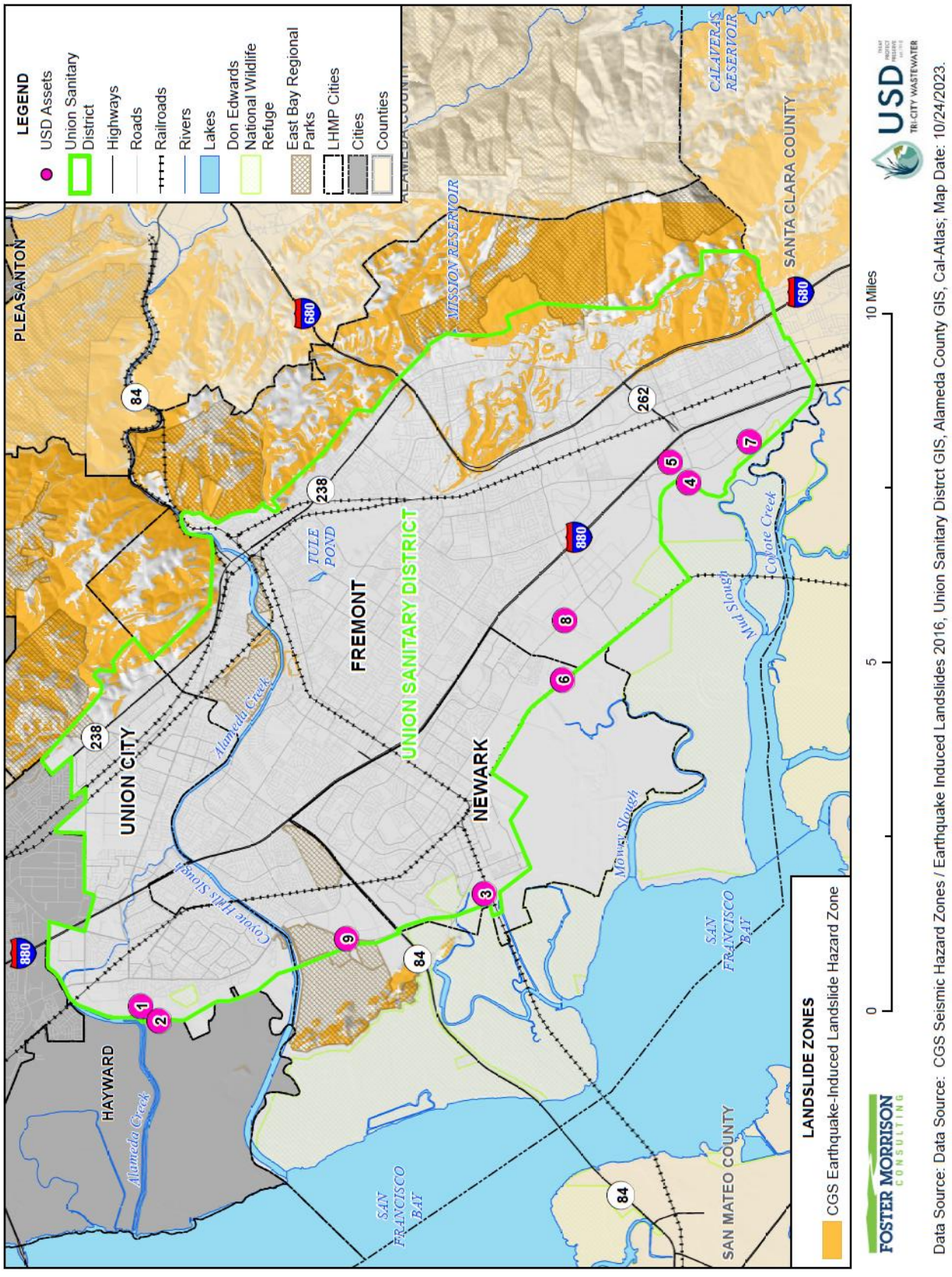
The analysis for structures in the District is separated out into two separate analyses:

- **USD Facility Assets** – These are the facilities, structures, and other assets which USD owns and maintains operational control.
- **Service Territory Structures** – This is comprised of the parcels and structures associated with the residents and businesses located within USD's Service Territory who use the wastewater services provided by USD.

USD Facility Assets

The District owns facilities that may be at risk to earthquake-induced landslide. GIS was used to determine the possible impacts of earthquake-induced landslide on USD facilities. The methodology described in Section E.4.1 (in the Structures section) above was followed in determining USD structures at risk to earthquake-induced landslide. Figure E-26 shows the USD facilities in the CGS Earthquake-Induced Landslide Zones. As shown, there are no USD facilities (either point of linear) in earthquake-induced landslide; as such no tabular analysis was performed.

Figure E-26 Union Sanitary District – Earthquake-Induced Landslide Zones



Service Territory Structures

Structures in the USD Service Territory have a measure of risk from earthquake-induced landslides. The CGS Earthquake-Induced Landslide zone layers were overlaid with the Tri-City parcel layer in GIS to obtain results. Table E-37 summarizes the potential estimated damages to structures in the District's Service Territory from properties in the Earthquake-Induced Landslide Zone.

Table E-38 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) in Earthquake-Induced Landslide Zones by Property Use

Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Agricultural	2	1	$0	$56,352	$56,352	$112,704
Commercial	3	3	$1,581,499	$2,815,416	$2,815,416	$7,212,331
Government / Institutional	75	0	$59,607	$0	$0	$59,607
Industrial	0	0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0
Residential	631	581	$348,128,859	$733,746,090	$366,873,019	$1,448,747,968
Unknown	14	1	$18,998,481	$179,857	$0	$19,178,338
Utilities	1	0	$0	$0	$0	$0
Vacant	41	5	$36,884,543	$5,495,007	$0	$42,379,550
Union Sanitary District Total	**767**	**591**	**$405,652,989**	**$742,292,722**	**$369,744,787**	**$1,517,690,498**

Source: CGS, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

Critical Facilities and Infrastructure

Earthquakes present a threat to critical facilities and infrastructure, and community lifelines. The following analysis discusses critical facilities and infrastructure, followed by community lifelines.

Critical Facilities and Infrastructure

As mentioned above, all USD Assets (including lines) are considered to be critical facilities. This analysis was shown on Table E-35 for District facilities in the structure analysis above.

Community Lifelines

Community lifelines at risk to earthquake include:

- **Safety and Security** – Many District personnel would be involved in response and recovery efforts.
- **Food, Hydration, and Shelter** – As homes are damaged, shelter needs would significantly increase. Water supplies could be offline for an extended period. Residents would need to find sources of food and water. The unsheltered would also need to find alternate sources of food and water until the District recovers.

- **Health and Medical** – Injuries and deaths can occur. This causes EMS calls and ER visits to spike. Transporting patients to medical facilities may be difficult. Depending on the extent of injuries, the capacity of medical facilities could be strained.
- **Energy** – The power grid may be damaged from earthquake. Damages to natural gas pipelines that feed homes and businesses in the District may also be disrupted.
- **Communications** – Communications systems may be damaged during shaking events. Once the shaking ceases, responder communications need to be back online quickly to coordinate response efforts in the District. Messaging boards and alerts need to be then put into place to ensure public safety and order.
- **Transportation** – Damage can occur to roads and bridges in the District. Damage can also occur to rail lines and airports in and near the District. Roads may be closed due to damage, or to debris on the roads from earthquake events.
- **Hazardous Material** – Hazardous materials facilities can be compromised during times of earthquake shaking causing releases of contaminants into the environment. Natural gas pipelines can be affected by earthquakes. This can affect not only residents, but those who are charged with responding to or resolving the spill/rupture.
- **Water Systems** – Damages to underground pipes may occur. These take time to locate and fix in normal circumstances. During periods of earthquake, this becomes even more difficult.

All community lifelines in the District are vulnerable to earthquakes, depending on the severity and location of the shake. Earthquake could cause these lifelines to be overwhelmed. Some of these would be able to be restored to service quickly, while others would take more time. More information on lifelines at risk can be seen in the Hazus scenarios in Section 4.3.10 of the Base Plan.

Natural, Historic, and Cultural Resources

The 2023 State Hazard Mitigation Plan noted that environmental problems from earthquakes can be numerous. Earthquake-induced landslides can significantly damage surrounding habitats. It is also possible for earthquakes to reroute streams, which can change the water quality, possibly damaging habitat and feeding areas. Streams fed by groundwater and/or springs may dry up because of changes in underlying geology. Another threat to the environment from earthquakes is the potential release of hazardous materials. Historical and cultural resources are at risk, often due to their age and construction types. The Hazus scenarios in Section 4.3.10 of the Base Plan and included below are relatively silent on the vulnerability to natural, historic, and cultural resources, but impacts to these resources could be long lasting. Specific natural, historic, and cultural facilities at risk can be found in the respective city annexes to this Plan Update.

Economic Assets and Community Activities of Value

All economic assets in the District's Service Territory are vulnerable to earthquakes, depending on the severity and location of the shake. All community activities of value would be affected by an earthquake if they were occurring during a period of earthquake shaking. More information on the economic assets and community activities of value at risk can be found in the respective city annexes to this Plan Update.

Hazus Analysis

Hazus is a regional earthquake loss estimation model that was developed by FEMA and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates can be used by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

Hazus 6.1 was utilized to model earthquake losses for the Tri-City Planning Area. Hazus level 2/3 analyses were run, meaning that this more advanced Hazus modelling utilized local inventory data of buildings, essential facilities, hazards, and other data, as provided by the local jurisdictions and Cal OES and FEMA. This local data was used in conjunction with the default Hazus data within the model. This is a planning level analysis. Four primary Hazus scenarios were created for this Plan:

- A Calaveras Fault 7.43 magnitude event
- A Hayward + Rodgers Creek Fault 7.57 magnitude event
- A Hayward (Haywired) Fault 7.0 magnitude event
- A San Andreas Fault 7.9 magnitude event

Details of these Hazus Scenarios are detailed in Table E-39.

Table E-39 Hazus Scenarios by Fault, Magnitude, and Epicenter

Earthquake Fault	Magnitude	Epicenter	Fault Name	Hazus Scenario Name (user named)
Calaveras	7.43	37.61, -121.89	sc+cc+nc--cs+cc+cn-3-10	DETERM CN_CC_CS_CE 7.43M EQ CT
Hayward + Rodgers Creek	7.57	37.55, -121.95	sh+nh+rc-- hs+hn+rc	DETERM SH_NH_RC 7.57M EQ CT
Hayward (Haywired)	7.00	37.88, -122.25	sh+nh-- hs+hn	DETERM HN_HS 7.0M EQ CT
San Andreas	7.90	37.76, -122.55	scz+pn+ncs+ncn --sas+sap+sa	DETERM SAO_SAN_SAP_SAS 7.9M EQ CT

Source: USGS Hazus Specialist; Tri-City Participating Jurisdictions; Hazus Scenario Catalogs:
https://earthquake.usgs.gov/scenarios/eventpage/bssc2014calaverascncccscesha_m7p43_se
https://earthquake.usgs.gov/scenarios/eventpage/bssc2014haywardrchnhsshaw09m_m7p57_se
https://earthquake.usgs.gov/scenarios/eventpage/ushaywiredm7.05_se
https://earthquake.usgs.gov/scenarios/eventpage/bssc2014nsanandreassansapsas_m7p88_se

Methodology

Hazus Version 6.1 was released in November 2023. This natural hazard risk assessment GIS-based software updates Hazus Version 6.0 previously released in November 2022. Hazus 6.1 includes major inventory data, methodology, and software enhancements. Utilizing Hazus 6.1, Hazus deterministic scenarios were run utilizing supplemental and locally provided inventory data developed for input into Hazus' Comprehensive Data Management System (CDMS). The deterministic approach allows for the selection of a recognized fault, epicenter, and magnitude associated with each identified scenario. The additional

steps taken to prepare the Hazus model were followed here, and as detailed in the Hazus methodology section of Chapter 4 of the Base Plan.

Running the Hazus Analyses

Running the four primary Hazus scenarios on each of the four study regions, as previously described, provides coverage and results for the Tri-City Planning Area and specific to each of the five participating jurisdictions to this LHMP Update.

Each of the four primary earthquake scenarios generated an Earthquake Hazus Global Summary Risk Report for each Hazus defined study region. The report provides an estimate of seismic risk and assesses current and future potential seismic-related losses. For each study region, the report provides information on loss estimates based on that study region's earthquake risk and general building stock value, which includes building and lifeline related losses on the study region's available inventory. The loss estimates provide Annualized Earthquake Loss (AEL) that detail long-term losses measured in U.S. dollars per one year. It also provides estimates of debris, displaced households, shelter requirements and casualties. The total economic loss includes:

- **Building-Related Losses.** The building losses are broken into two categories: direct building losses and business interruption losses.
- **Transportation and Utility Lifeline Losses**. For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages.

To support the results presented in the Hazus Global Summary Risk Reports for each primary scenario (and by each jurisdiction's study region), three maps each were developed to further illustrate seismic risk and losses. These include:

- Peak Ground Acceleration Shake Map
- Liquefaction Susceptibility Map
- Total Loss Map

Fire Following Earthquake

The Hazus analysis for each of the primary Hazus runs also includes two scenarios or iterations of Fire Following Earthquake. The Fire Following Earthquake component to the Hazus tool allows for parameters to be adjusted to obtain varying output results based on factors such as fire engine response times and weather-related parameters such as wind speed and direction. For each of the four Hazus primary scenarios run for each of the four study regions (i.e., The Tri-City Planning Area/ACWD/USD, Fremont, Newark, and Union City), two Fire Following Earthquake iterations were run. The two Fire Following Earthquake parameters modified for this analysis included Wind Speed and Direction:

- **Fire Following Earthquake Baseline Parameters.** Utilizes a wind speed of 10 mph, with a default direction of 0, which is a north wind.
- **Fire Following Earthquake Adjusted Parameters.** Utilizes a wind speed of 50 mph, with a northeast direction. Note: this is based on the presence of the Diablo Winds in the study region which generally flow at a northeasterly direction and can reach speeds (or gusts) of up to 70-80 mph. The 50 mph wind speed was utilized as this was the reported wind speed that occurred during the 1991 Tunnel Fire.

These are shown in Table E-40.

Table E-40 Fire Following Earthquake – Wind Speed and Direction Scenarios

Jurisdiction / Hazus Study Region	Scenario 1	Scenario 2
Tri-City	Wind: 10 MPH, Wind Direction: 0	Wind: 50 MPH, Wind Direction: 45 degrees
Fremont	Wind: 10 MPH, Wind Direction: 0	Wind: 50 MPH, Wind Direction: 45 degrees
Newark	Wind: 10 MPH, Wind Direction: 0	Wind: 50 MPH, Wind Direction: 45 degrees
Union City	Wind: 10 MPH, Wind Direction: 0	Wind: 50 MPH, Wind Direction: 45 degrees
ACWD	Wind: 10 MPH, Wind Direction: 0	Wind: 50 MPH, Wind Direction: 45 degrees
USD	Wind: 10 MPH, Wind Direction: 0	Wind: 50 MPH, Wind Direction: 45 degrees

Source: Hazus 6.1

To support the Fire Following Earthquake results for each primary scenario (and by each study region), four maps were developed to further illustrate Fire Following Earthquake risk and exposure. These include:

- Number of Ignitions Map
- Population Exposure Map
- Value Exposure Map
- Fire Water Demand (gpm) Map

Hazus Results by Scenario

The Hazus results by scenario are summarized below. Of the four primary earthquake scenarios run for the Tri-City Planning Area, the Hayward Rodgers Creek Scenario is the one likeliest to cause the greatest damage.

Calaveras Fault Hazus Scenario (Epicenter: Fremont; Magnitude: 7.43)

The Hazus results for the Calaveras Fault Hazus Scenario is summarized below in Table E-41. Appendix H includes the Earthquake Hazus Global Summary Risk Report for each Hazus defined study region where more detailed information can be obtained.

Table E-41 Tri-City Planning Area– Calaveras Fault HAZUS Earthquake Deterministic Results for 7.43 M Event

Type of Impact	Impacts to City from 7.43 Deterministic Earthquake
Total Buildings Damaged (based on 102,000 buildings)	Slight: 34,485 Moderate: 10,737 Extensive: 3,324 Complete: 802
Building and Income Related Losses	$6,072,200,000
Total Economic Losses (Includes building, income and lifeline losses)	$6,694,910,000
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 410 Requiring hospitalization: 64

Type of Impact	Impacts to City from 7.43 Deterministic Earthquake	
	Life threatening: 4 Fatalities: 7	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 655 Requiring hospitalization: 134 Life threatening: 20 Fatalities: 32	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 534 Requiring hospitalization: 138 Life threatening: 74 Fatalities: 34	
Damage to Transportation Systems	1 bridge with at least moderate damage	
Damage to Essential Facilities	4 schools and 1 EOC with at least moderate damage. 0 facilities with complete damage.	
Damage to Utility Systems	1 wastewater facility, 1 electrical power facility, and 2 communication facility with at least moderate damage. 0 facilities with complete damage. 1,018 potable water line breaks, 511 wastewater line breaks, and 8 natural gas line breaks.	
Households without Power/Water Service (Based on 113,685 total households)	Power loss, Day 1: 113,685 Power loss, Day 3: 113,685 Power loss, Day 7: Power loss, Day 30: 113,685 Power loss, Day 90: 113,685	Water loss, Day 1: 110,435 Water loss, Day 3: 109,958 Water loss, Day 7: 108,722 Water loss, Day 30: 72,925 Water loss, Day 90: 0
Displaced Households	2,703 displaced households	
Shelter Requirements	1,328 persons	
Debris Generation	624,000 tons	

Hazus 6.1

Loss Estimates Highlights

Hazus estimates that about 14,862 buildings will be at least moderately damaged. This is over 14.00 % of the buildings in the region. There are an estimated 801 buildings that will be damaged beyond repair.

Before the earthquake, the region had 556 hospital beds available for use. On the day of the earthquake, the model estimates that only 310 hospital beds (56.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 79.00% of the beds will be back in service. By 30 days, 93.00% will be operational.

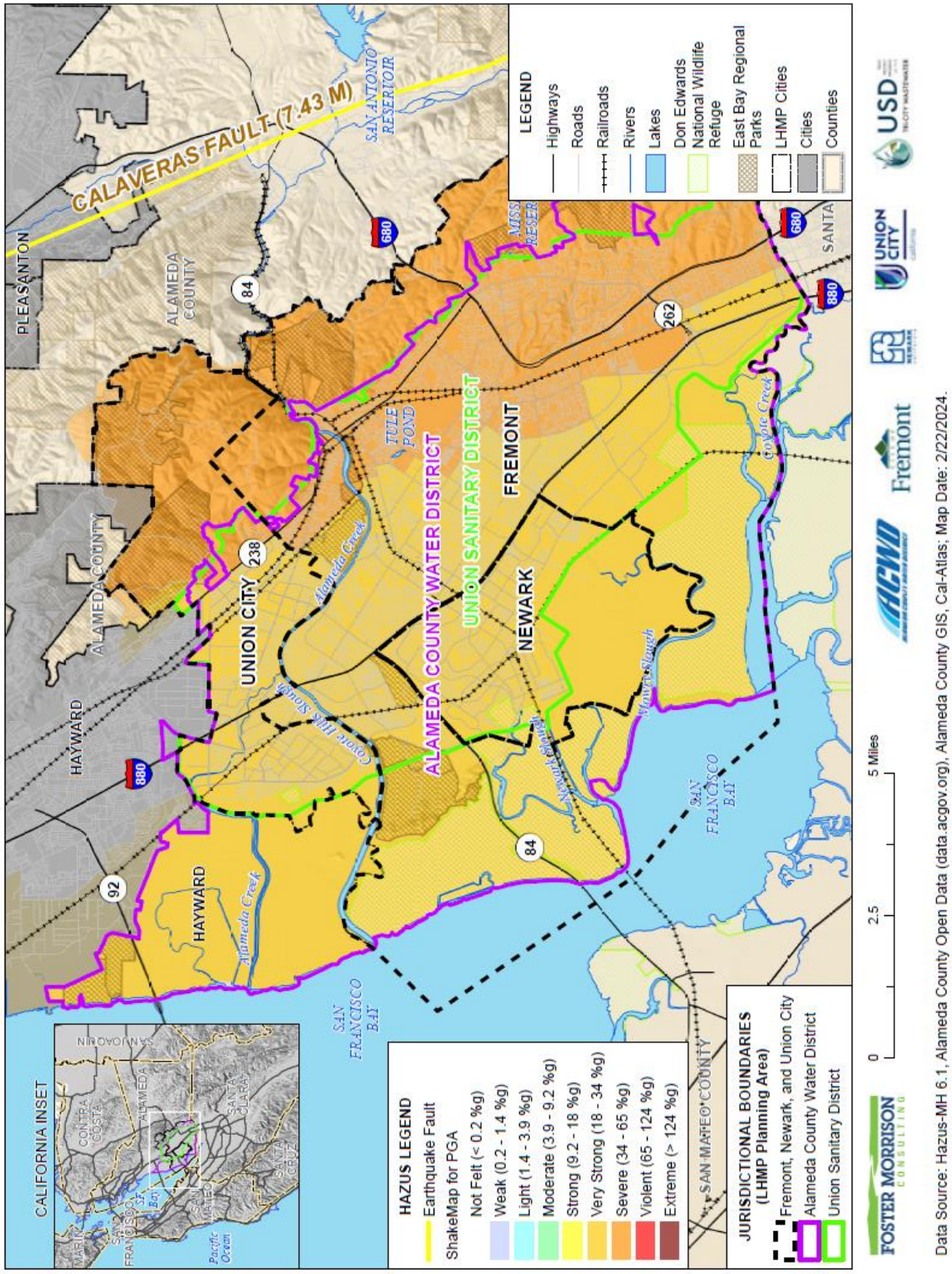
The total building-related losses were 6,027.20 (millions of dollars); 10 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 50 % of the total loss.

Peak Ground Acceleration (Shaking)

Hazus evaluates the geographic distribution of ground shaking as a result of a specific earthquake scenario and expresses ground shaking using several quantitative parameters, including the peak ground

acceleration. The peak ground acceleration map associated with this Hazus scenario can be seen on Figure E-27.

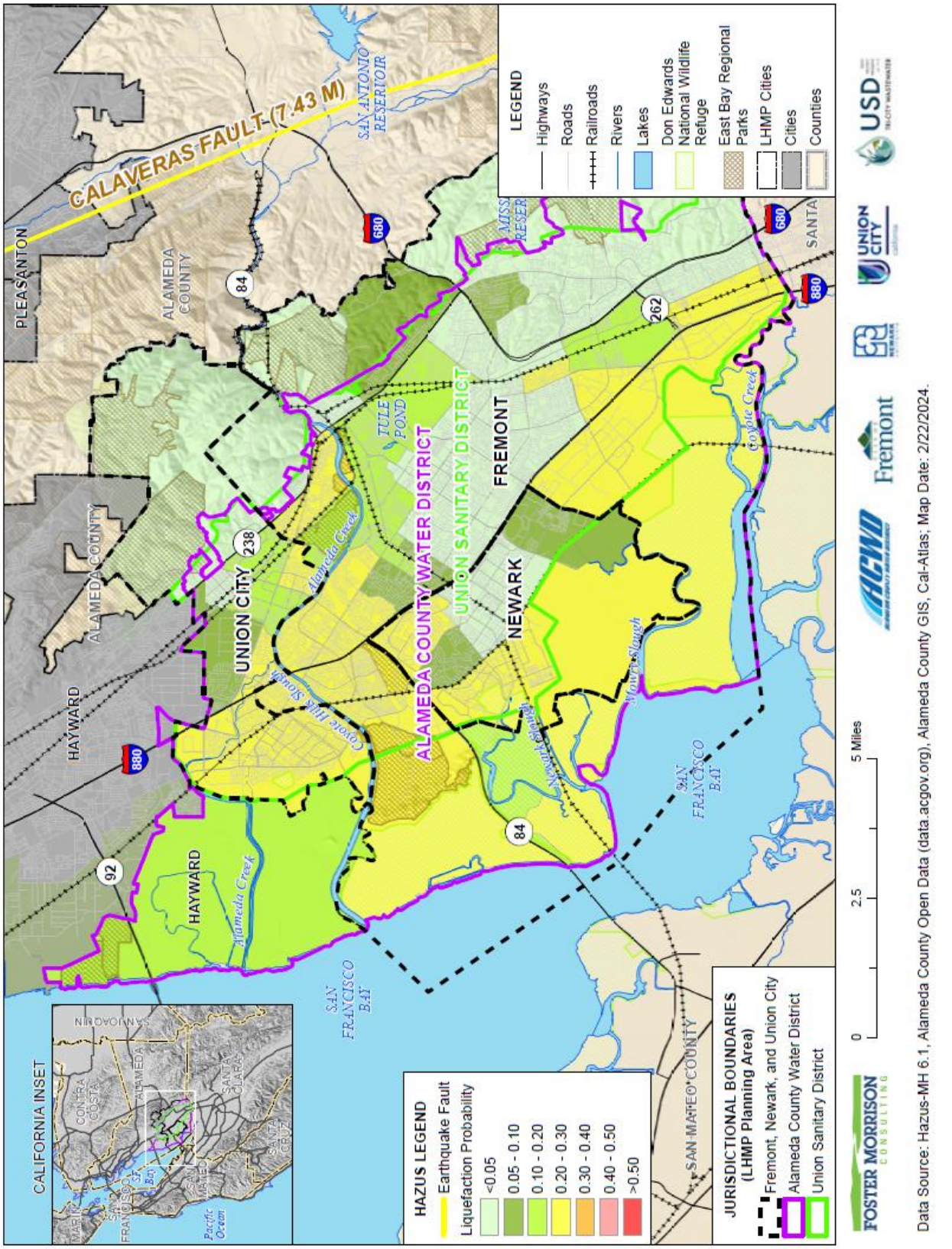
Figure E-27 Calaveras Fault - 7.43 Magnitude Peak Ground Acceleration



Liquefaction

Liquefaction occurs when loose, water-saturated soils are shaken strongly and causes sudden loss of strength and stiffness in soils. This shaking can lead to settlement and horizontal movements of the ground. The liquefaction probability associated with this Hazus scenario can be seen on Figure E-28.

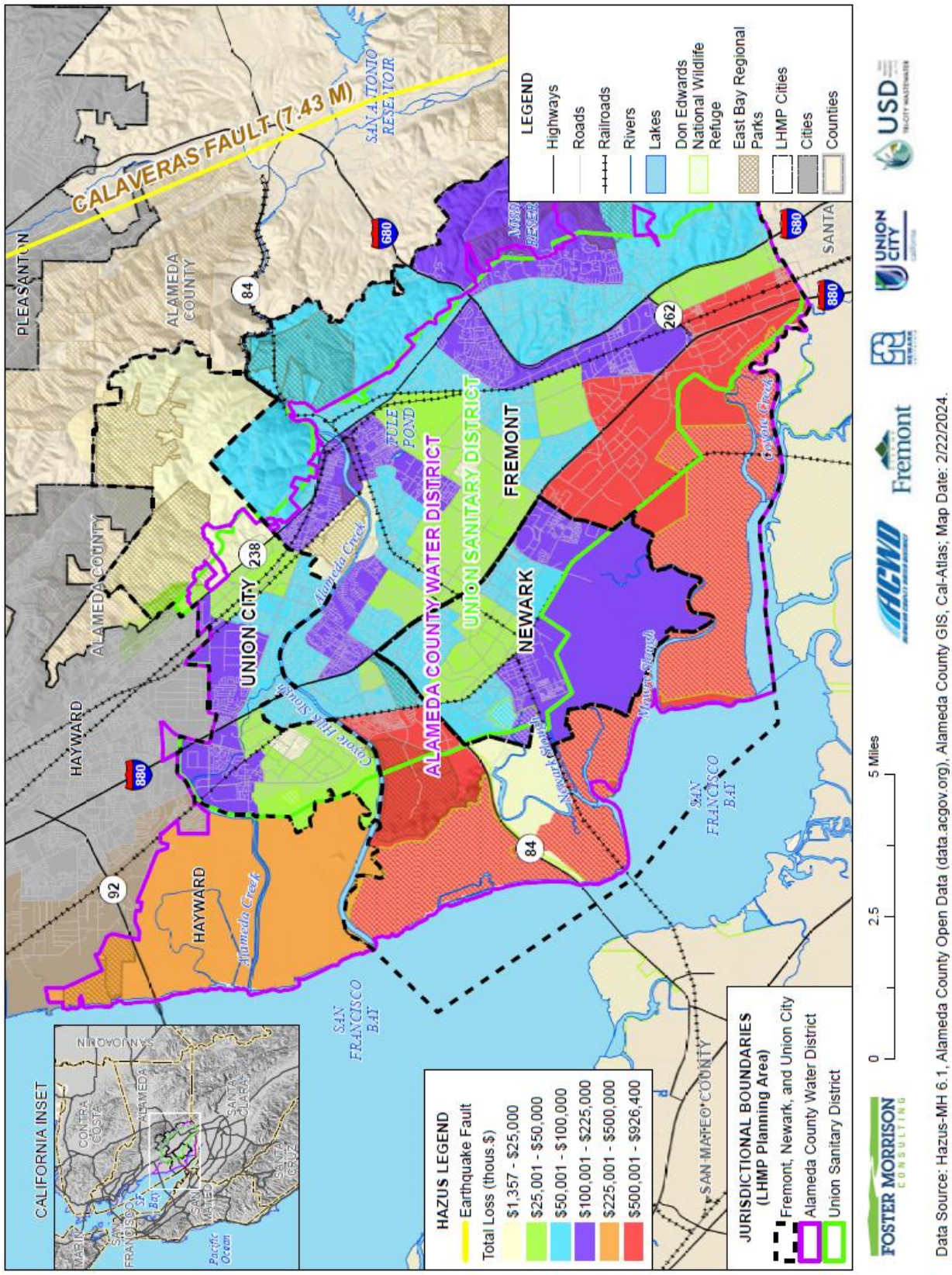
Figure E-28 Calaveras Fault 7.43 Magnitude Liquefaction Probability



Total Loss Estimates

For each study region, information on loss estimates is provided based on that study region's earthquake risk and general building stock value, which includes building and lifeline related losses on the study region's available inventory. The total loss estimates associated with this scenario can be seen on Figure E-29.

Figure E-29 Calaveras Fault 7.43 Total Loss



Fire Following Earthquake

As detailed in the above methodology, two iterations of the Fire Following Earthquake were conducted for each primary Hazus Scenario. The results for the two iterations for the Calaveras Scenario are included below.

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area.

- Four maps were created for the 10-mph scenario:
  - ✓ Number of Ignitions is shown on Figure E-30.
  - ✓ Population Exposure is shown on Figure E-31.
  - ✓ Value Exposure is shown on Figure E-32.
  - ✓ Fire Water Demand (gpm) is shown on Figure E-33.
- Four maps were created for the 50-mph scenario
  - ✓ Number of Ignitions is shown on Figure E-34.
  - ✓ Population Exposure is shown on Figure E-35
  - ✓ Value Exposure is shown on Figure E-36
  - ✓ Fire Water Demand (gpm) is shown on Figure E-37.

Figure E-30 Calaveras Fault 7.43 Magnitude Number of Ignitions (10 MPH Winds)

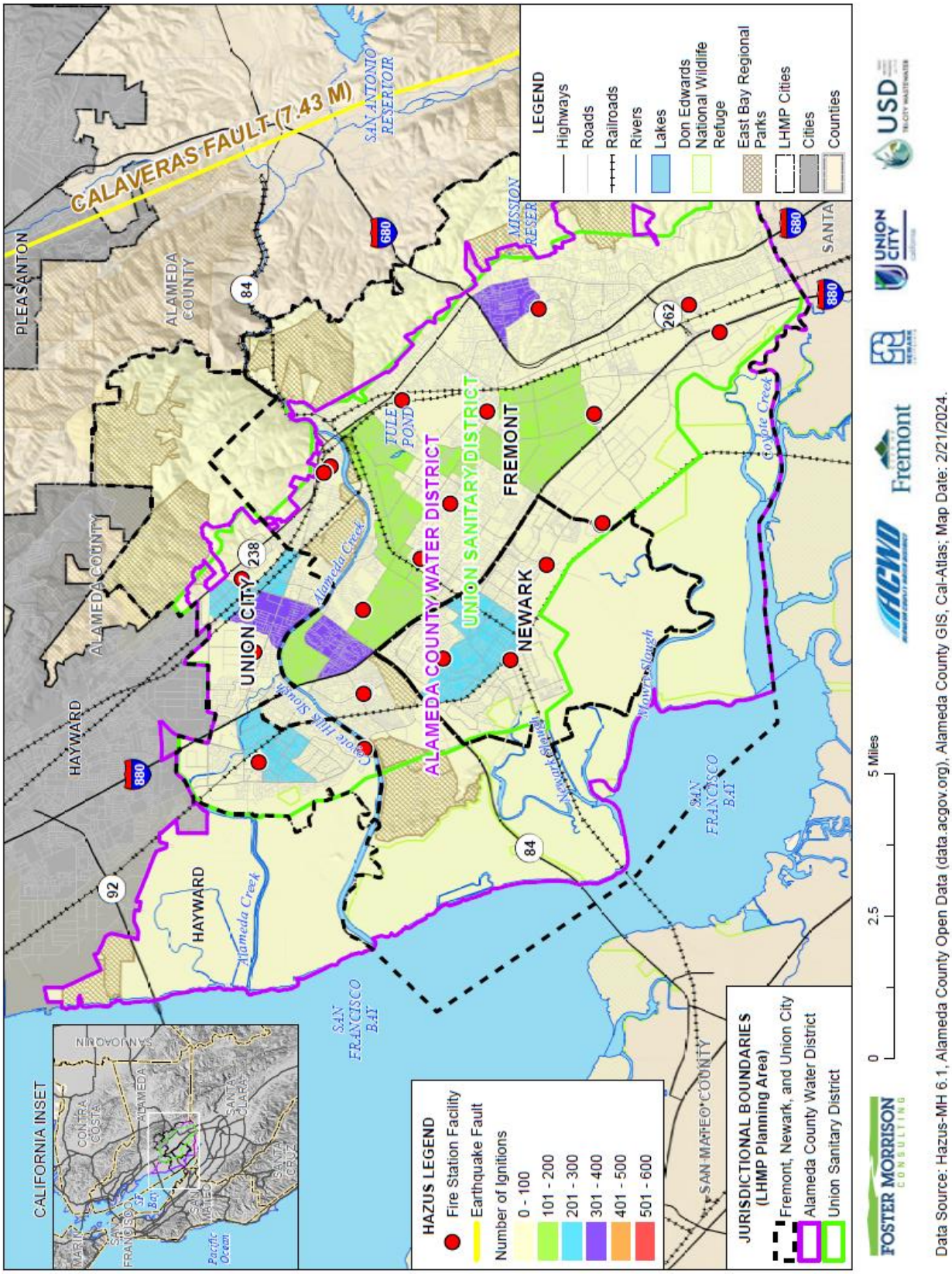


Figure E-31 Calaveras Fault 7.43 Magnitude Population Exposure (10 MPH Winds)

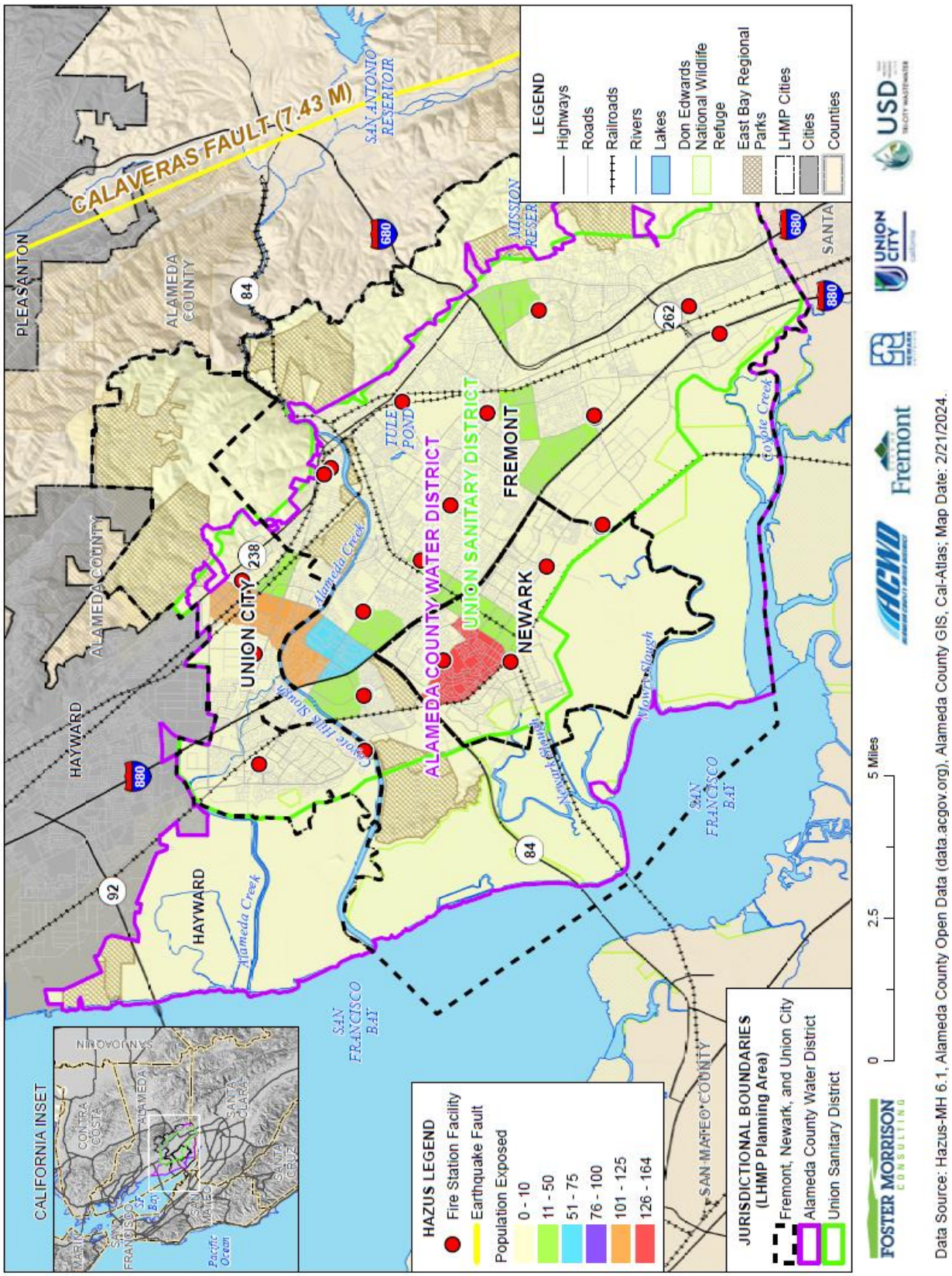


Figure E-32 Calaveras Fault 7.43 Magnitude Exposed Values (10 MPH Winds)

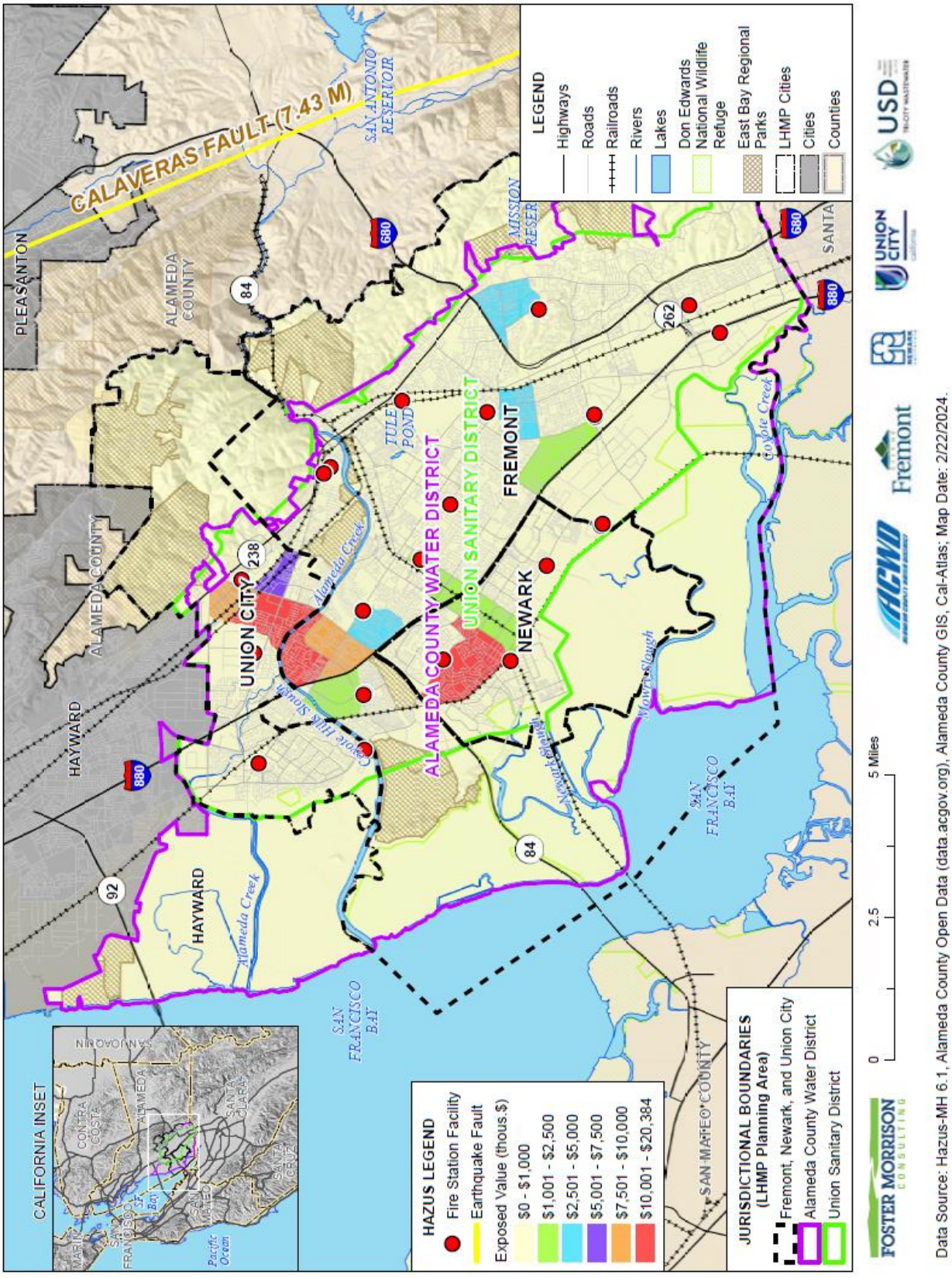


Figure E-33 Calaveras Fault 7.43 Magnitude Fire Water Demand in GPM (10 MPH Winds)

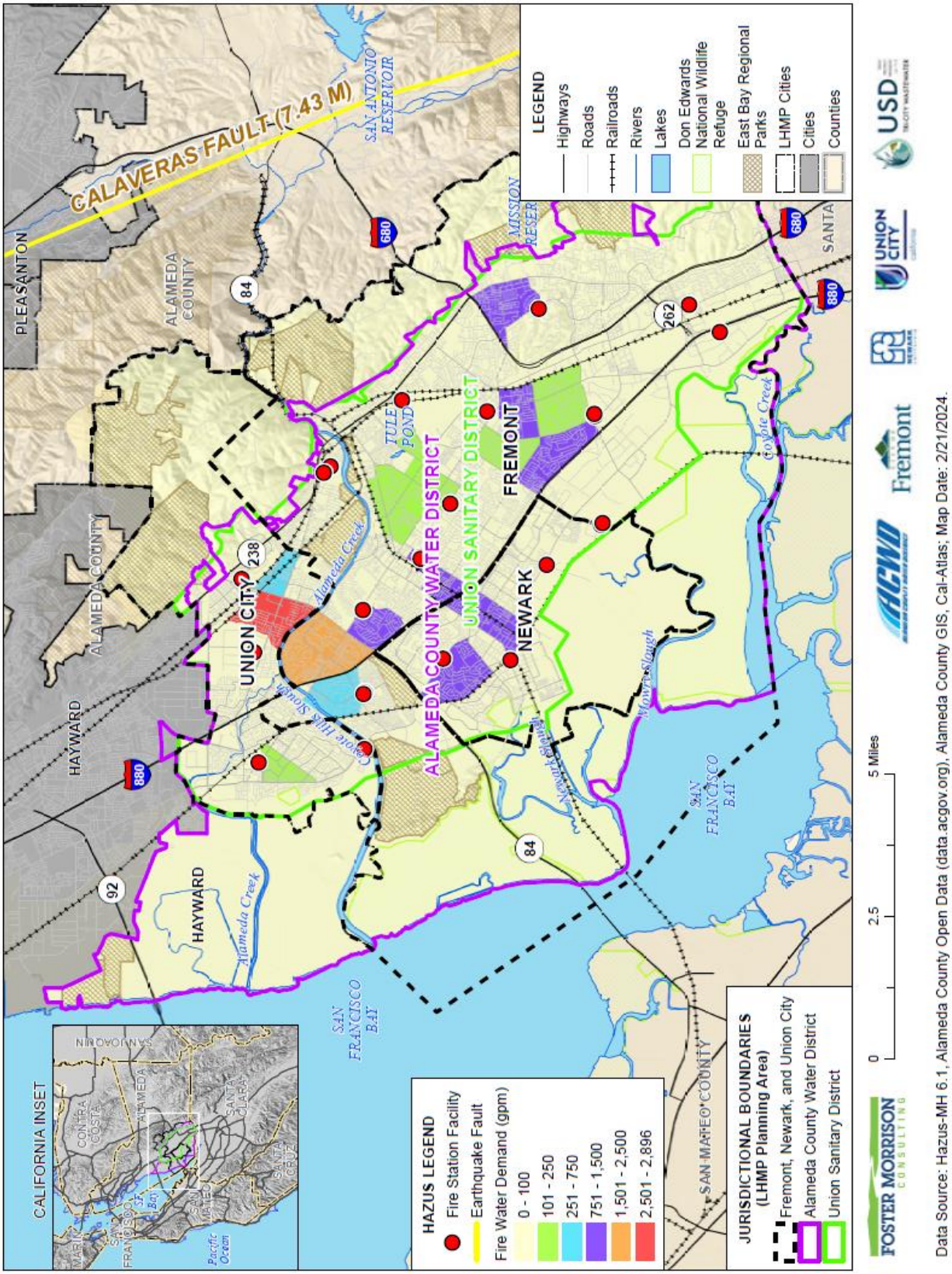


Figure E-34 Calaveras Fault 7.43 Magnitude Number of Ignitions (50 MPH Winds)

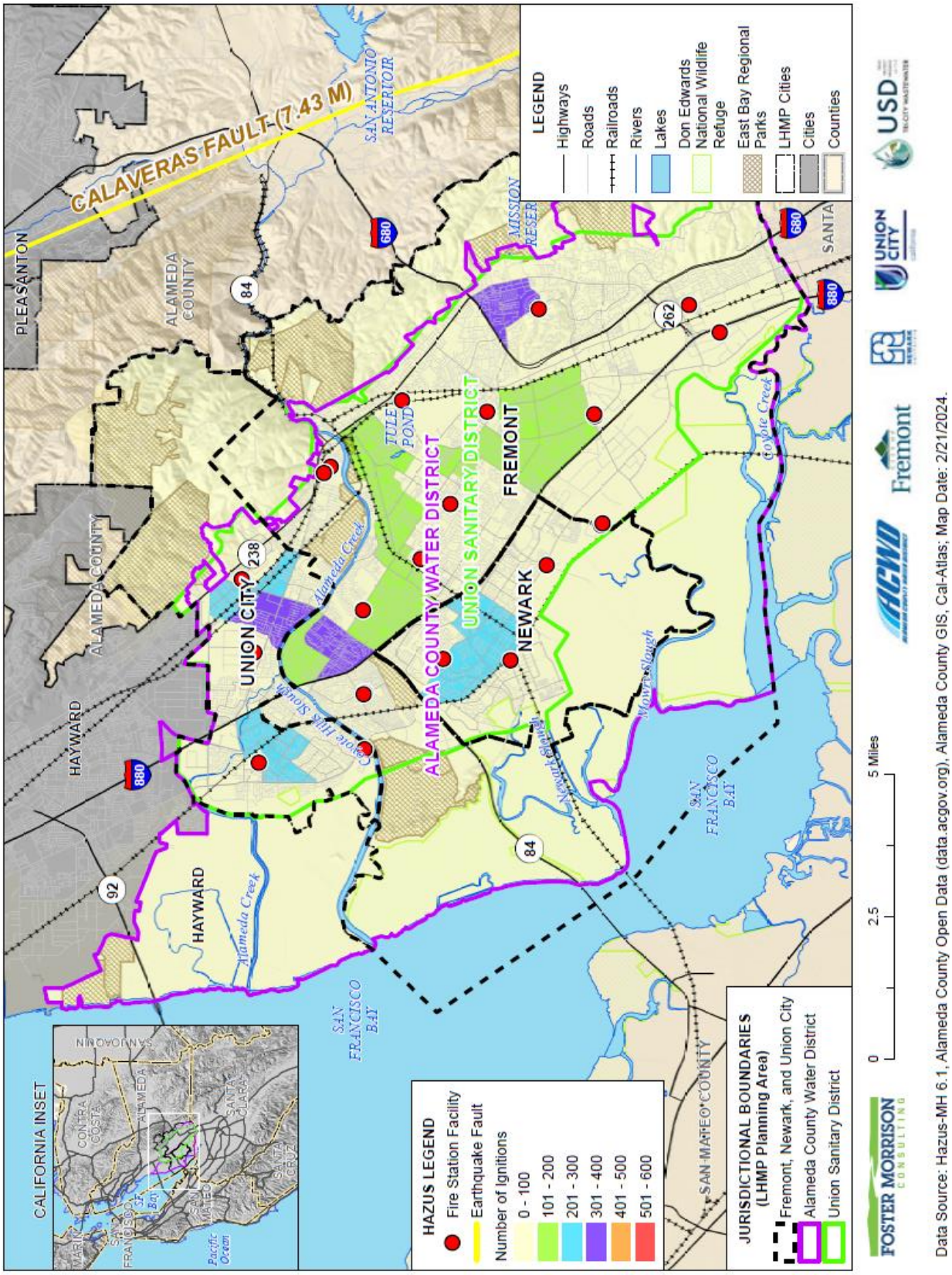


Figure E-35 Calaveras Fault 7.43 Magnitude Population Exposure (50 MPH Winds)

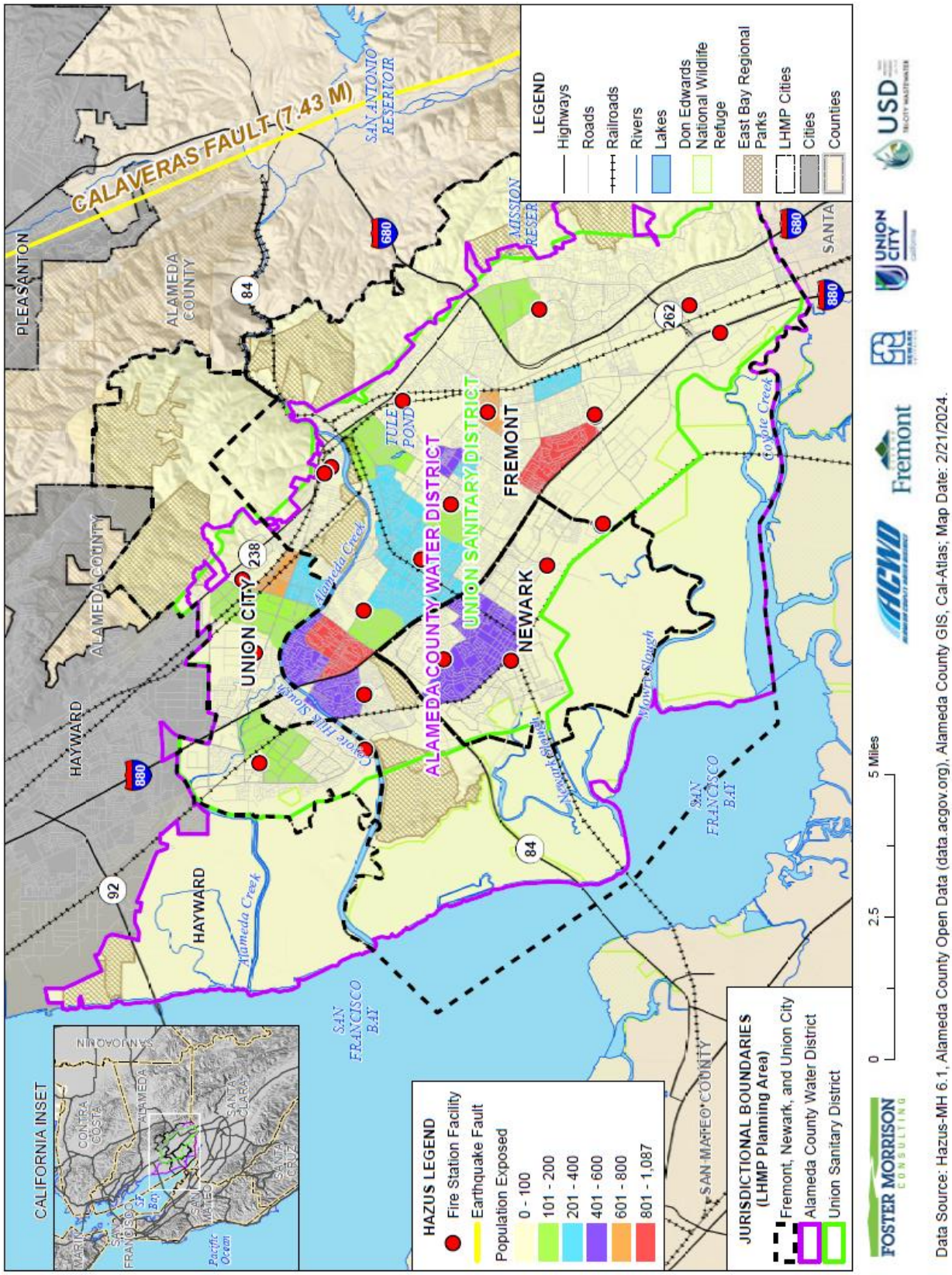


Figure E-36 Calaveras Fault 7.43 Magnitude Exposed Values (50 MPH Winds)

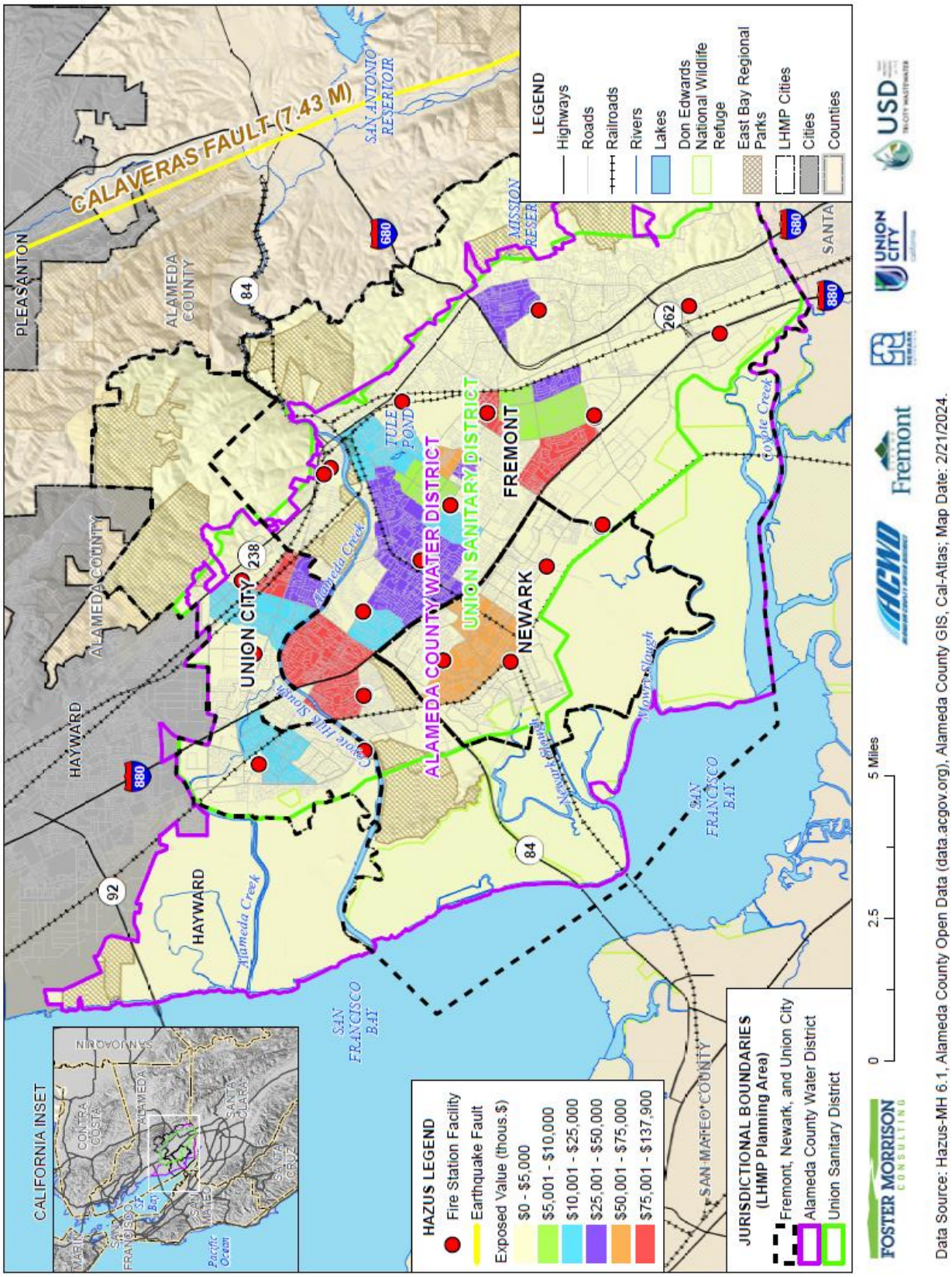
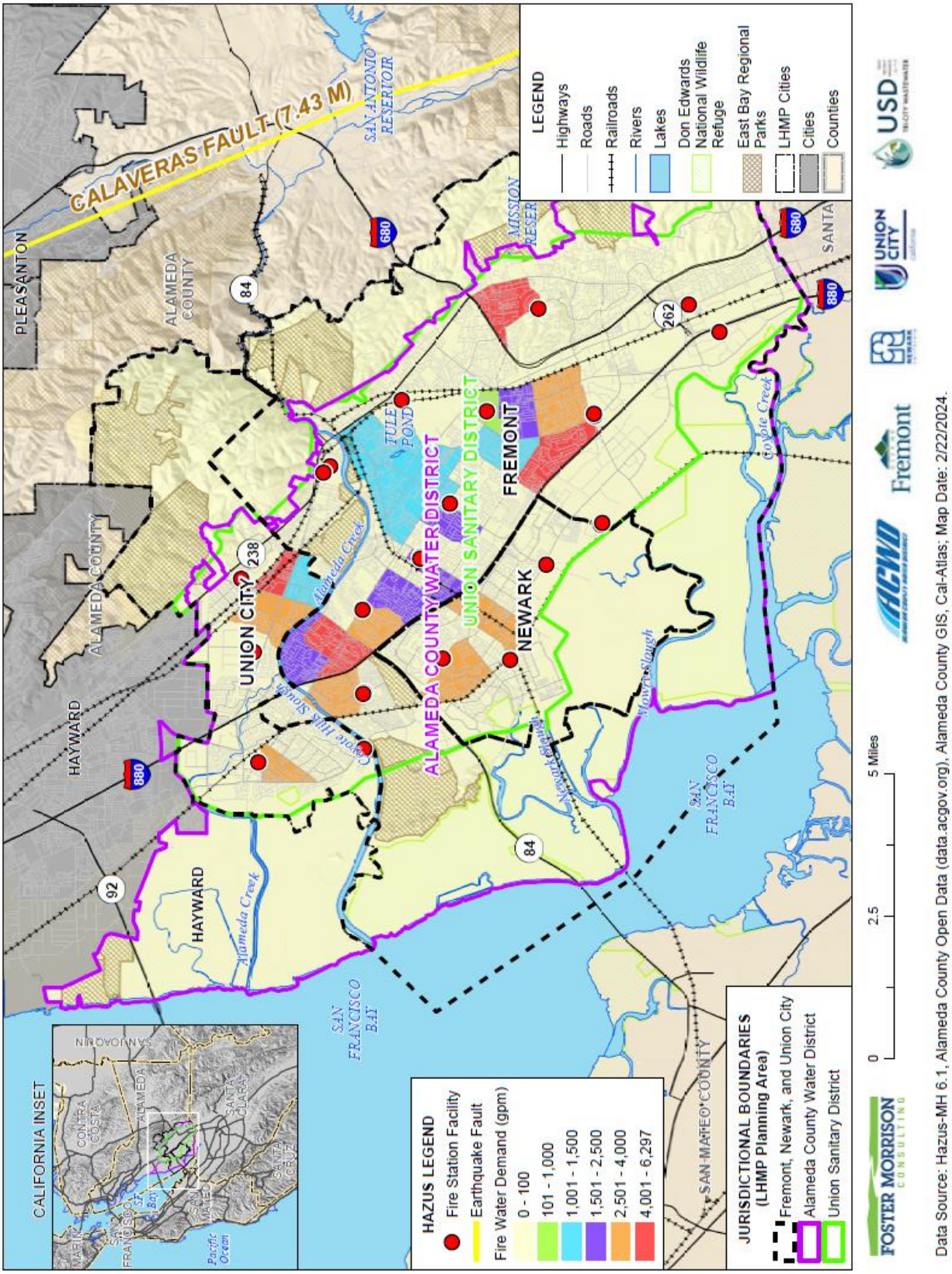


Figure E-37 Calaveras Fault 7.43 Magnitude Fire Water Demand in GPM (50 MPH Winds)



Hayward + Rodgers Creek Fault Hazus Scenario (Epicenter: Fremont; Magnitude: 7.57)

The Hazus results for the Hayward + Rodgers Creek Fault Hazus Scenario is summarized below in Table E-42. Appendix H includes the Earthquake Hazus Global Summary Risk Report for each Hazus defined study region where more detailed information can be obtained. ***Note***: The location of the Hayward Fault on the maps below was noted by the District to not be in the correct locations. Foster Morrison was unable to modify the fault location on the maps below as that is the location that FEMA's Hazus program has recorded for the fault. Its actual location is correct in terms of the analysis (so the table below remain correct). FEMA was notified of this error.

Table E-42 Tri-City Planning Area– Hayward + Rodgers Creek Fault HAZUS Earthquake Deterministic Results for 7.57 M Event

Type of Impact	Impacts to City from 7.57 Deterministic Earthquake	
Total Buildings Damaged (based on 102,000 buildings)	Slight: 39,420 Moderate: 24,508 Extensive: 10,382 Complete: 3,703	
Building and Income Related Losses	$17,055,480,000	
Total Economic Losses (Includes building, income and lifeline losses)	$18,535,370,000	
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 1,344 Requiring hospitalization: 264 Life threatening: 22 Fatalities: 38	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 3,083 Requiring hospitalization: 822 Life threatening: 131 Fatalities: 241	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 2,315 Requiring hospitalization: 657 Life threatening: 199 Fatalities: 185	
Damage to Transportation Systems	27 highway bridges, 8 railway bridges, 2 railway facilities, and 1 airport facility with at least moderate damage. 2 highway bridges with complete damage.	
Damage to Essential Facilities	59 schools, 1 EOC, 5 police stations, and 2 fire stations with at least moderate damage. 4 school facilities with complete damage.	
Damage to Utility Systems	1 wastewater facility, 1 electrical power facility, and 1 communication facility with at least moderate damage. None with complete damage. 2,251 potable water line breaks, 1,131 wastewater line breaks, and 17 natural gas line breaks.	
Households without Power/Water Service (Based on 113,685 total households)	Power loss, Day 1: 113,685 Power loss, Day 3: 113,685 Power loss, Day 7: 113,685 Power loss, Day 30: 113,685 Power loss, Day 90: 113,685	Water loss, Day 1: 113,428 Water loss, Day 3: 113,406 Water loss, Day 7: 113,356 Water loss, Day 30: 112,715 Water loss, Day 90: 0
Displaced Households	11,362 displaced households	

Type of Impact	Impacts to City from 7.57 Deterministic Earthquake
Shelter Requirements	5,637 persons
Debris Generation	2,390,000 tons

Hazus 6.1

Loss Estimates Highlights

Hazus estimates that about 38,593 buildings will be at least moderately damaged. This is over 38.00 % of the buildings in the region. There are an estimated 3,702 buildings that will be damaged beyond repair.

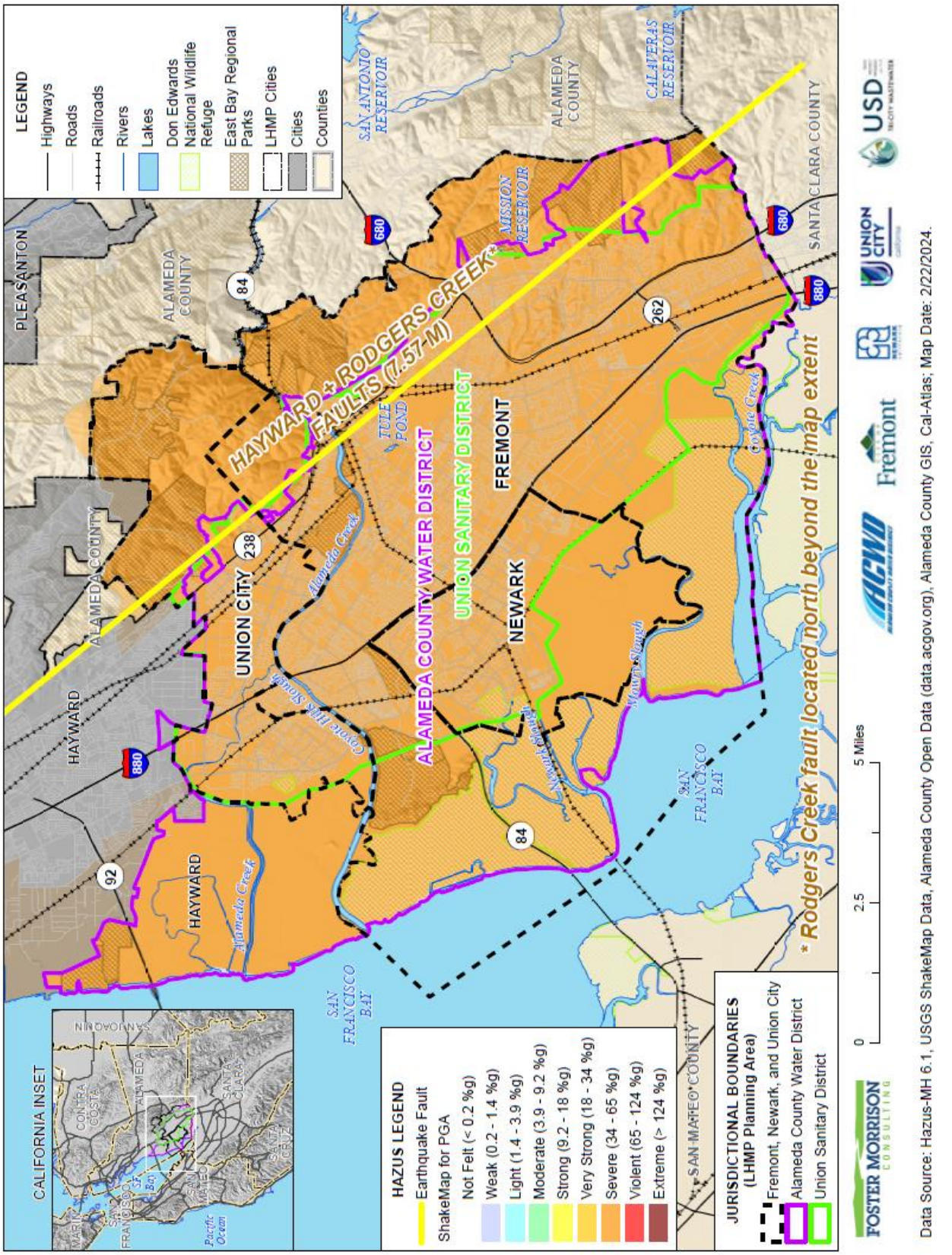
Before the earthquake, the region had 556 hospital beds available for use. On the day of the earthquake, the model estimates that only 173 hospital beds (31.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 60.00% of the beds will be back in service. By 30 days, 88.00% will be operational.

The total building-related losses were 17,055.48 (millions of dollars); 12 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 44 % of the total loss.

Peak Ground Acceleration (Shaking)

Hazus evaluates the geographic distribution of ground shaking as a result of a specific earthquake scenario and expresses ground shaking using several quantitative parameters, including the peak ground acceleration. The peak ground acceleration map associated with this Hazus scenario can be seen on Figure E-38.

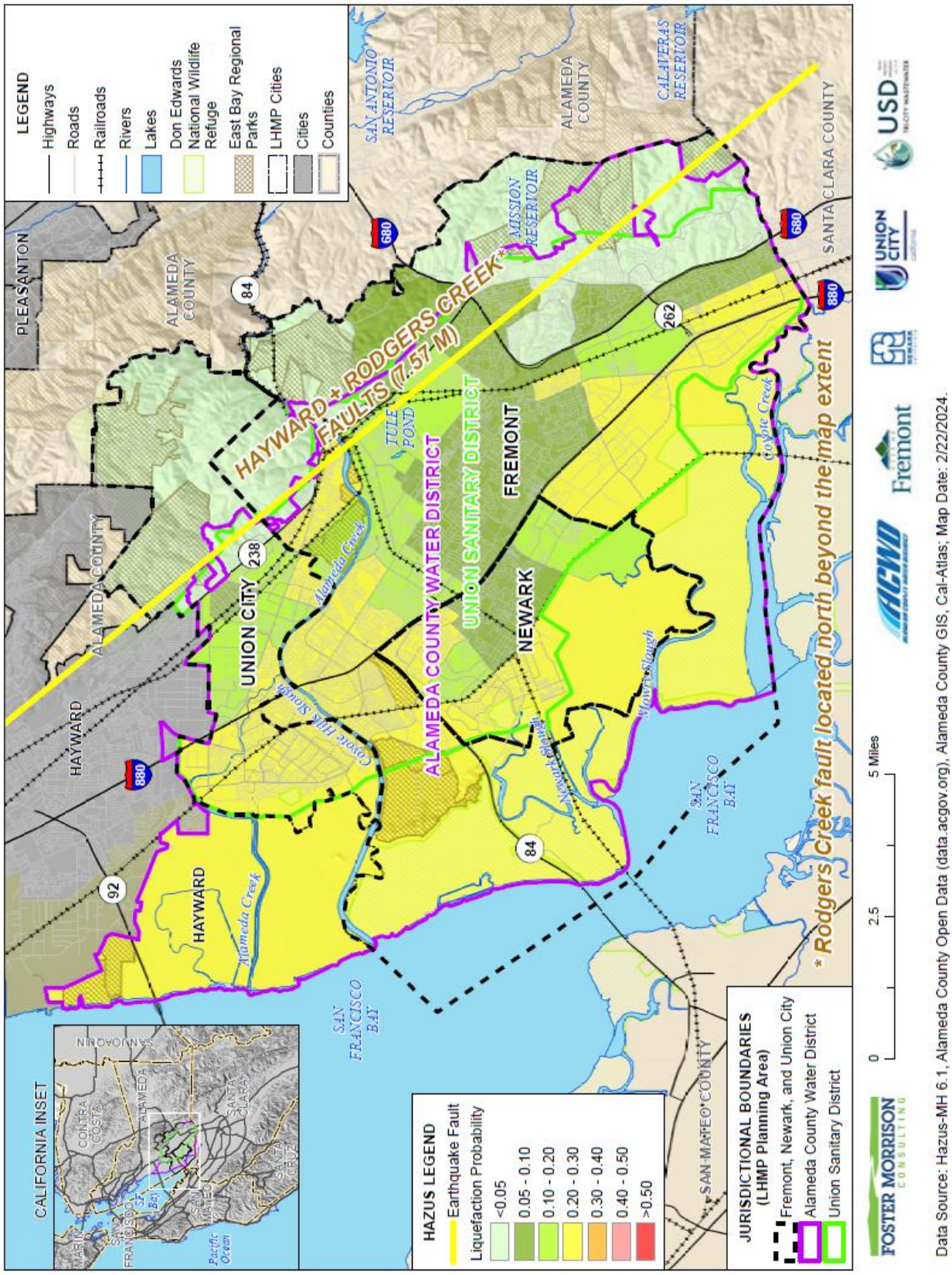
Figure E-38 Hayward + Rodgers Creek Fault - 7.57 Magnitude Peak Ground Acceleration



Liquefaction

Liquefaction occurs when loose, water-saturated soils are shaken strongly and causes sudden loss of strength and stiffness in soils. This shaking can lead to settlement and horizontal movements of the ground. The liquefaction probability associated with this Hazus scenario can be seen on Figure E-39.

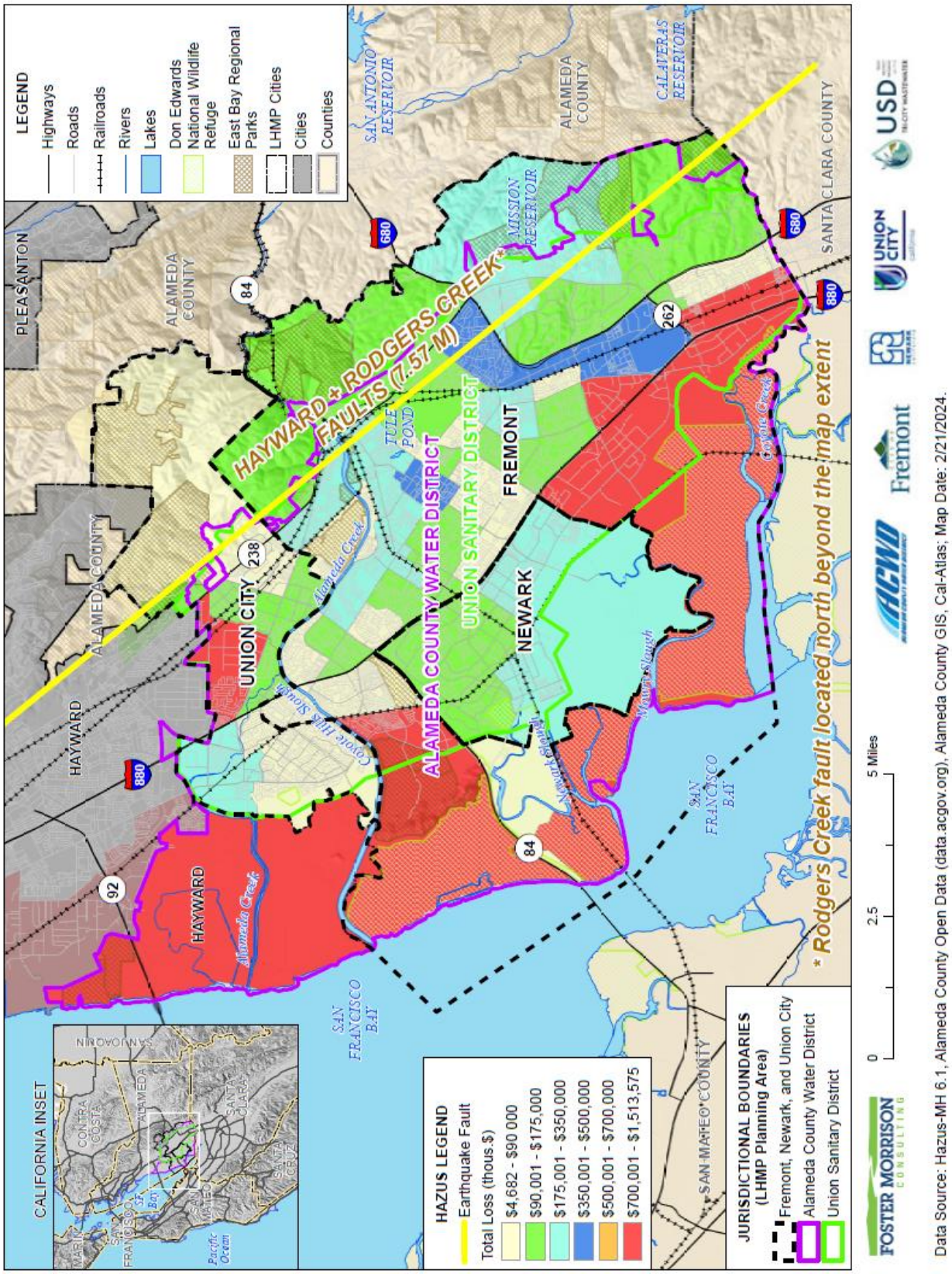
Figure E-39 Hayward + Rodgers Creek Fault 7.57 Magnitude Liquefaction Probability



Total Loss Estimates

For each study region, information on loss estimates is provided based on that study region's earthquake risk and general building stock value, which includes building and lifeline related losses on the study region's available inventory. The total loss estimates associated with this scenario can be seen on Figure E-40.

Figure E-40 Hayward + Rodgers Creek Fault 7.57 Magnitude Total Loss



Fire Following Earthquake

As detailed in the above methodology, two iterations of the Fire Following Earthquake were conducted for each primary Hazus Scenario. The results for the two iterations for the Haywood + Rodgers Creek Scenario are included below.

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area.

- Four maps were created for the 10-mph scenario:
  - ✓ Number of Ignitions is shown on Figure E-41.
  - ✓ Population Exposure is shown on Figure E-42.
  - ✓ Value Exposure is shown on Figure E-43.
  - ✓ Fire Water Demand (gpm) is shown on Figure E-44.
- Four maps were created for the 50-mph scenario:
  - ✓ Number of Ignitions is shown on Figure E-45.
  - ✓ Population Exposure is shown on Figure E-46.
  - ✓ Value Exposure is shown on Figure E-47.
  - ✓ Fire Water Demand (gpm) is shown on Figure E-48.

Figure E-41 Hayward + Rodgers Creek Fault 7.57 Magnitude Number of Ignitions (10 MPH Winds)

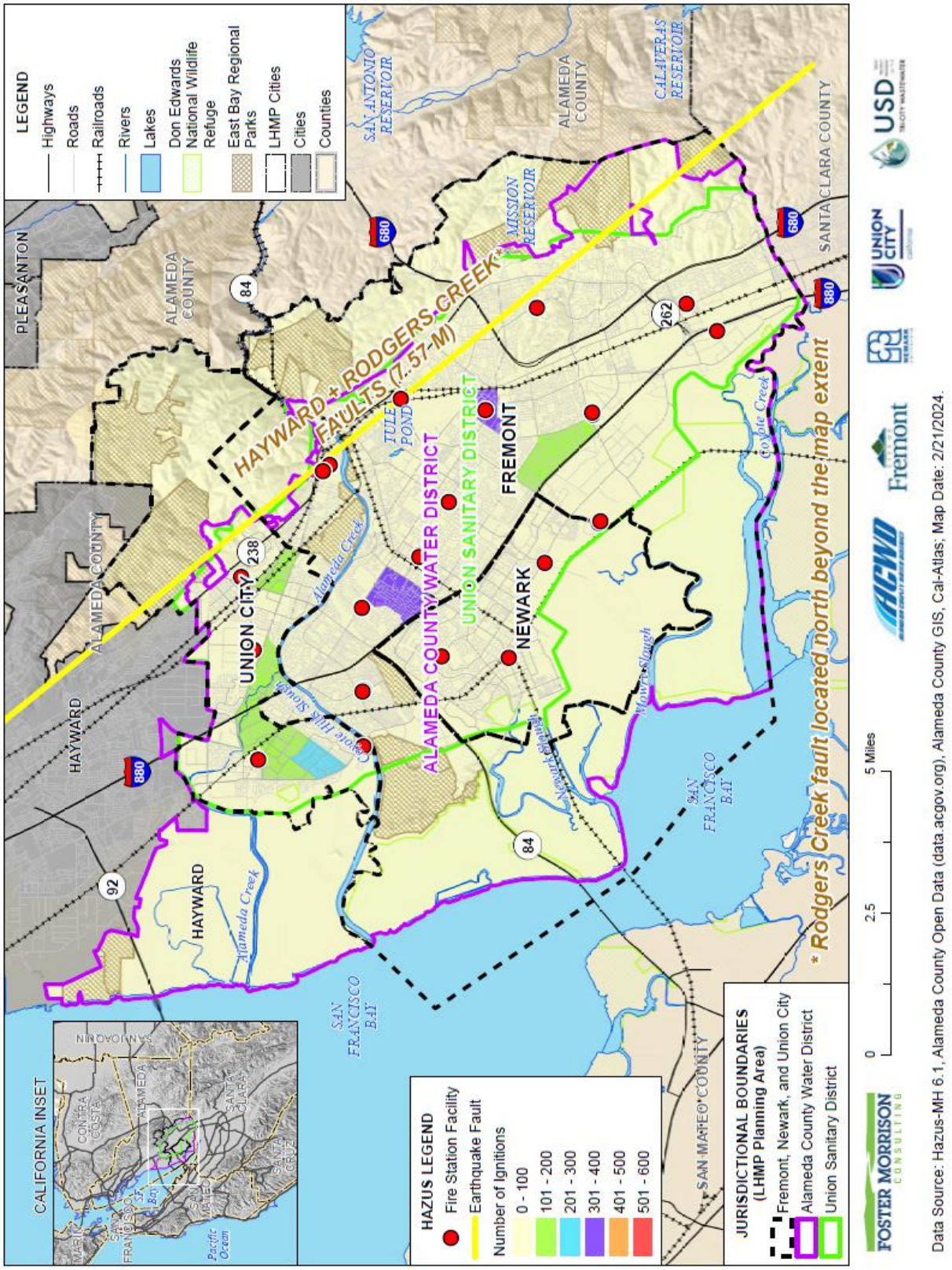


Figure E-42 Hayward + Rodgers Creek Fault 7.57 Magnitude Population Exposure (10 MPH Winds)

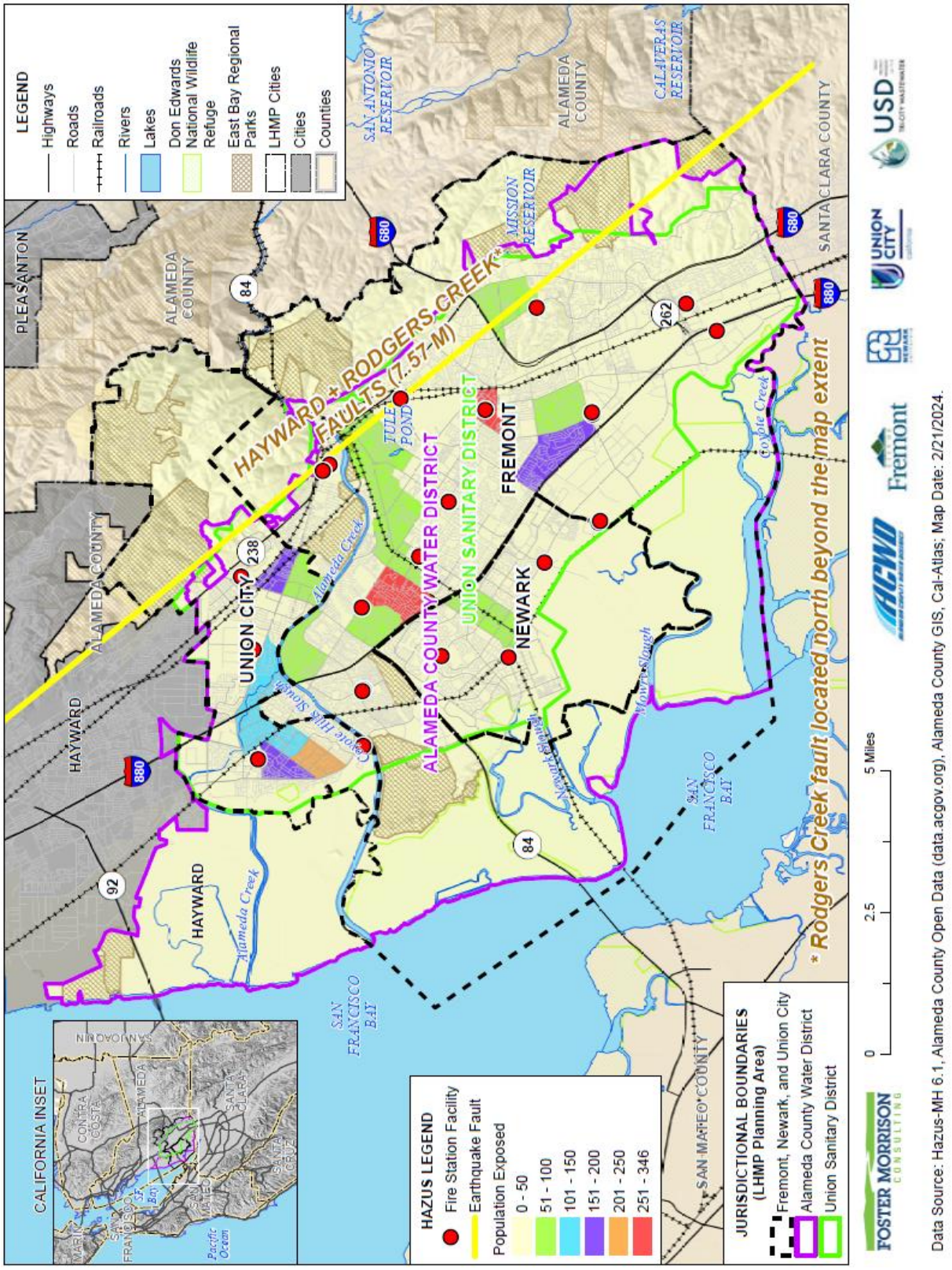


Figure E-43 Hayward + Rodgers Creek Fault 7.57 Magnitude Exposed Values (10 MPH Winds)

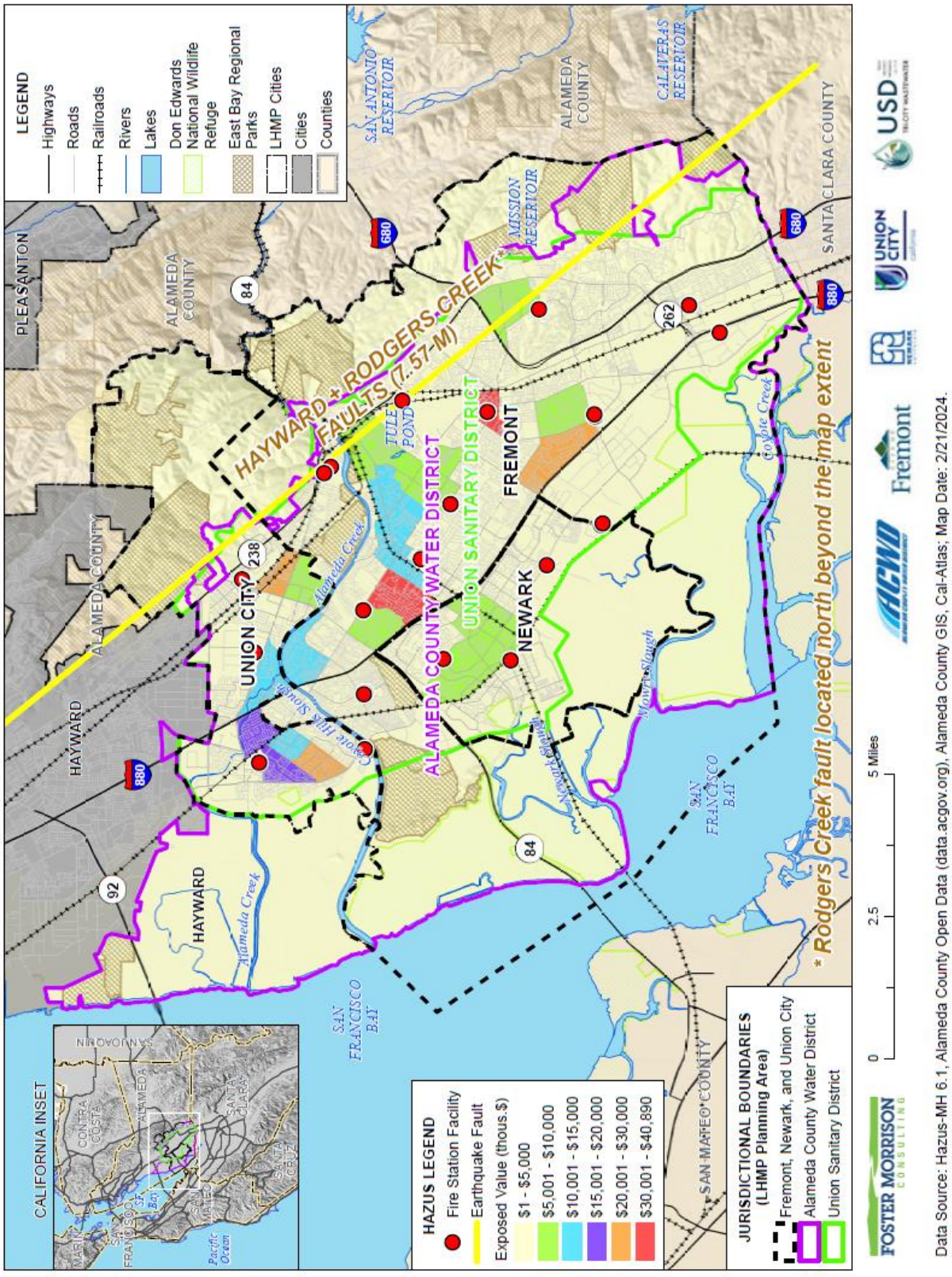


Figure E-44 Hayward + Rodgers Creek Fault 7.57 Magnitude Fire Water Demand in GPM (10 MPH Winds)

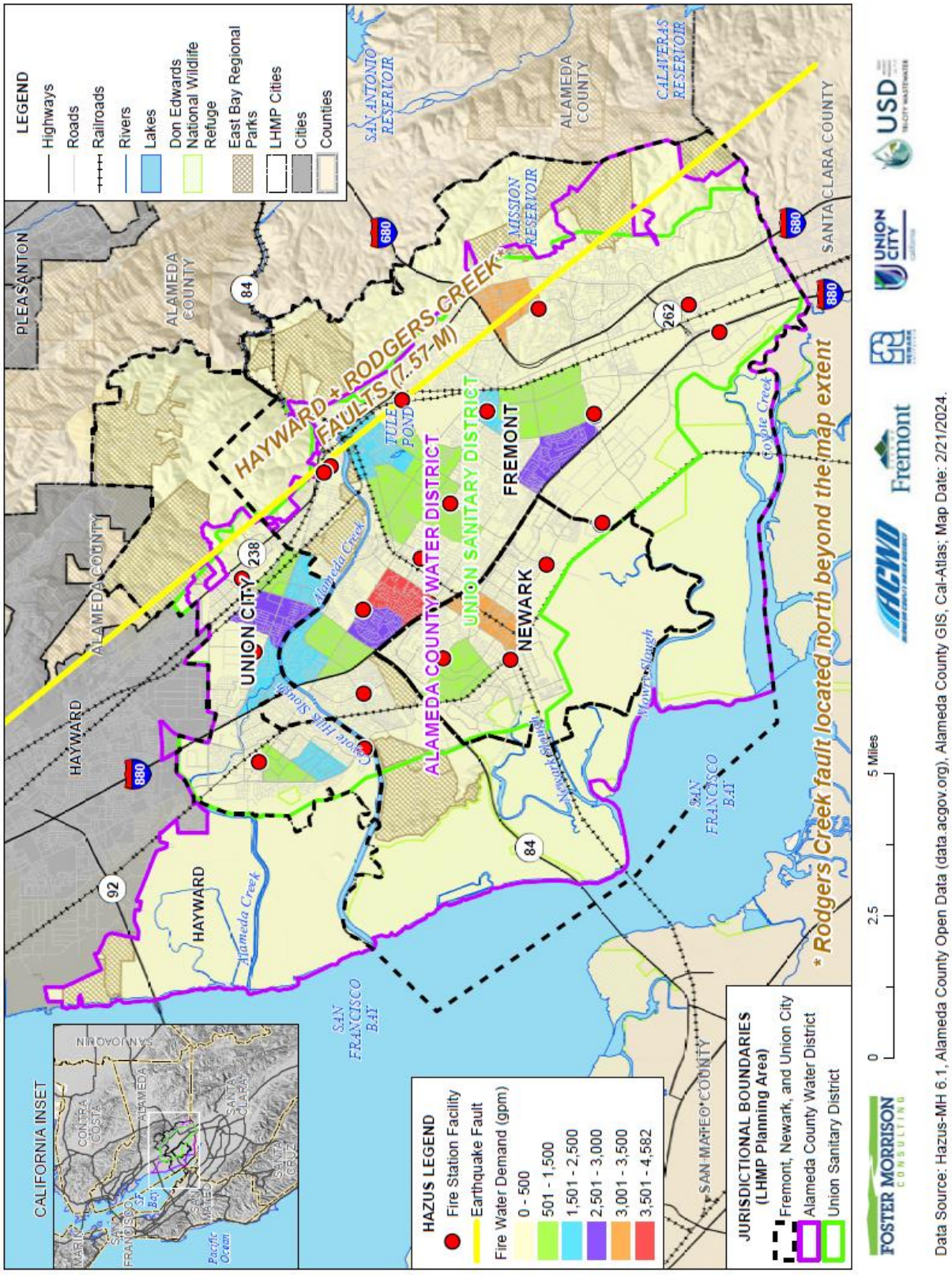


Figure E-45 Hayward + Rodgers Creek Fault 7.57 Magnitude Number of Ignitions (50 MPH Winds)

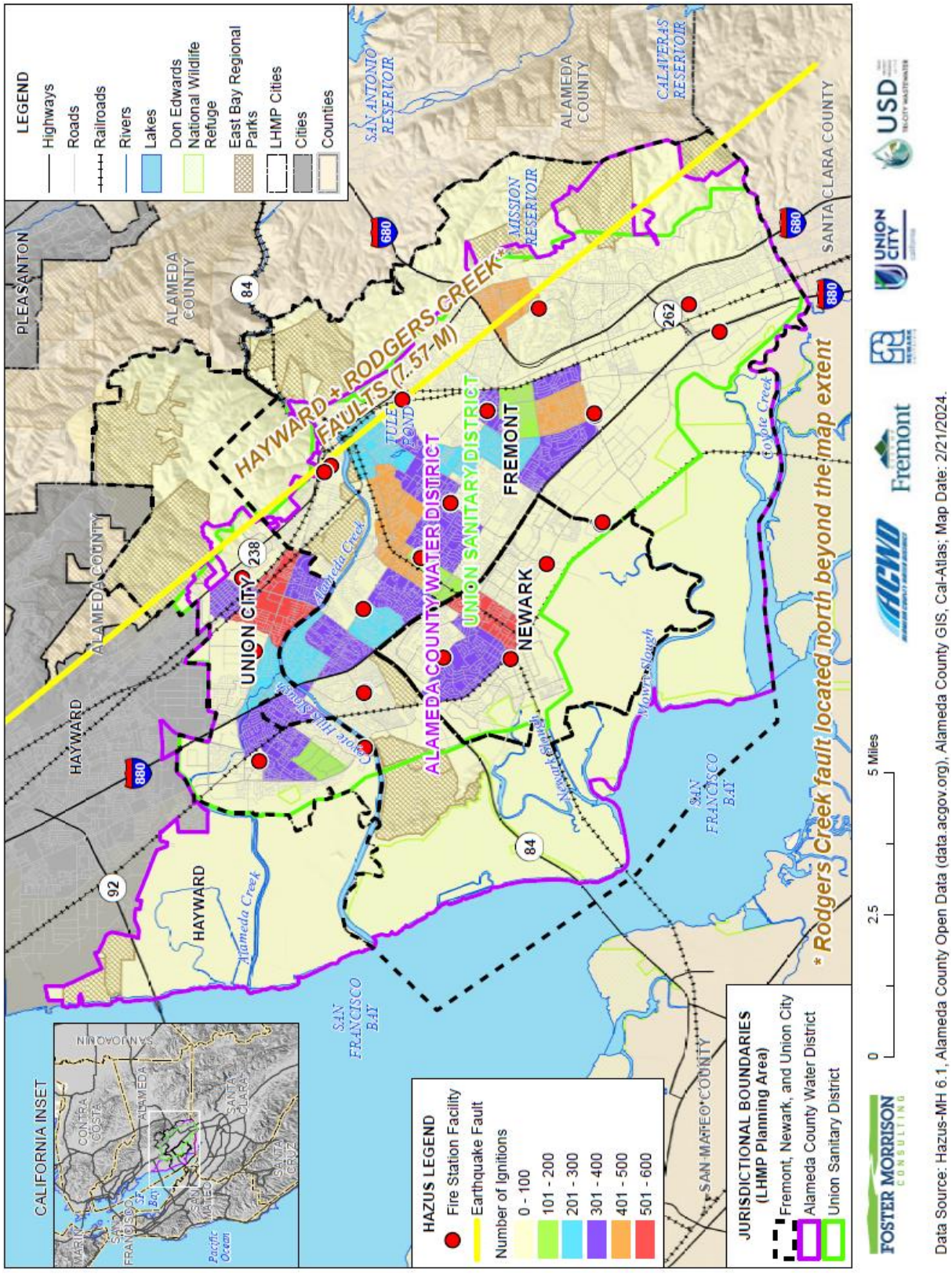


Figure E-46 Hayward + Rodgers Creek Fault 7.57 Magnitude Population Exposure (50 MPH Winds)

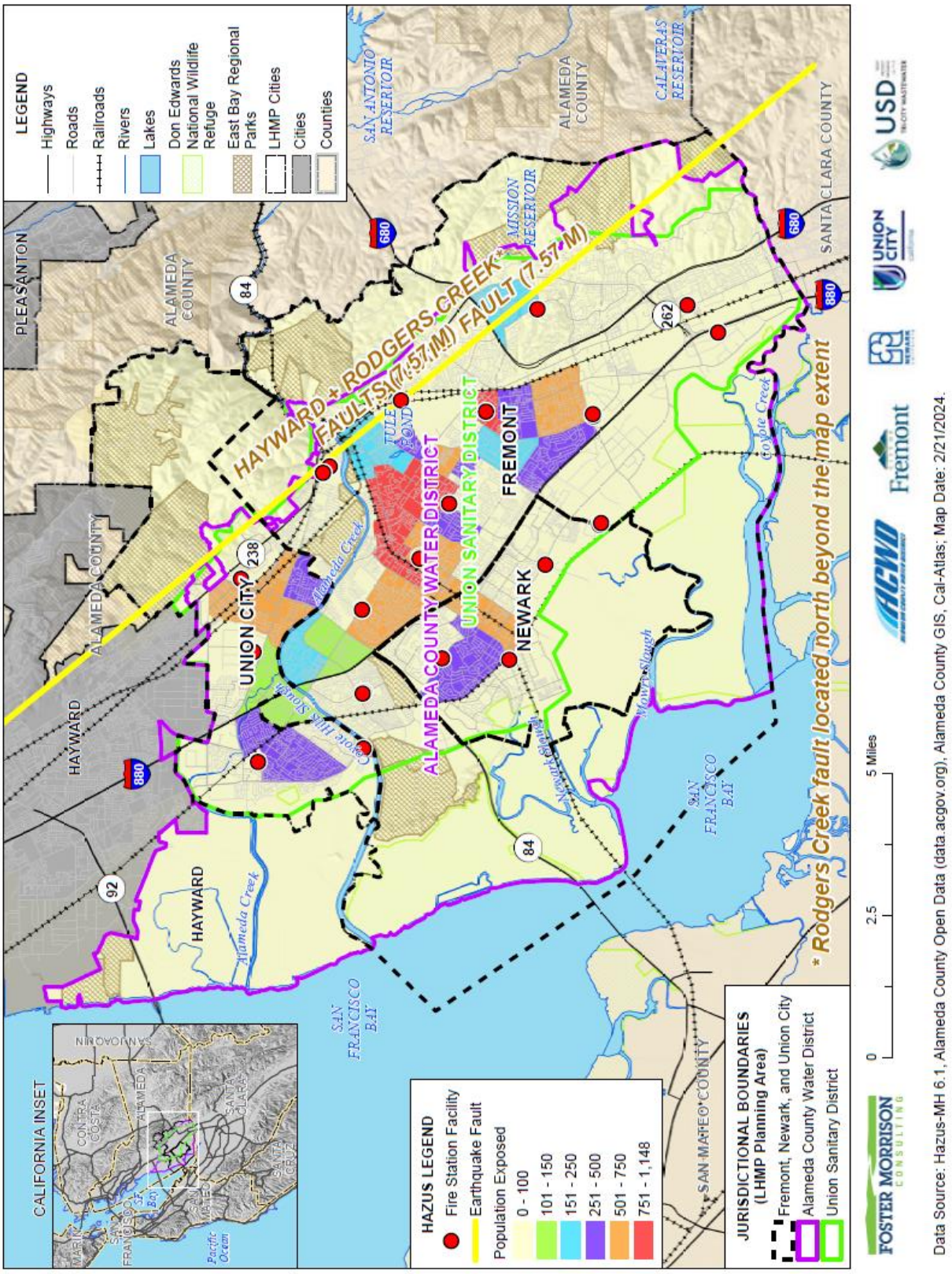


Figure E-47 Hayward + Rodgers Creek Fault 7.57 Magnitude Exposed Values (50 MPH Winds)

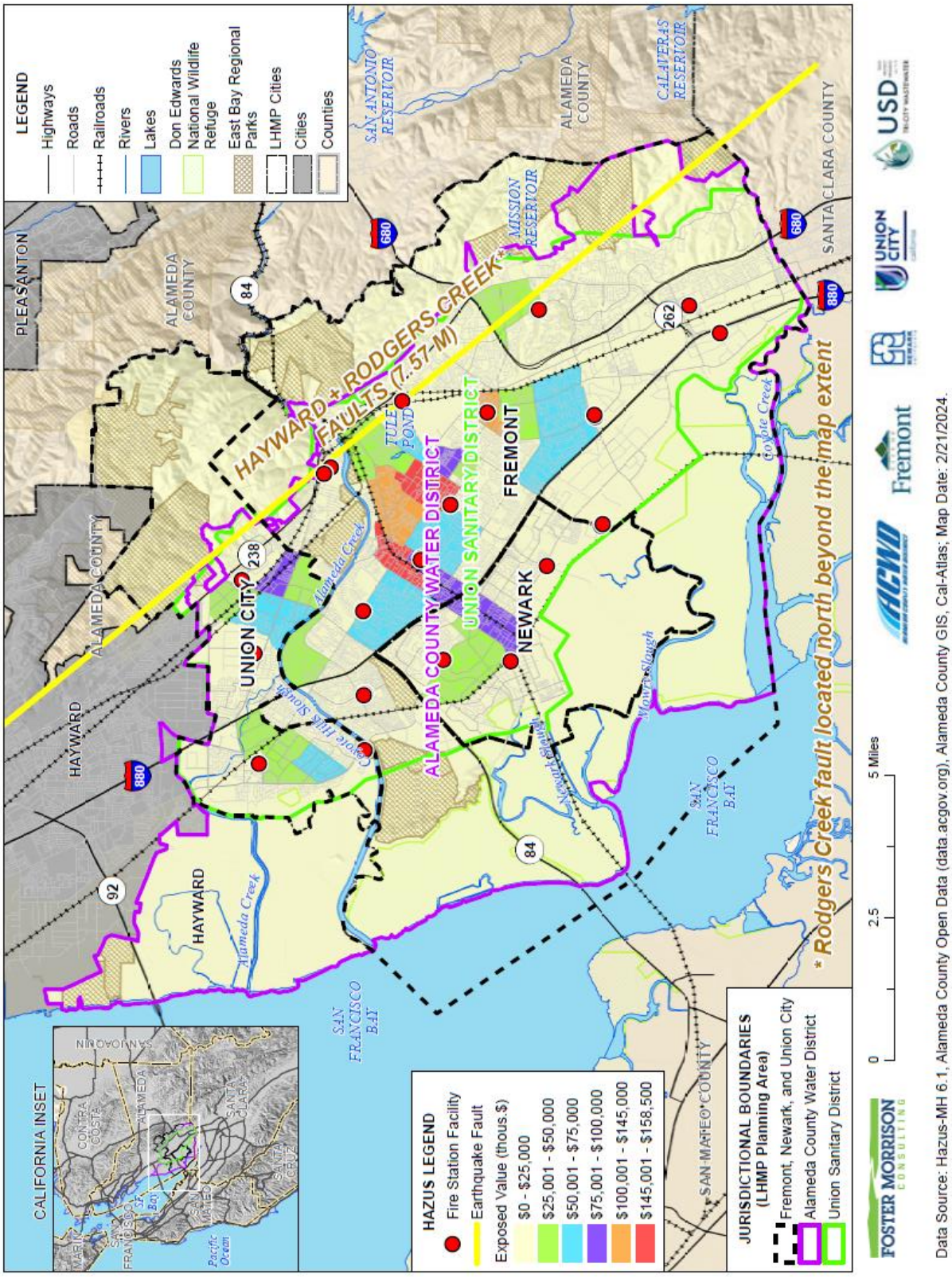
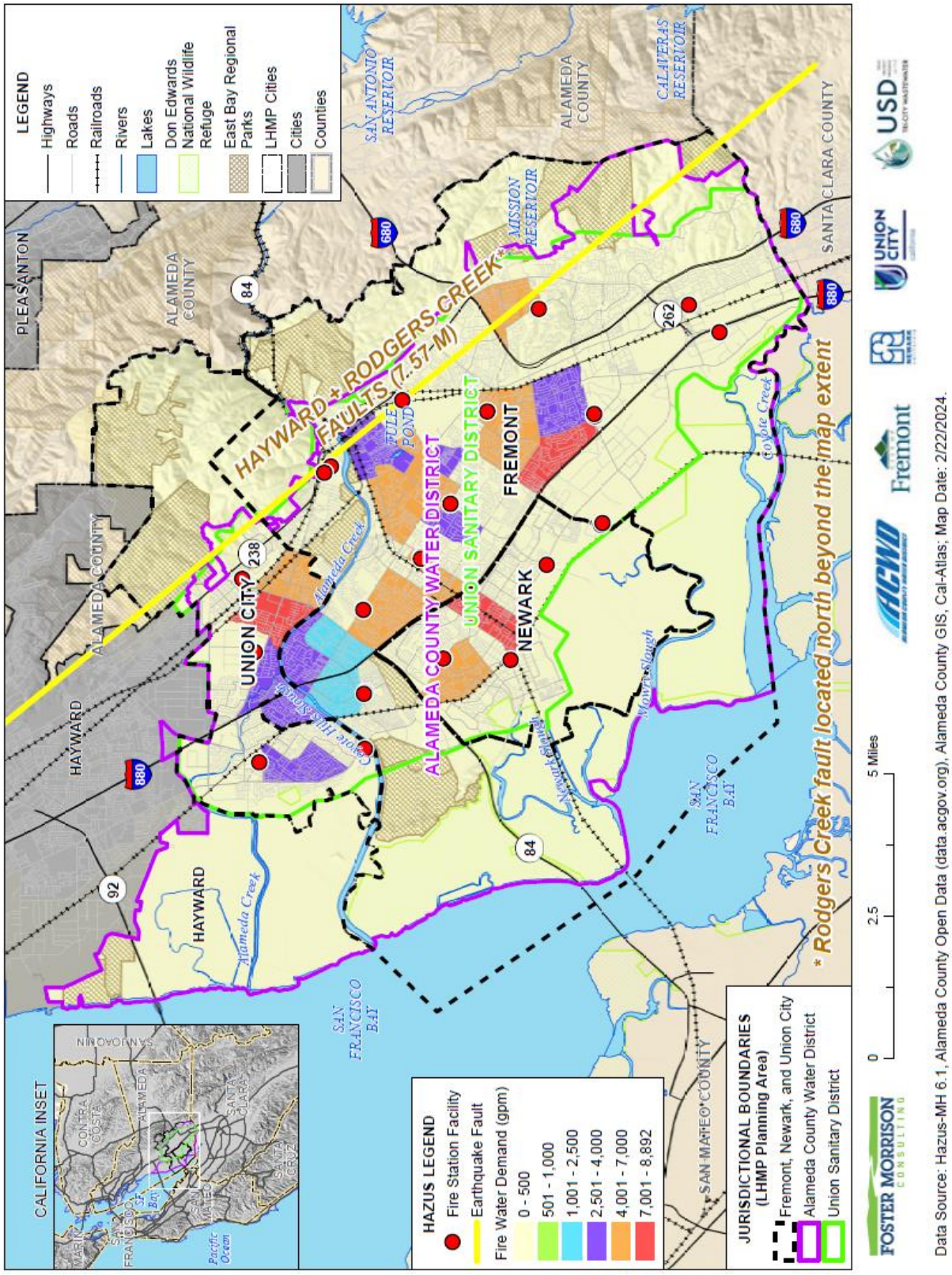


Figure E-48 Hayward + Rodgers Creek Fault 7.57 Magnitude Fire Water Demand in GPM (50 MPH Winds)



Haywired Scenario (Hayward Fault) HAZUS-MH Earthquake Loss Estimation Deterministic Results for 7.0 M Event

The Hazus results for the Haywired Hazus Scenario is summarized below in Table E-43. Appendix H includes the Earthquake Hazus Global Summary Risk Report for each Hazus defined study region where more detailed information can be obtained. ***Note***: The location of the Hayward Fault on the maps below was noted by the District to not be in the correct locations. Foster Morrison was unable to modify the fault location on the maps below as that is the location that FEMA's Hazus program has recorded for the fault. Its actual location is correct in terms of the analysis (so the table below remain correct). FEMA was notified of this error.

Table E-43 Tri-City Planning Area– Haywired (Hayward Fault) HAZUS Earthquake Deterministic Results for 7.0 M Event

Type of Impact	Impacts to City from 7.0 Deterministic Earthquake	
Total Buildings Damaged (based on 102,000 buildings)	Slight: 24,315 Moderate: 5,421 Extensive: 1,472 Complete: 327	
Building and Income Related Losses	$3,287,230,000	
Total Economic Losses (Includes building, income and lifeline losses)	$4,058,120,000	
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 191 Requiring hospitalization: 27 Life threatening: 2 Fatalities: 3	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 296 Requiring hospitalization: 55 Life threatening: 9 Fatalities: 12	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 250 Requiring hospitalization: 55 Life threatening: 9 Fatalities: 12	
Damage to Transportation Systems	1 airport facility with at least moderate damage	
Damage to Essential Facilities	3 schools with at least moderate damage. 0 facilities with complete damage.	
Damage to Utility Systems	1 electrical power facility and 2 communications facilities with at least moderate damage. 563 potable water line breaks, 268 wastewater line breaks, and 4 natural gas line breaks.	
Households without Power/Water Service (Based on 113,685 total households)	Power loss, Day 1: 113,685 Power loss, Day 3: 113,685 Power loss, Day 7: 113,685 Power loss, Day 30: 113,685 Power loss, Day 90: 113,685	Water loss, Day 1: 98,615 Water loss, Day 3: 95,442 Water loss, Day 7: 86,276 Water loss, Day 30: 0 Water loss, Day 90: 0
Displaced Households	993 displaced households	
Shelter Requirements	499 persons	

Type of Impact	Impacts to City from 7.0 Deterministic Earthquake
Debris Generation	367,000 tons

Hazus 6.1

Loss Estimates Highlights

Hazus estimates that about 7,219 buildings will be at least moderately damaged. This is over 7.00 % of the buildings in the region. There are an estimated 326 buildings that will be damaged beyond repair.

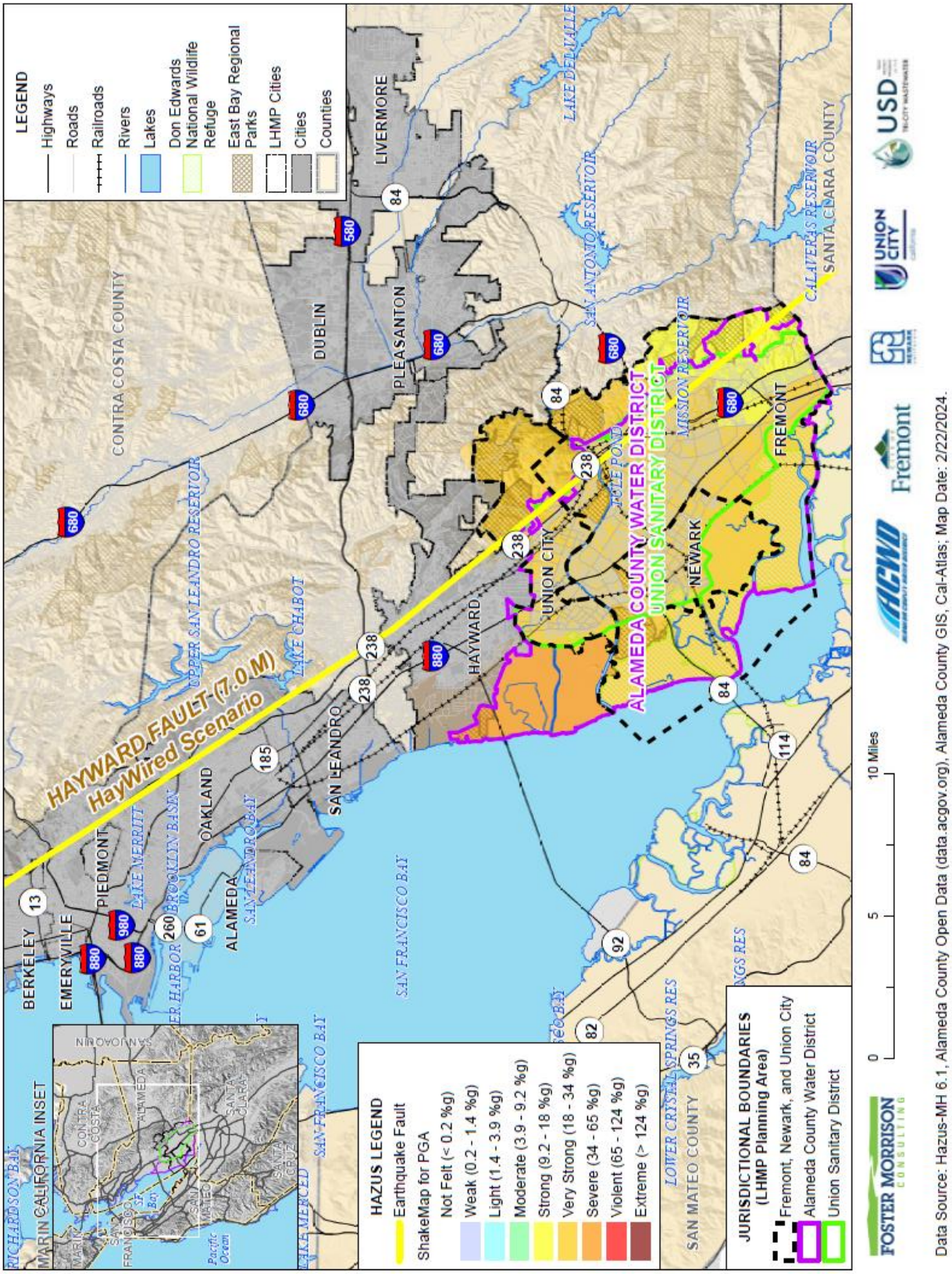
Before the earthquake, the region had 556 hospital beds available for use. On the day of the earthquake, the model estimates that only 443 hospital beds (80.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 93.00% of the beds will be back in service. By 30 days, 98.00% will be operational.

The total building-related losses were 3,287.23 (millions of dollars); 10 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 42 % of the total loss.

Peak Ground Acceleration (Shaking)

Hazus evaluates the geographic distribution of ground shaking as a result of a specific earthquake scenario and expresses ground shaking using several quantitative parameters, including the peak ground acceleration. The peak ground acceleration map associated with this Hazus scenario can be seen on Figure E-49.

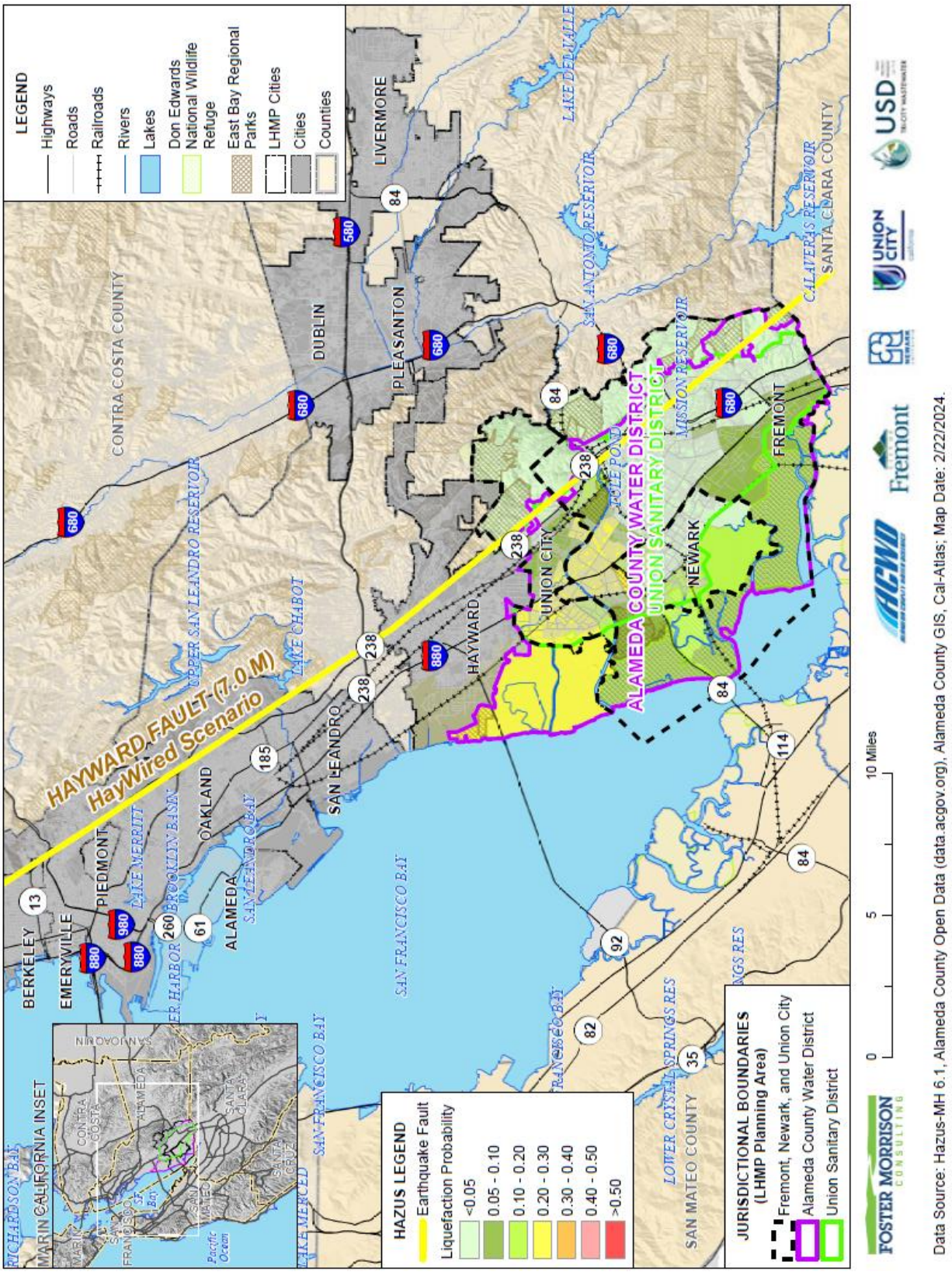
Figure E-49 Haywired (Hayward Fault) Scenario 7.0 Magnitude Peak Ground Acceleration



Liquefaction

Liquefaction occurs when loose, water-saturated soils are shaken strongly and causes sudden loss of strength and stiffness in soils. This shaking can lead to settlement and horizontal movements of the ground. The liquefaction probability associated with this Hazus scenario can be seen on Figure E-50.

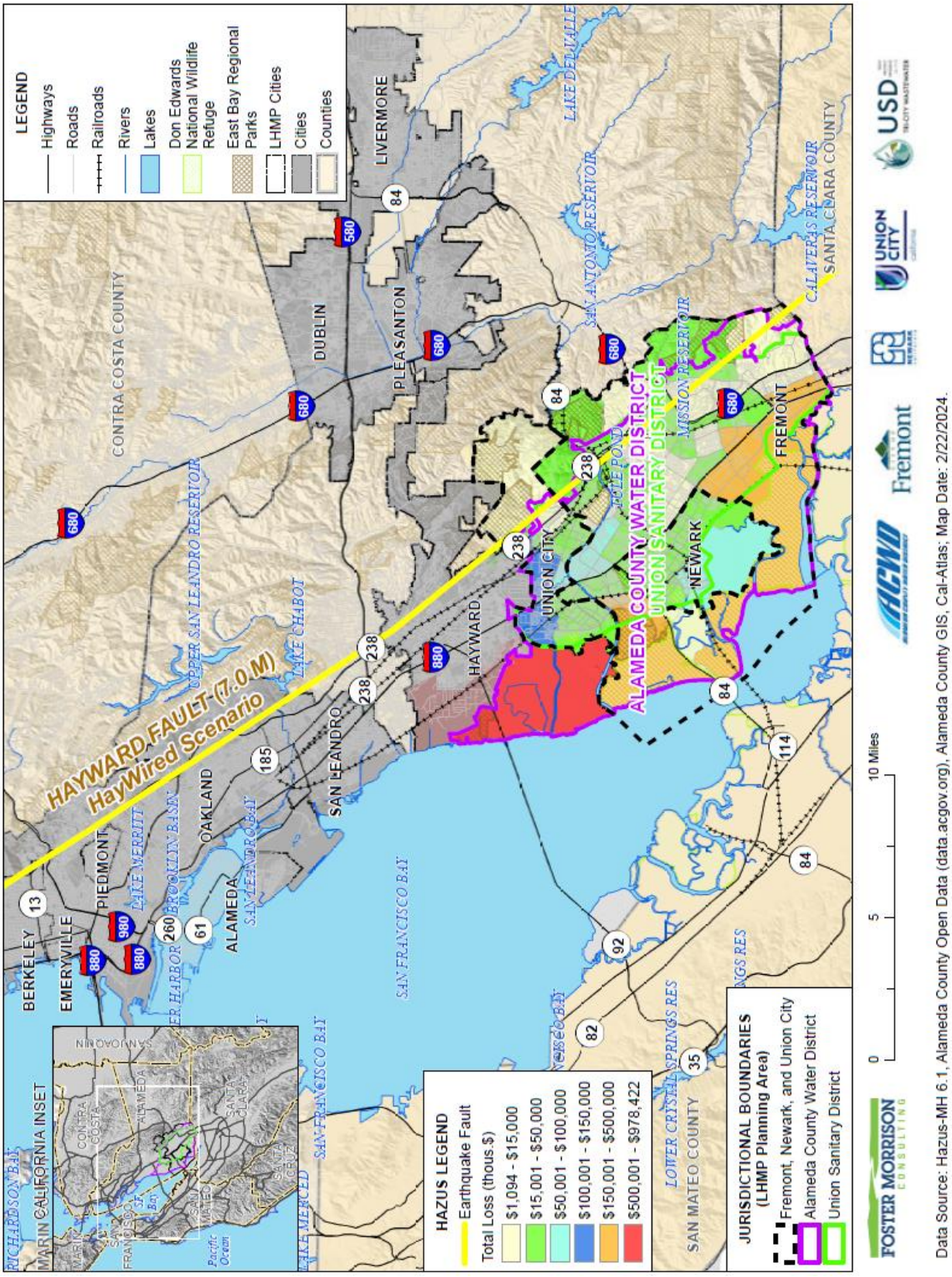
Figure E-50 Haywired (Hayward Fault) Scenario 7.0 Magnitude Liquefaction Probability



Total Loss Estimates

For each study region, information on loss estimates is provided based on that study region's earthquake risk and general building stock value, which includes building and lifeline related losses on the study region's available inventory. The total loss estimates associated with this scenario can be seen on Figure E-51.

Figure E-51 Haywired (Hayward Fault) Scenario 7.0 Magnitude Total Loss



Fire Following Earthquake

As detailed in the above methodology, two iterations of the Fire Following Earthquake were conducted for each primary Hazus Scenario. The results for the two iterations for the Haywired Scenario are included below.

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area.

- Four maps were created for the 10-mph scenario:
  - ✓ Number of Ignitions is shown on Figure E-52.
  - ✓ Population Exposure is shown on Figure E-53.
  - ✓ Value Exposure is shown on Figure E-54.
  - ✓ Fire Water Demand (gpm) is shown on Figure E-55.
- Four maps were created for the 50-mph scenario:
  - ✓ Number of Ignitions is shown on Figure E-56.
  - ✓ Population Exposure is shown on Figure E-57.
  - ✓ Value Exposure is shown on Figure E-58.
  - ✓ Fire Water Demand (gpm) is shown on Figure E-59.

Figure E-52 Haywired (Hayward Fault) Scenario 7.0 Magnitude Number of Ignitions (10 MPH Winds)

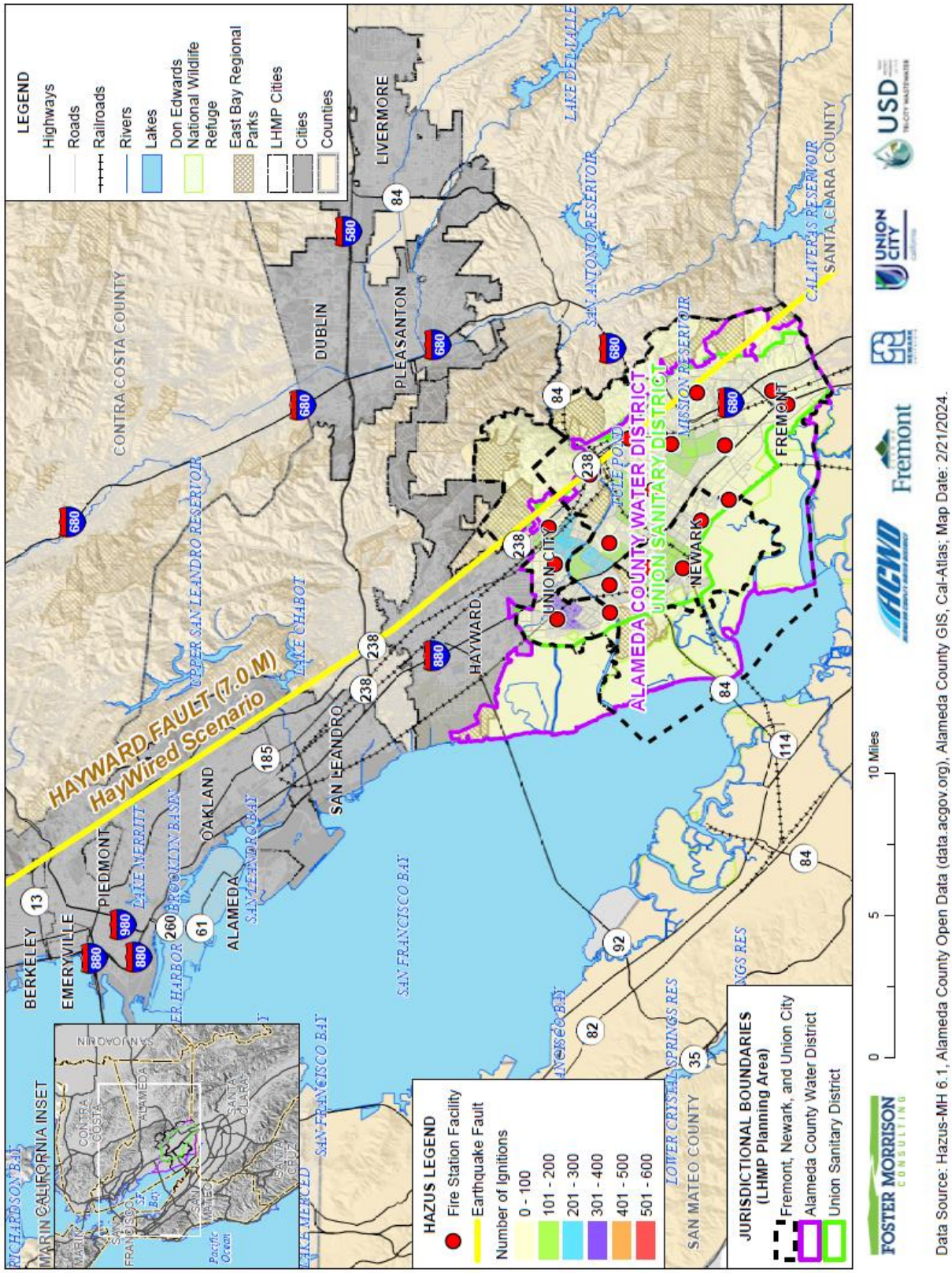


Figure E-53 Haywired (Hayward Fault) Scenario 7.0 Magnitude Population Exposure (10 MPH Winds)

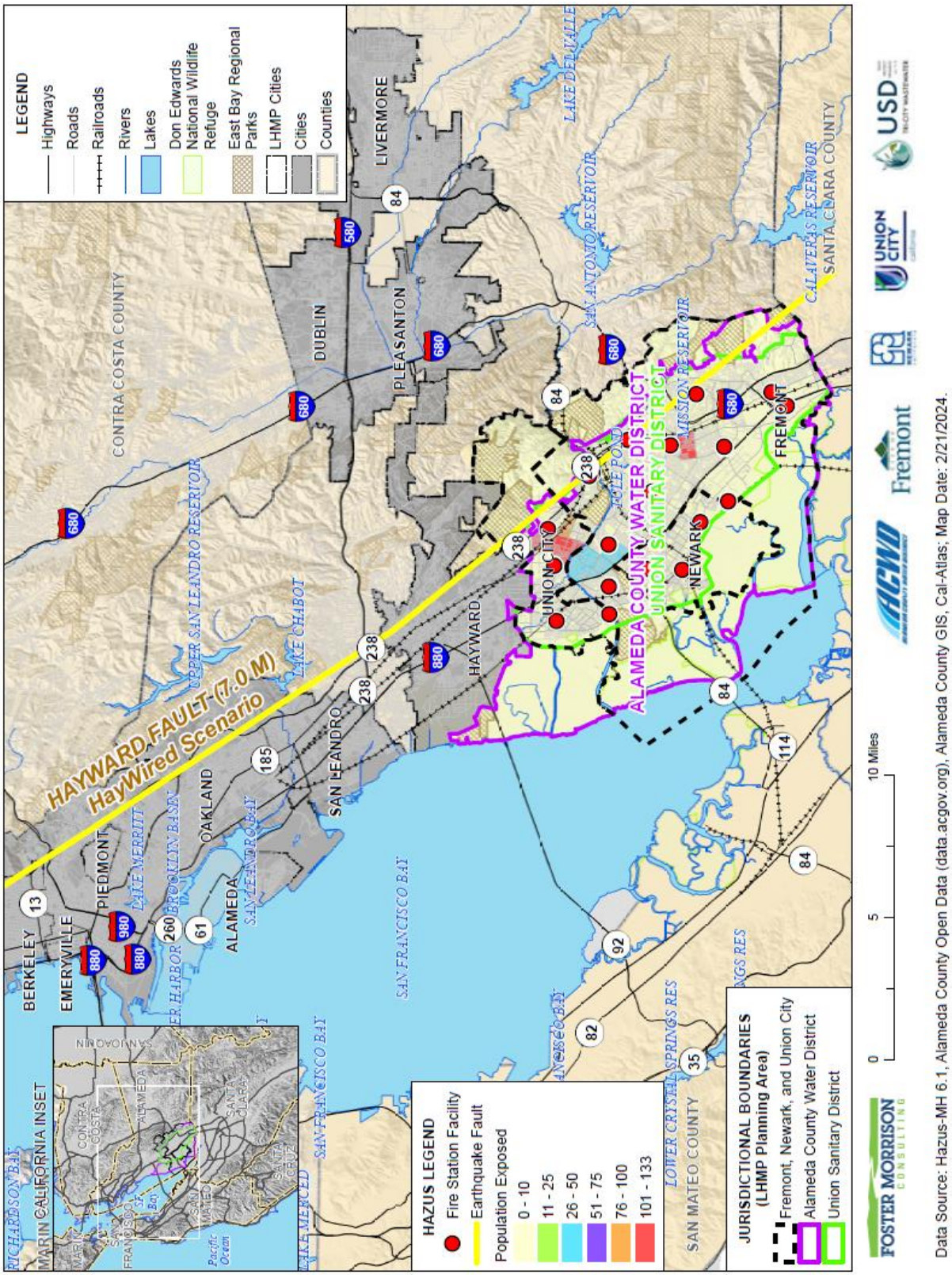


Figure E-54 Haywired (Hayward Fault) Scenario 7.0 Magnitude Exposed Values (10 MPH Winds)

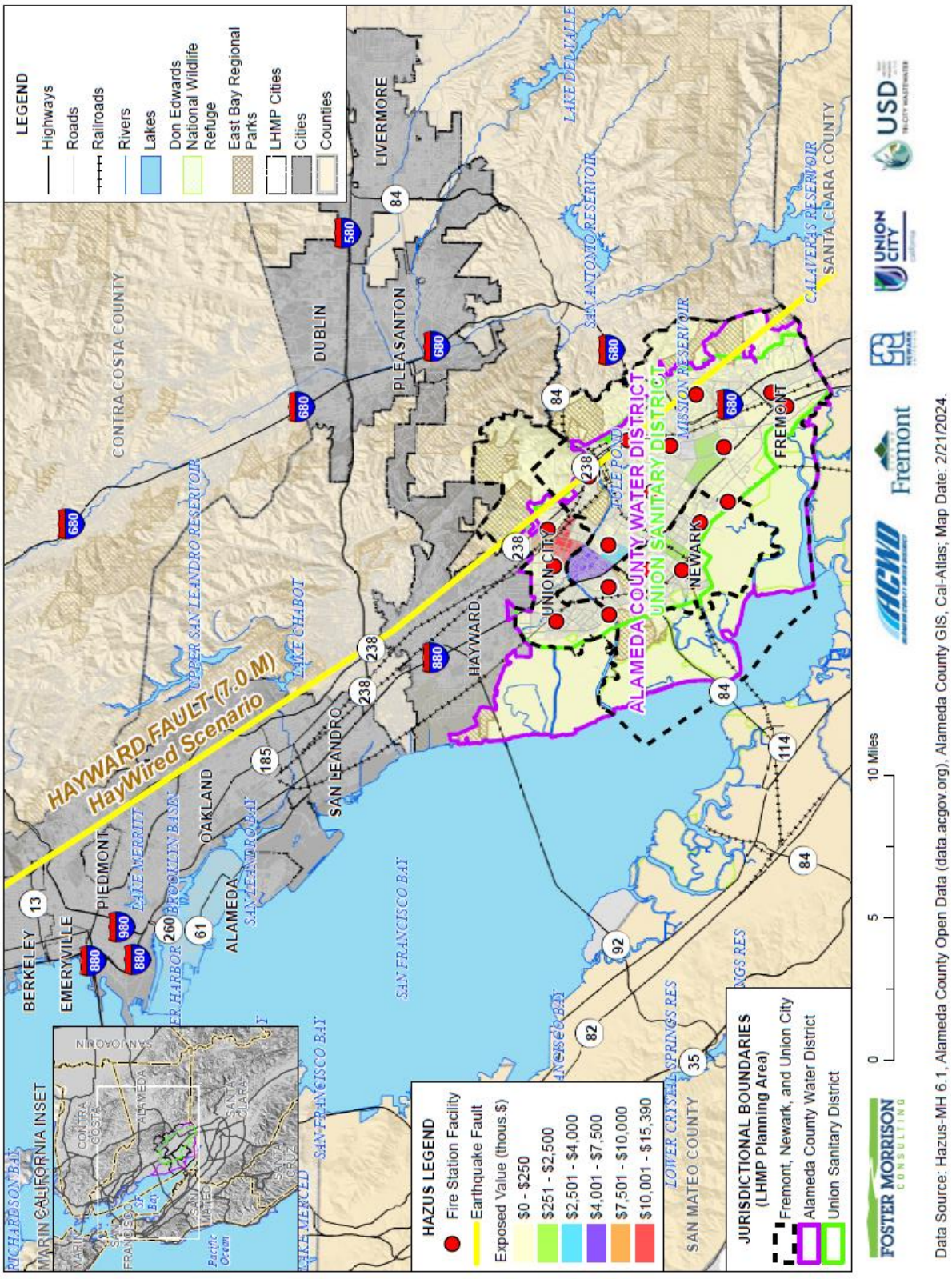


Figure E-55 Haywired (Hayward Fault) Scenario 7.0 Magnitude Fire Water Demand in GPM (10 MPH Winds)

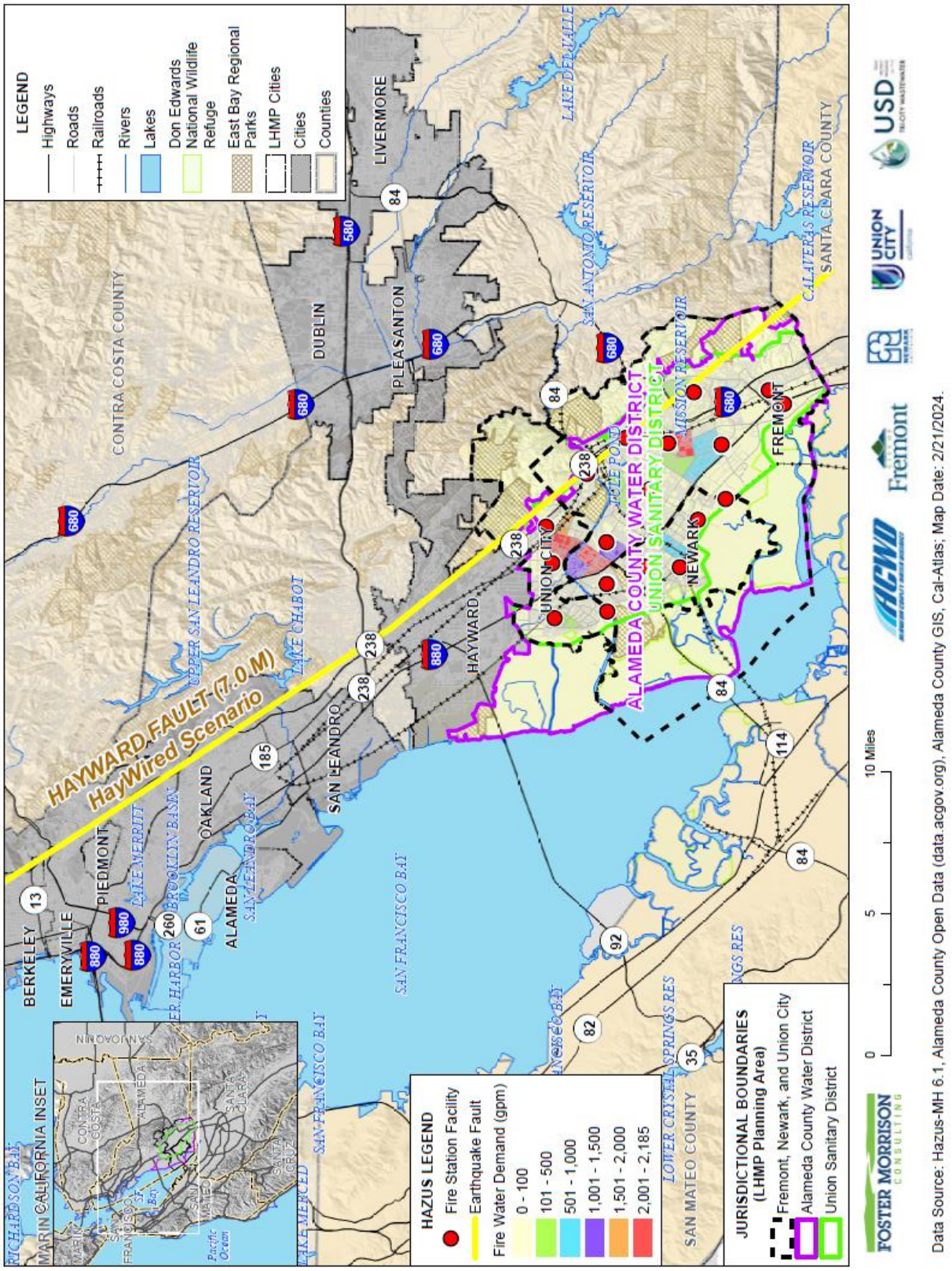


Figure E-56 Haywired (Hayward Fault) Scenario 7.0 Magnitude Number of Ignitions (50 MPH Winds)

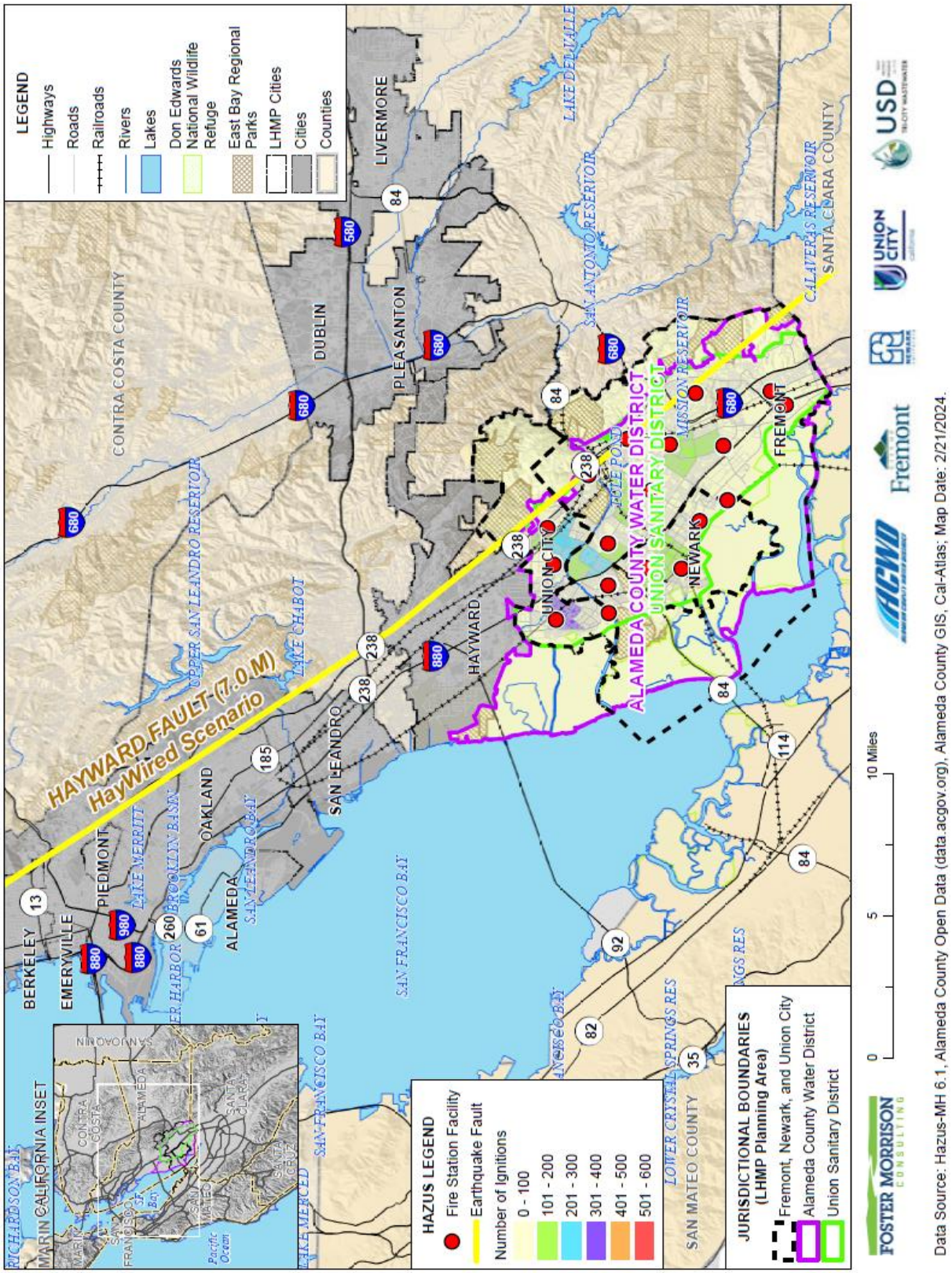


Figure E-57 Haywired (Hayward Fault) Scenario 7.0 Magnitude Population Exposure (50 MPH Winds)

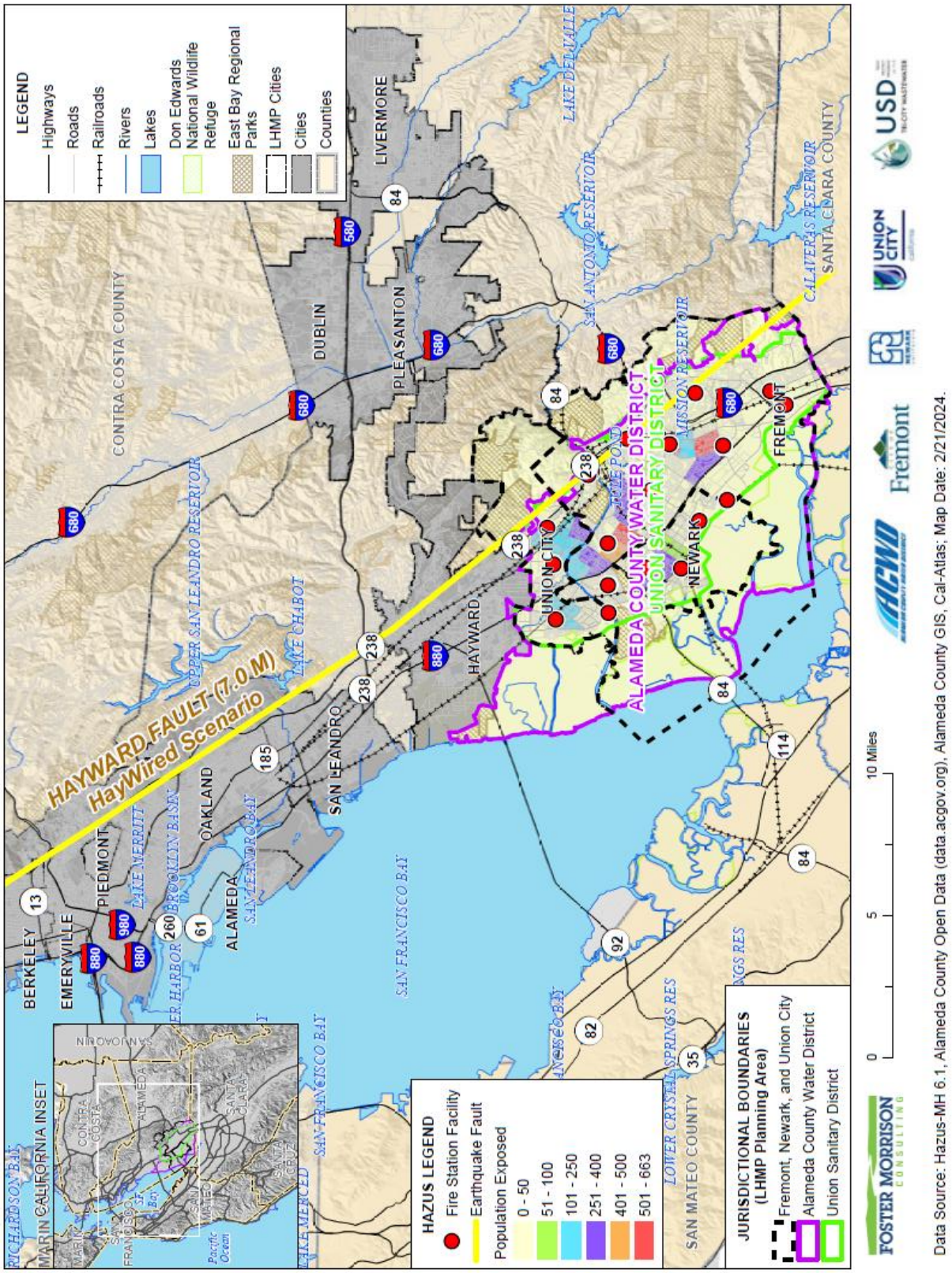


Figure E-58 Haywired (Hayward Fault) Scenario 7.0 Magnitude Exposed Values (50 MPH Winds)

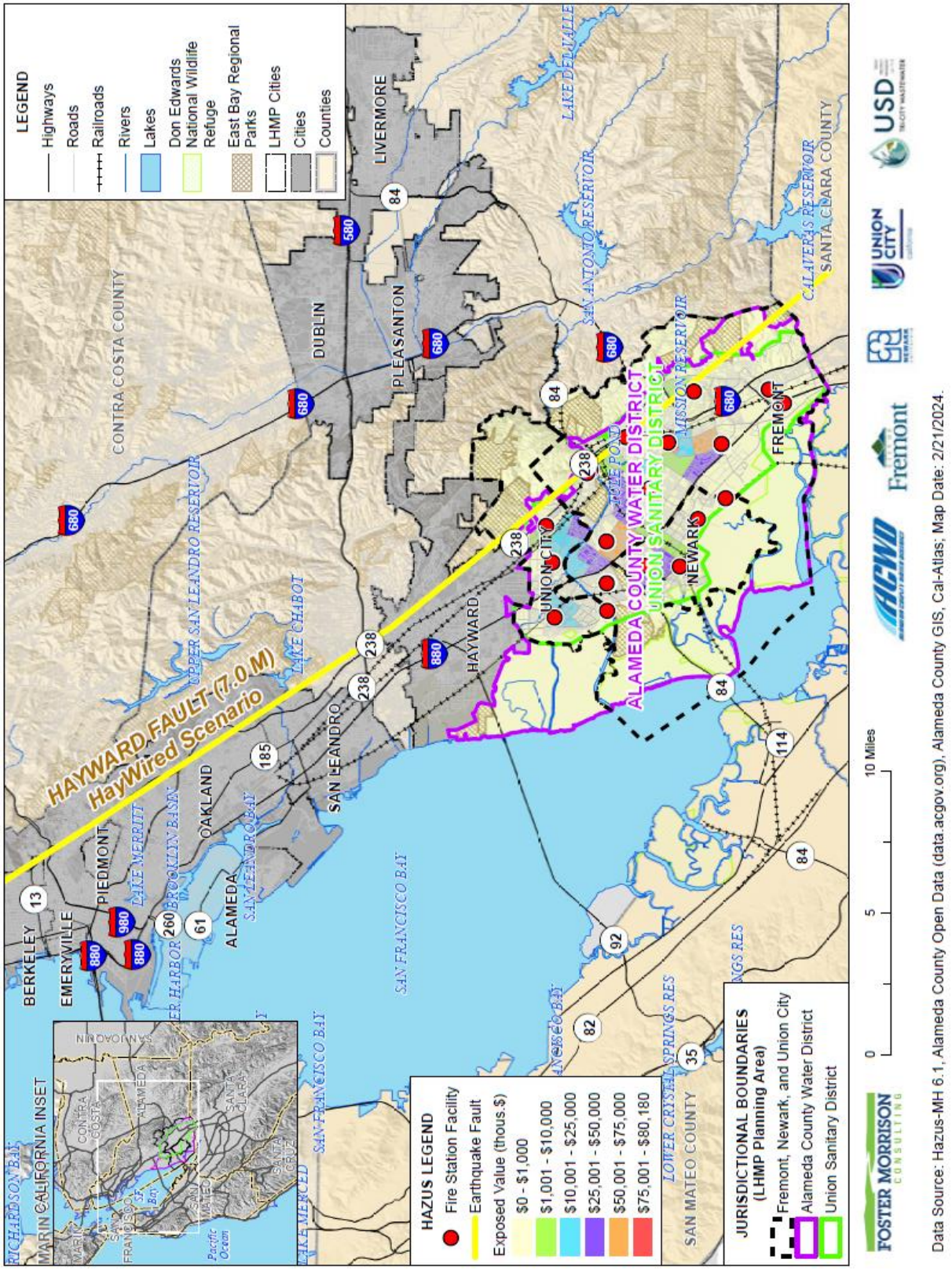
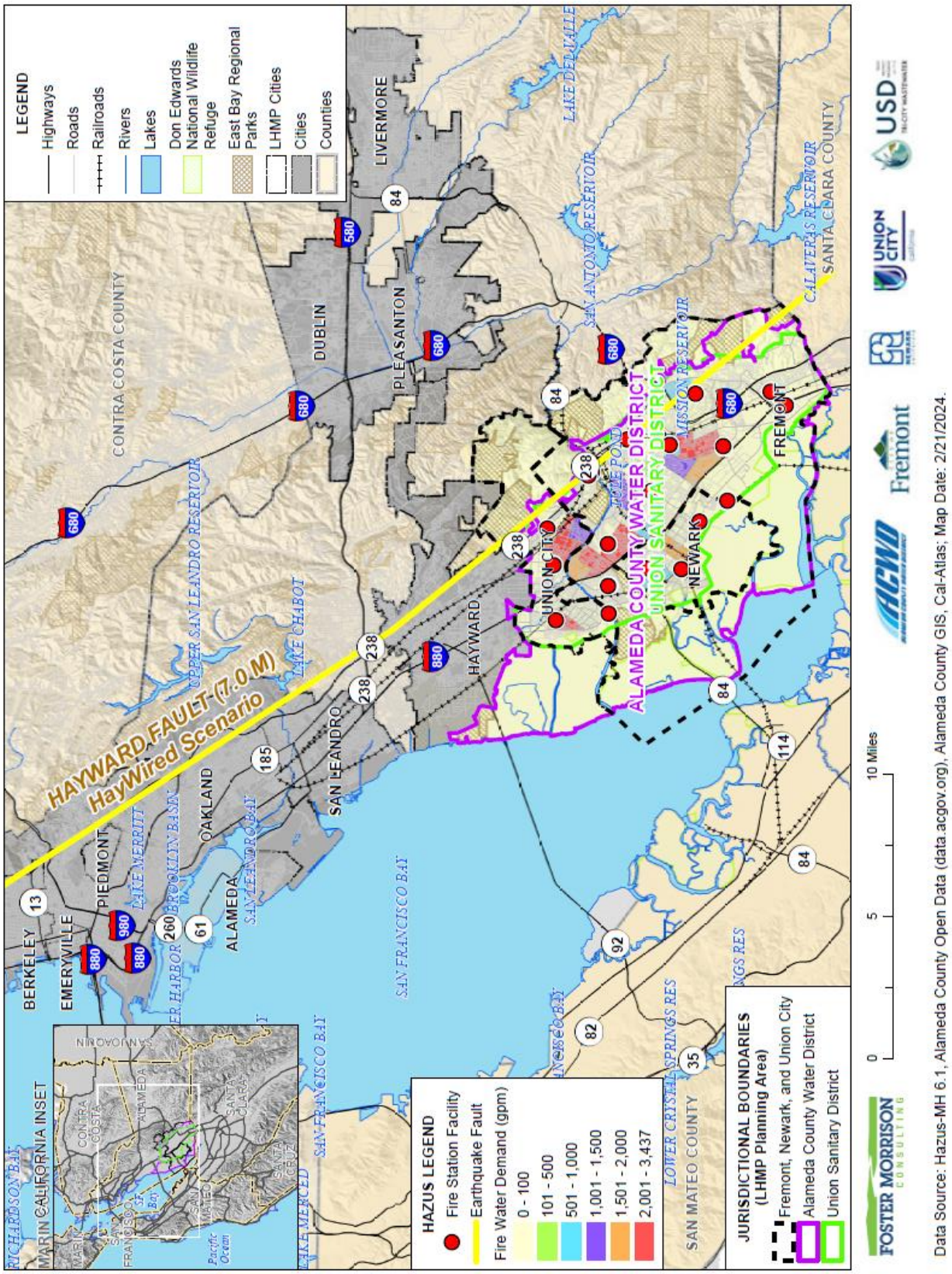


Figure E-59 Haywired Scenario 7.0 Magnitude Fire Water Demand in GPM (50 MPH Winds)



San Andreas Scenario (Epicenter: Bay Bridge; Magnitude: 8.04)

The Hazus results for the San Andreas Fault Hazus Scenario is summarized below in Table E-44. Appendix H includes the Earthquake Hazus Global Summary Risk Report for each Hazus defined study region where more detailed information can be obtained.

Table E-44 Tri-City Planning Area– San Andreas Fault HAZUS Earthquake Deterministic Results for 8.04 M Event

Type of Impact	Impacts to City from 8.04 Deterministic Earthquake	
Total Buildings Damaged (based on 102,000 buildings)	Slight: 25,938 Moderate: 5,918 Extensive: 2,318 Complete: 556	
Building and Income Related Losses	$4,072,960,000	
Total Economic Losses (Includes building, income and lifeline losses)	$4,558,370,000	
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 269 Requiring hospitalization: 42 Life threatening: 3 Fatalities: 5	
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 459 Requiring hospitalization: 96 Life threatening: 15 Fatalities: 24	
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 377 Requiring hospitalization: 100 Life threatening: 58 Fatalities: 26	
Damage to Transportation Systems	None with at least moderate damage	
Damage to Essential Facilities	4 schools with at least moderate damage. 0 facilities with complete damage.	
Damage to Utility Systems	1 electrical power facility, and 3 communication facility with at least moderate damage. 803 potable water line breaks, 403 wastewater line breaks, and 6 natural gas line breaks.	
Households without Power/Water Service (Based on 113,685 total households)	Power loss, Day 1: 113,685 Power loss, Day 3: 113,685 Power loss, Day 7: 113,685 Power loss, Day 30: 113,685 Power loss, Day 90: 113,685	Water loss, Day 1: 107,645 Water loss, Day 3: 106,623 Water loss, Day 7: 103,868 Water loss, Day 30: 6,937 Water loss, Day 90: 0
Displaced Households	1,731 displaced households	
Shelter Requirements	860 persons	
Debris Generation	471,000 tons	

Hazus 6.1

Loss Estimates Highlights

Hazus estimates that about 8,792 buildings will be at least moderately damaged. This is over 9.00 % of the buildings in the region. There are an estimated 555 buildings that will be damaged beyond repair.

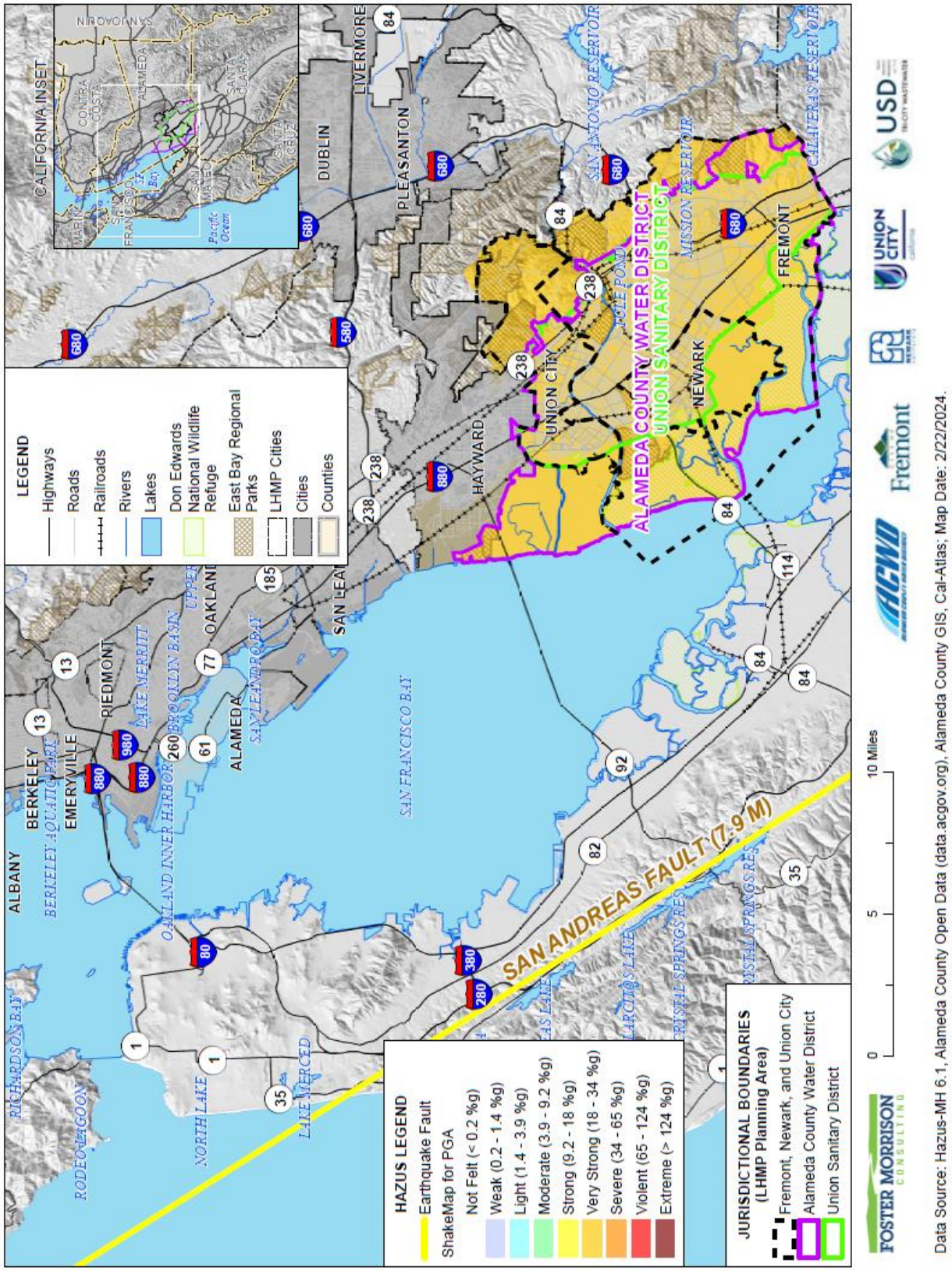
Before the earthquake, the region had 556 hospital beds available for use. On the day of the earthquake, the model estimates that only 424 hospital beds (76.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 91.00% of the beds will be back in service. By 30 days, 97.00% will be operational.

The total building-related losses were 4,072.96 (millions of dollars); 11 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 44 % of the total loss.

Peak Ground Acceleration (Shaking)

Hazus evaluates the geographic distribution of ground shaking as a result of a specific earthquake scenario and expresses ground shaking using several quantitative parameters, including the peak ground acceleration. The peak ground acceleration map associated with this Hazus scenario can be seen on Figure E-60.

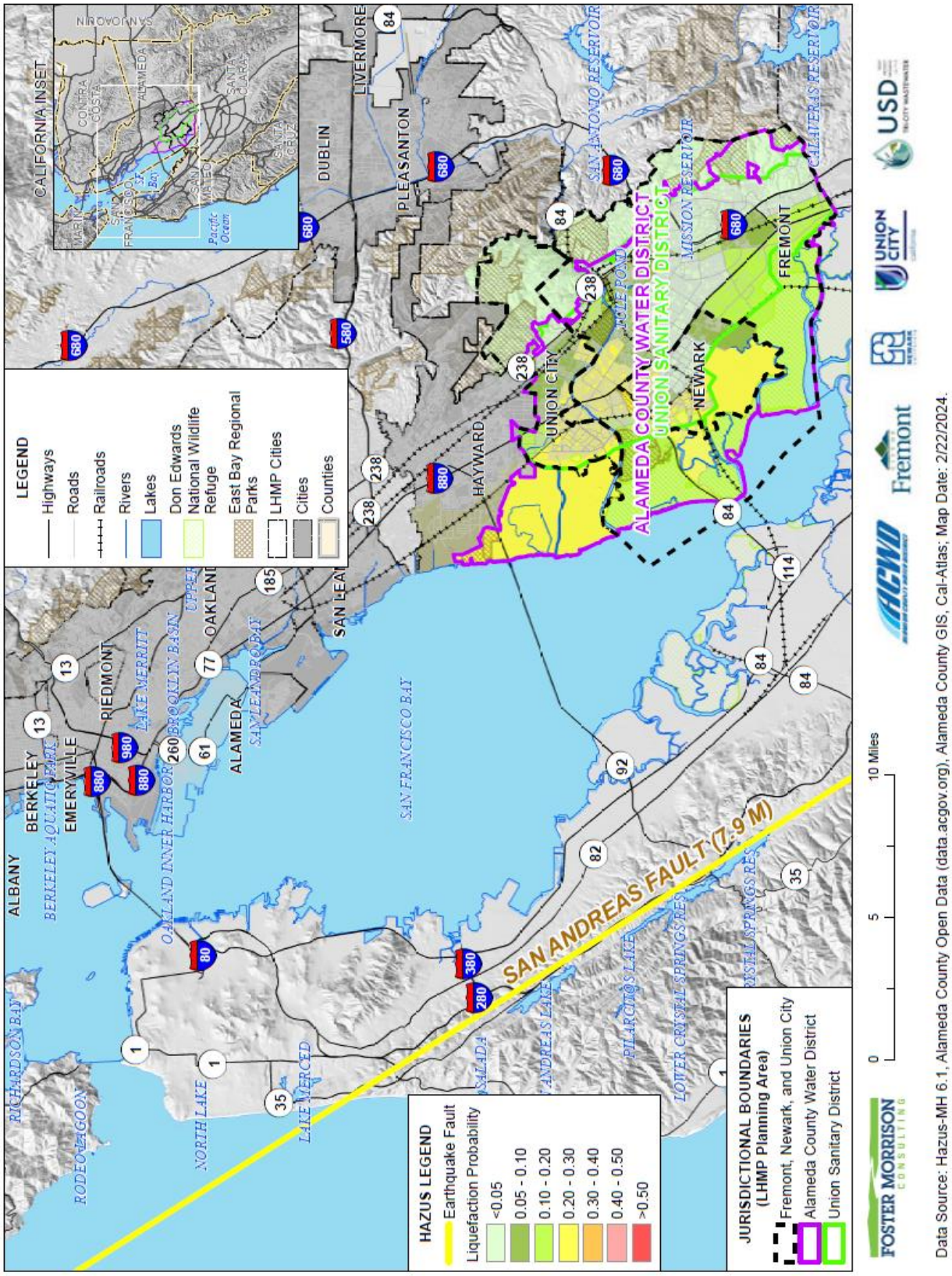
Figure E-60 San Andreas Fault – 8.04 Magnitude Peak Ground Acceleration



Liquefaction

Liquefaction occurs when loose, water-saturated soils are shaken strongly and causes sudden loss of strength and stiffness in soils. This shaking can lead to settlement and horizontal movements of the ground. The liquefaction probability associated with this Hazus scenario can be seen on Figure E-61.

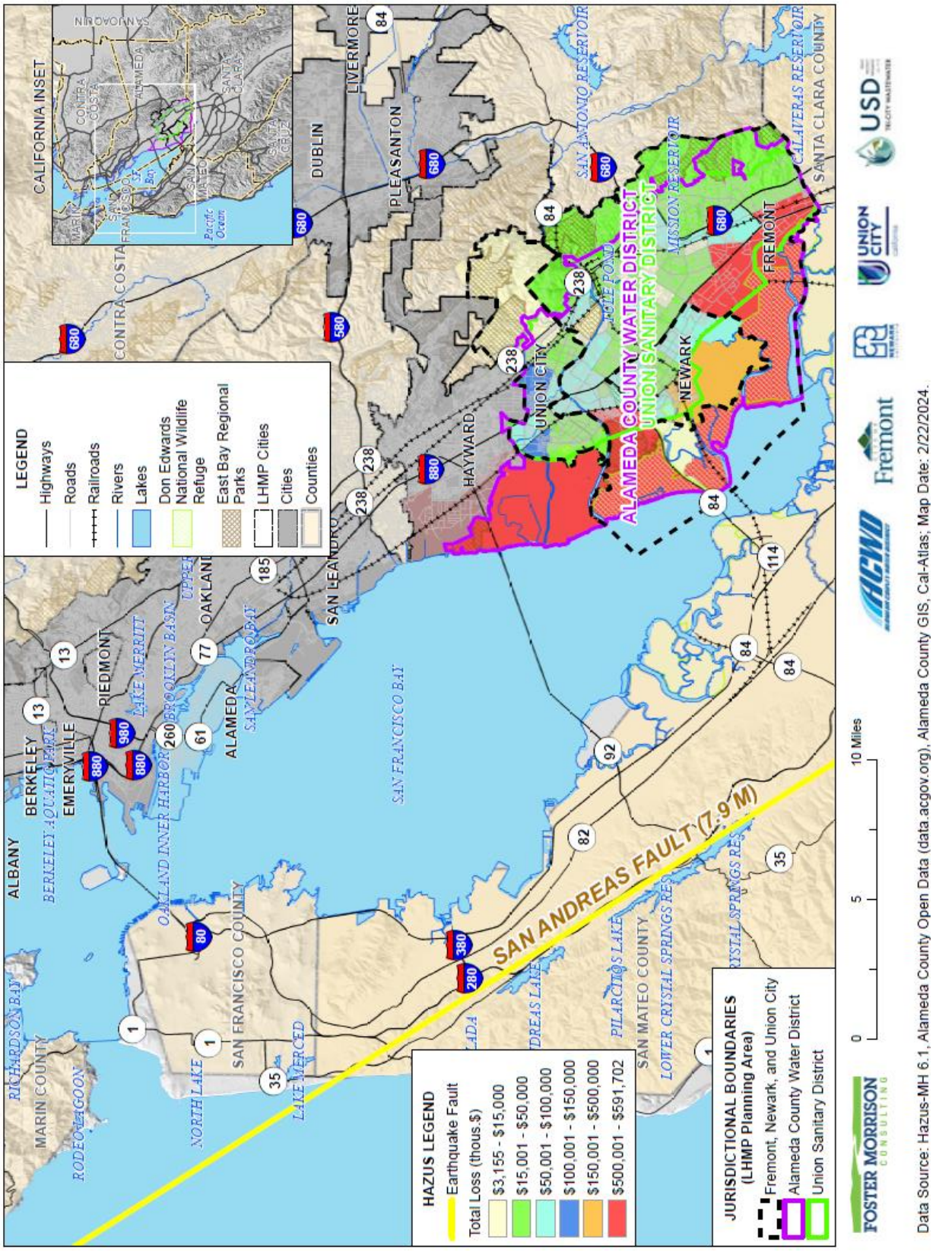
Figure E-61 San Andreas Fault 8.04 Magnitude Liquefaction Probability



Total Loss Estimates

For each study region, information on loss estimates is provided based on that study region's earthquake risk and general building stock value, which includes building and lifeline related losses on the study region's available inventory. The total loss estimates associated with this scenario can be seen on Figure E-62.

Figure E-62 San Andreas Fault 8.04 Total Loss



Fire Following Earthquake

As detailed in the above methodology, two iterations of the Fire Following Earthquake were conducted for each primary Hazus Scenario. The results for the two iterations for the San Andreas Scenario are included below.

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area.

- Four maps were created for the 10-mph scenario:
  - ✓ Number of Ignitions is shown on Figure E-63.
  - ✓ Population Exposure is shown on Figure E-64.
  - ✓ Value Exposure is shown on Figure E-65.
  - ✓ Fire Water Demand (gpm) is shown on Figure E-66.
- Four maps were created for the 50-mph scenario:
  - ✓ Number of Ignitions is shown on Figure E-67.
  - ✓ Population Exposure is shown on Figure E-68.
  - ✓ Value Exposure is shown on Figure E-69.
  - ✓ Fire Water Demand (gpm) is shown on Figure E-70.

Figure E-63 San Andreas Fault 8.04 Magnitude Number of Ignitions (10 MPH Winds)

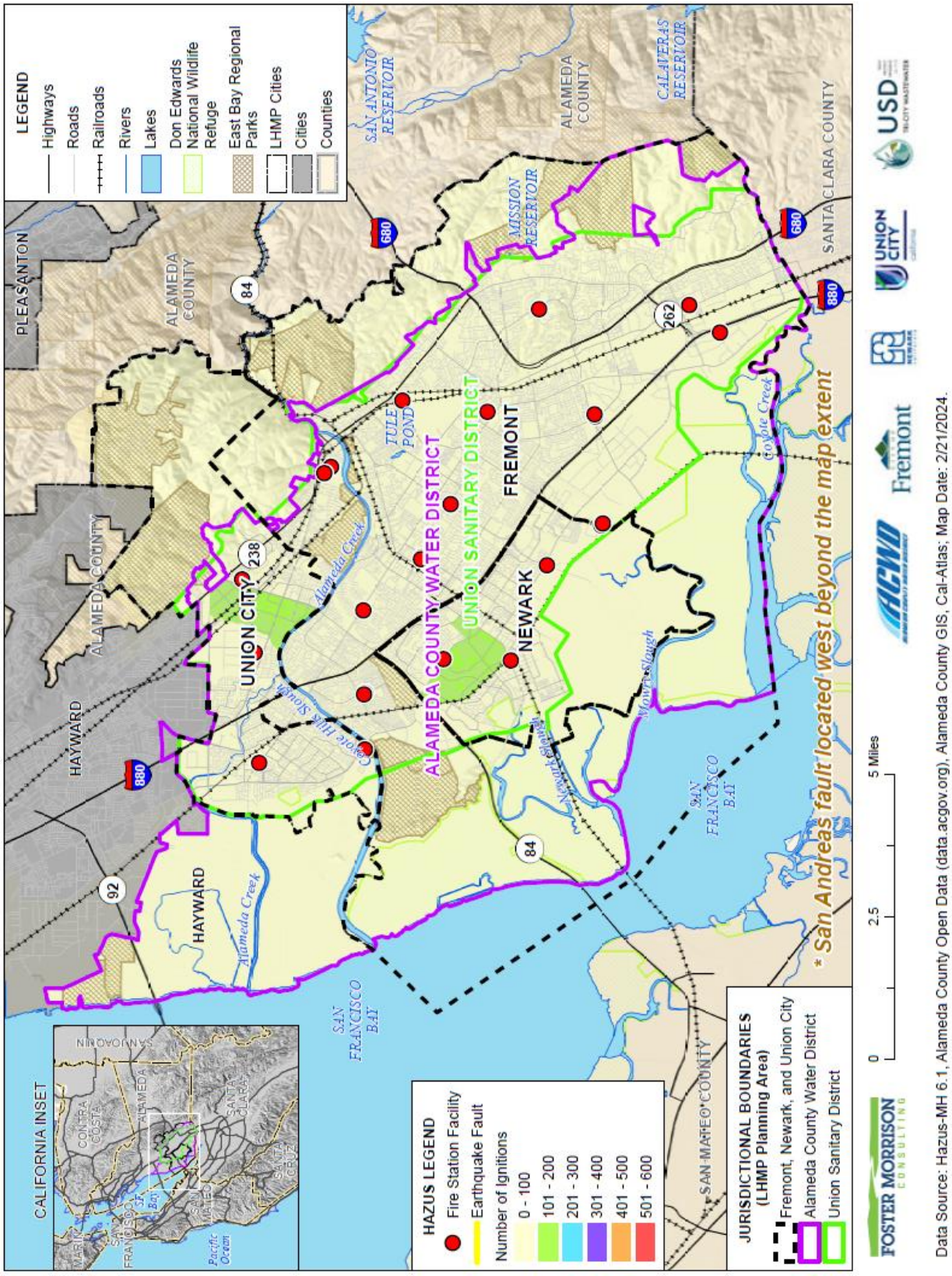


Figure E-64 San Andreas Fault 8.04 Magnitude Population Exposure (10 MPH Winds)

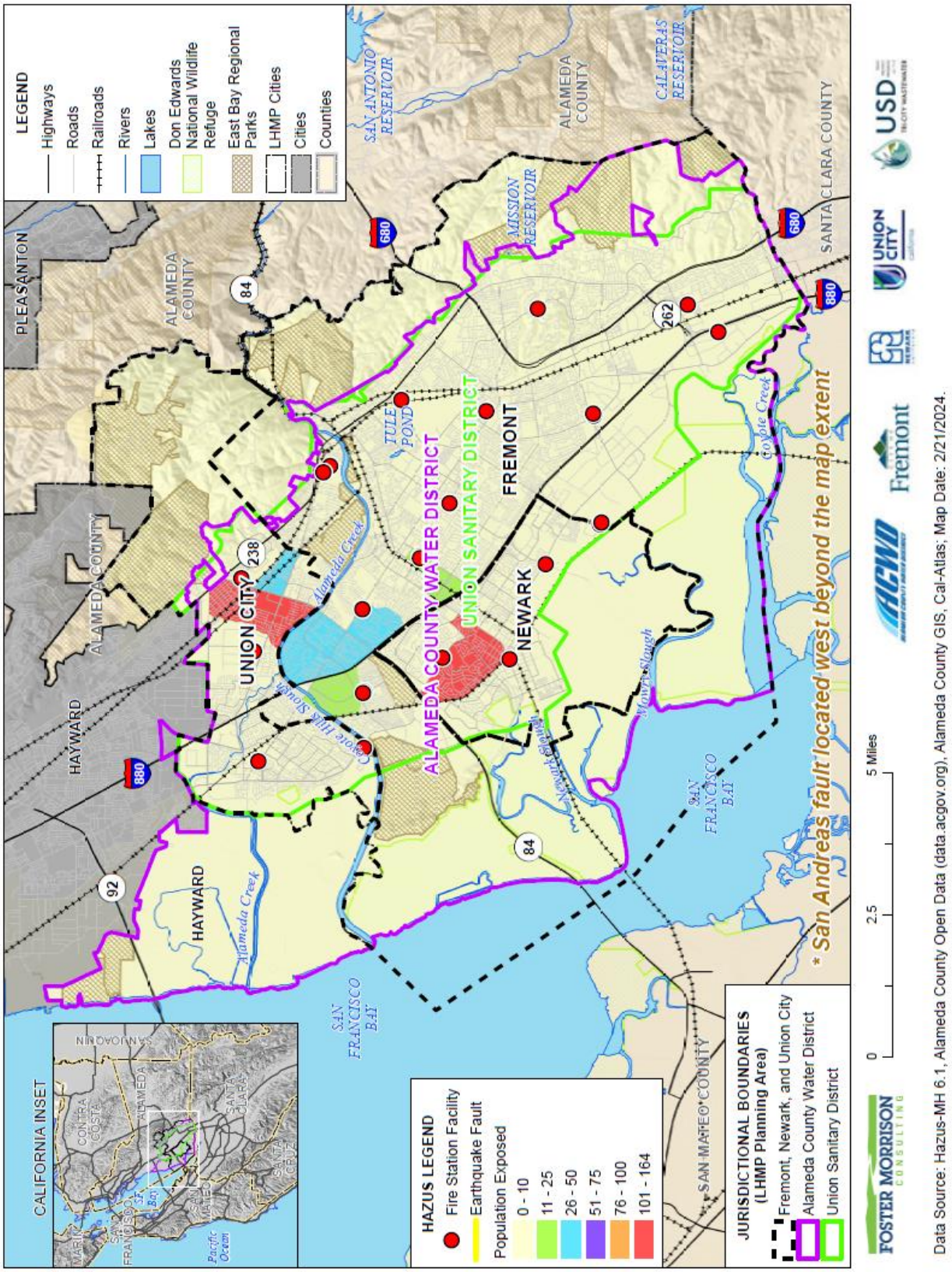


Figure E-65 San Andreas Fault 8.04 Magnitude Exposed Values (10 MPH Winds)

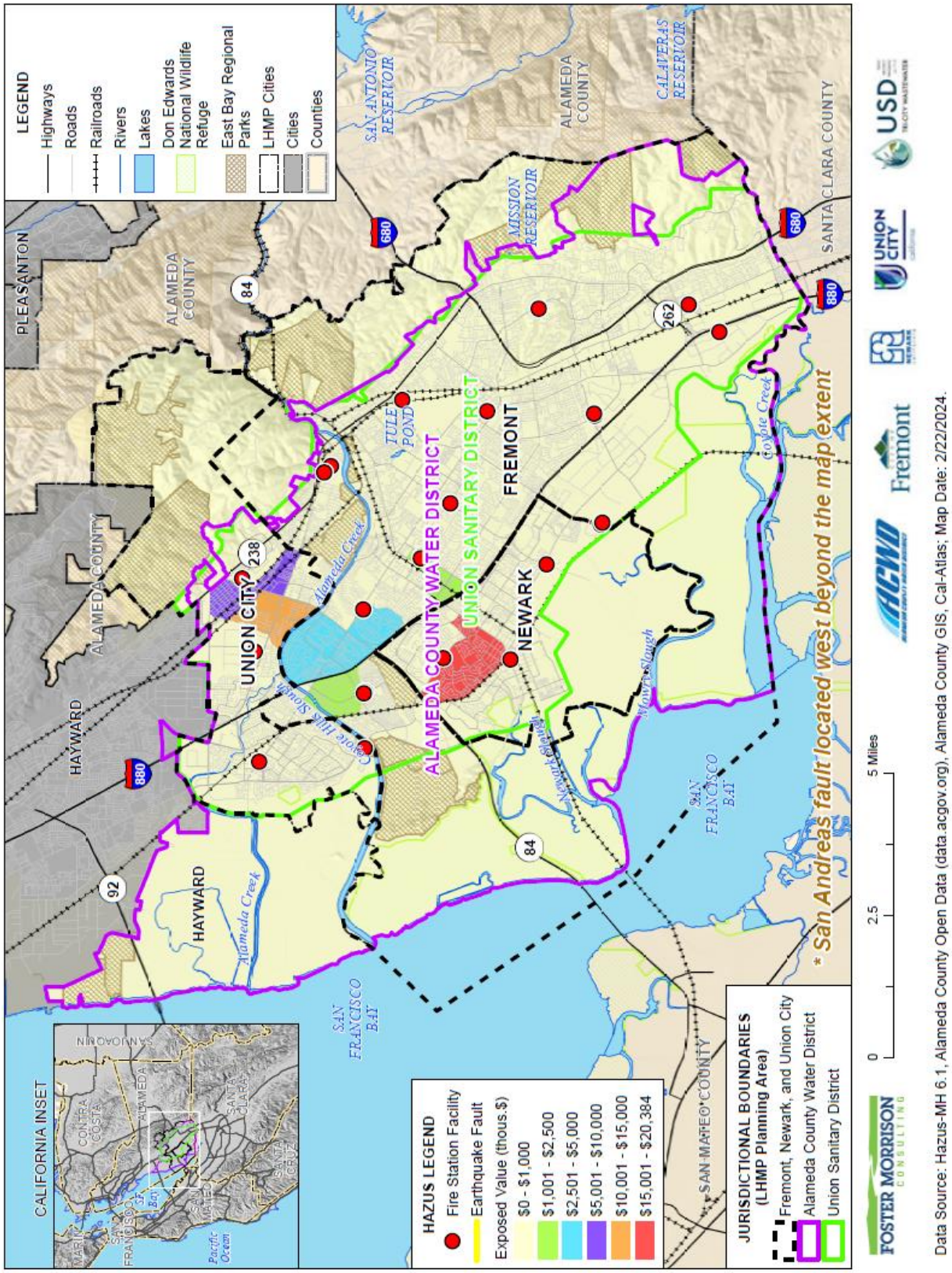


Figure E-66 San Andreas Fault 8.04 Magnitude Fire Water Demand in GPM (10 MPH Winds)

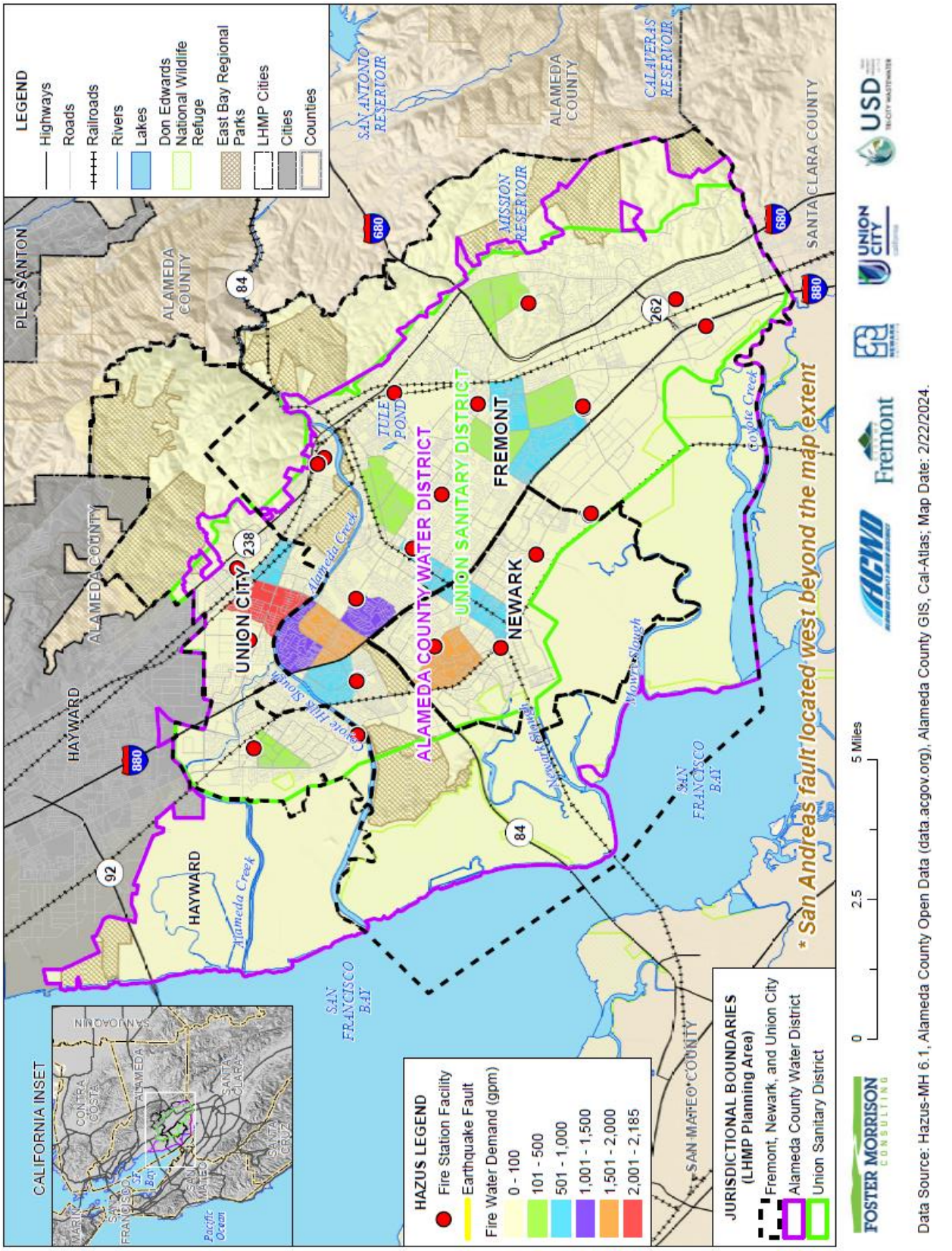


Figure E-67 San Andreas Fault 8.04 Magnitude Number of Ignitions (50 MPH Winds)

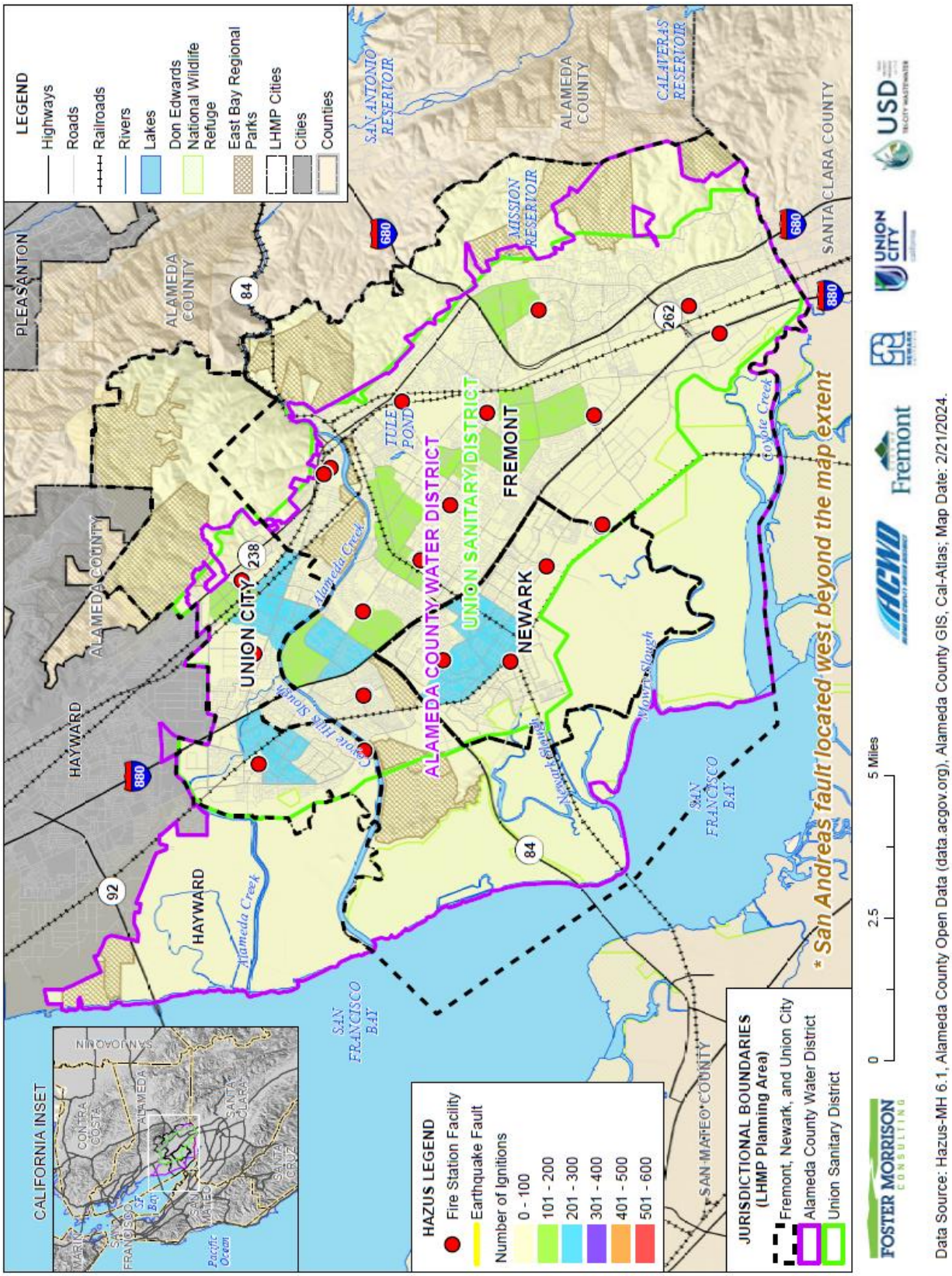


Figure E-68 San Andreas Fault 8.04 Magnitude Population Exposure (50 MPH Winds)

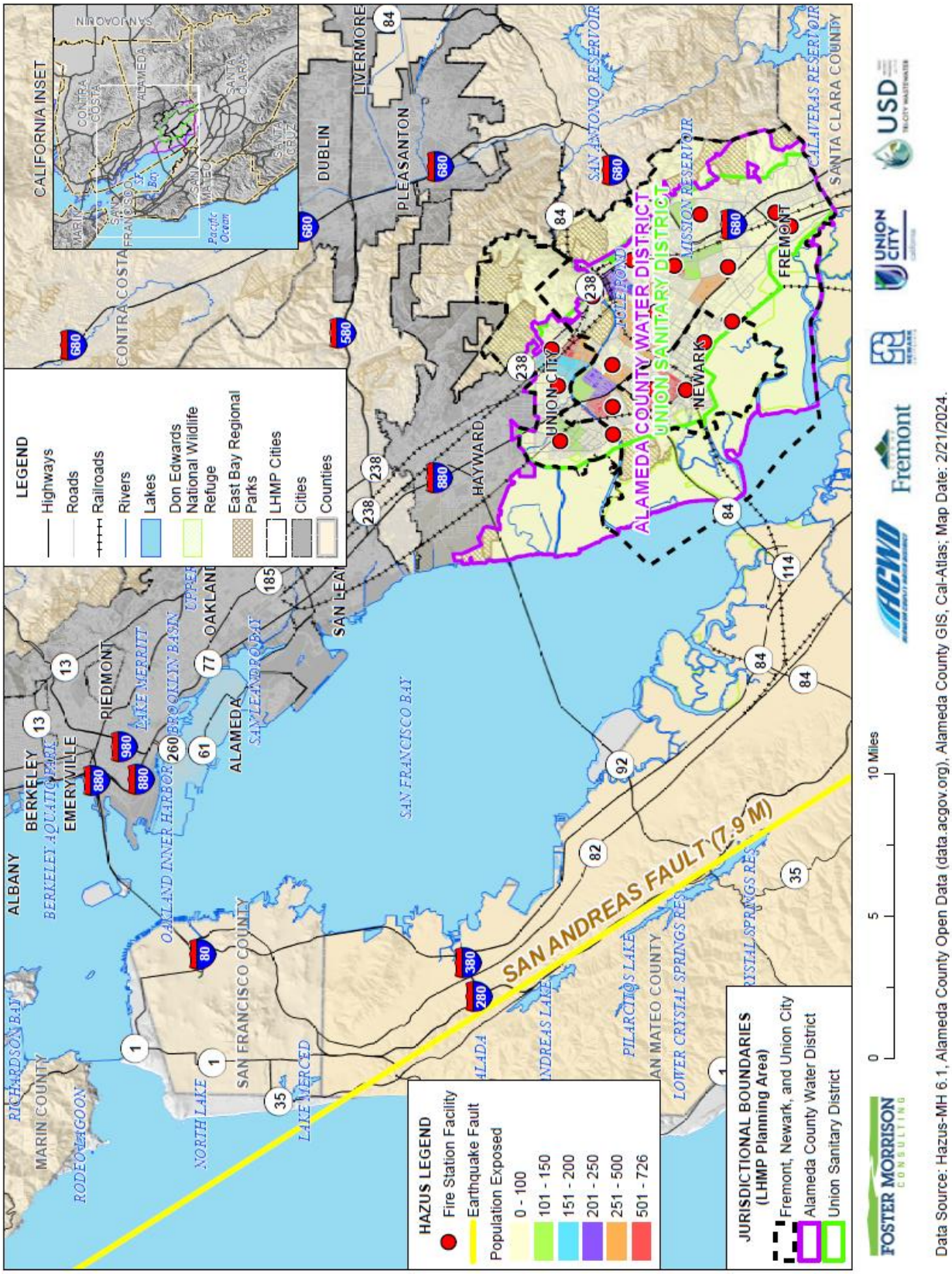


Figure E-69 San Andreas Fault 8.04 Magnitude Exposed Values (50 MPH Winds)

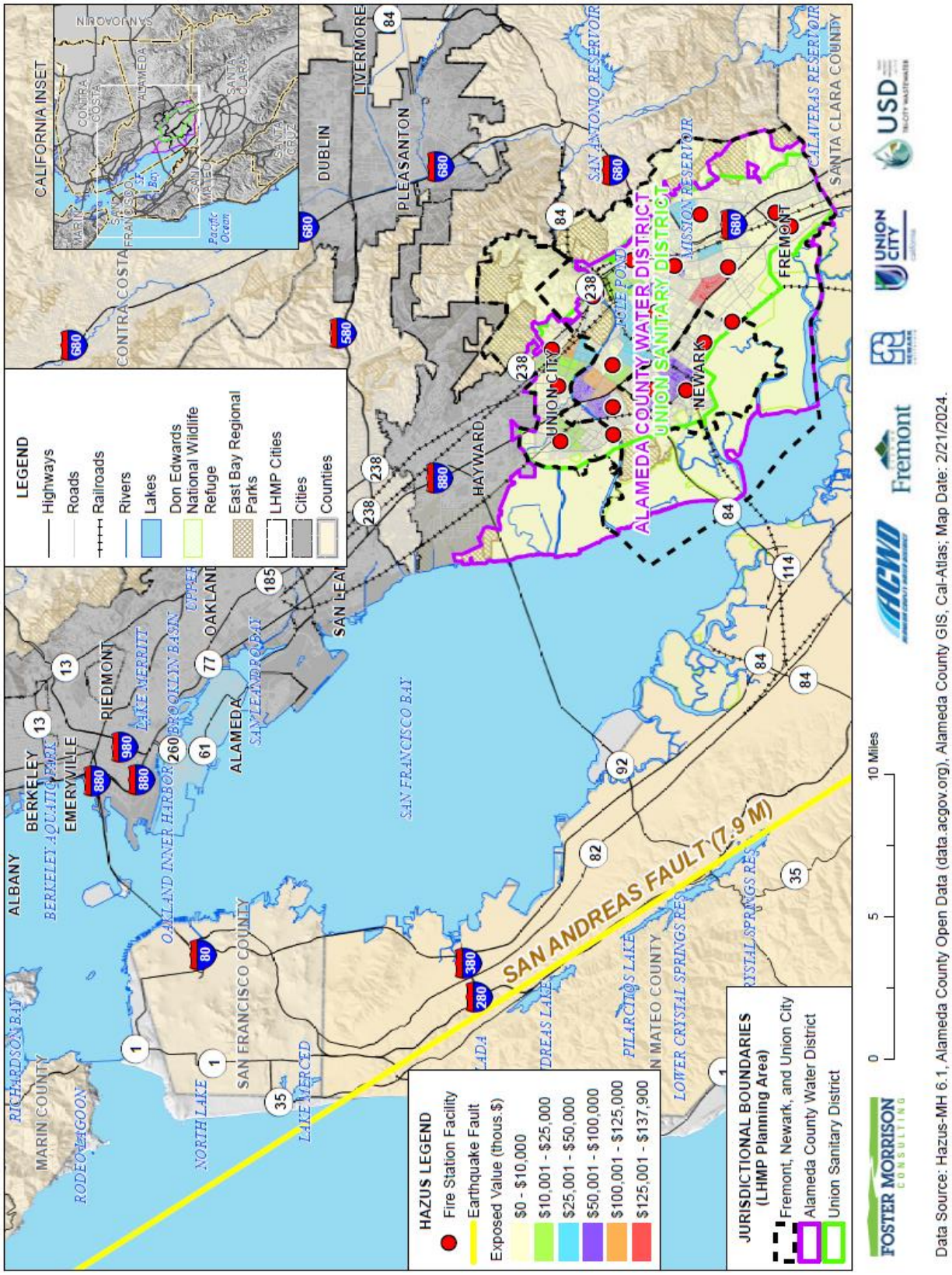


Figure E-70 San Andreas Fault 8.04 Magnitude Fire Water Demand in GPM (50 MPH Winds)

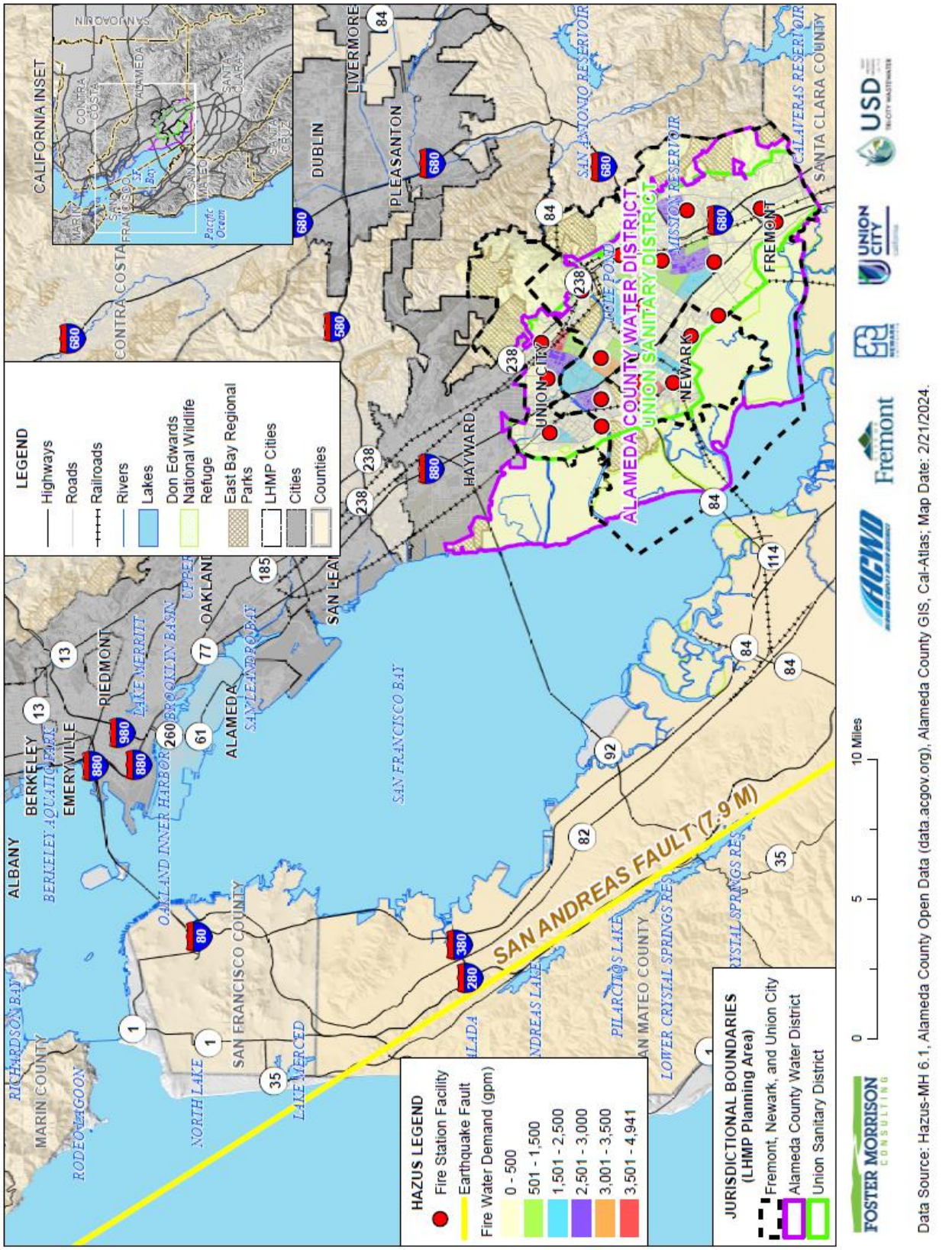


Table E-45 Tri-City Planning Area – HAZUS-MH Earthquake Loss Estimation Scenario Comparison

Type of Impact	Calaveras Fault (CN+CC+CS+CE) Impacts to City from 7.43 Deterministic Earthquake	Hayward and Rodgers Creek Fault (RC+HN+HS) Impacts to City from 7.57 Deterministic Earthquake	Hayward Fault Haywired (HN+HS) Impacts to City from 7.0 Deterministic Earthquake	San Andreas Fault (SAO+SAN+SAP+SAS) Impacts to City from 8.04 Deterministic Earthquake
Total Buildings Damaged (based on 102,000 buildings)	Slight: 34,485 Moderate: 10,737 Extensive: 3,324 Complete: 802	Slight: 39,420 Moderate: 24,508 Extensive: 10,382 Complete: 3,703	Slight: 24,315 Moderate: 5,421 Extensive: 1,472 Complete: 327	Slight: 25,938 Moderate: 5,918 Extensive: 2,318 Complete: 556
Building and Income Related Losses	$6,072,200,000	$17,055,480,000	$3,287,230,000	$4,072,960,000
Total Economic Losses (Includes building, income and lifeline losses)	$6,694,910,000	$18,535,370,000	$4,058,120,000	$4,558,370,000
Casualties (Based on 2 a.m. time of occurrence)	Without requiring hospitalization: 410 Requiring hospitalization: 64 Life threatening: 4 Fatalities: 7	Without requiring hospitalization: 1,344 Requiring hospitalization: 264 Life threatening: 22 Fatalities: 38	Without requiring hospitalization: 191 Requiring hospitalization: 27 Life threatening: 2 Fatalities: 3	Without requiring hospitalization: 269 Requiring hospitalization: 42 Life threatening: 3 Fatalities: 5
Casualties (Based on 2 p.m. time of occurrence)	Without requiring hospitalization: 655 Requiring hospitalization: 134 Life threatening: 20 Fatalities: 32	Without requiring hospitalization: 3,083 Requiring hospitalization: 822 Life threatening: 131 Fatalities: 241	Without requiring hospitalization: 296 Requiring hospitalization: 55 Life threatening: 9 Fatalities: 12	Without requiring hospitalization: 459 Requiring hospitalization: 96 Life threatening: 15 Fatalities: 24
Casualties (Based on 5 p.m. time of occurrence)	Without requiring hospitalization: 534 Requiring hospitalization: 138 Life threatening: 74 Fatalities: 34	Without requiring hospitalization: 2,315 Requiring hospitalization: 657 Life threatening: 199 Fatalities: 185	Without requiring hospitalization: 250 Requiring hospitalization: 55 Life threatening: 9 Fatalities: 12	Without requiring hospitalization: 377 Requiring hospitalization: 100 Life threatening: 58 Fatalities: 26
Damage to Transportation Systems	1 bridge with at least moderate damage	27 highway bridges, 8 railway bridges, 2 railway facilities, and 1 airport facility with at least moderate damage. 2 highway bridges with complete damage.	1 airport facility with at least moderate damage	None with at least moderate damage

Type of Impact	Calaveras Fault (CN+CC+CS+CE) Impacts to City from 7.43 Deterministic Earthquake		Hayward and Rodgers Creek Fault (RC+HN+HS) Impacts to City from 7.57 Deterministic Earthquake		Hayward Fault Haywired (HN+HS) Impacts to City from 7.0 Deterministic Earthquake		San Andreas Fault (SAO+SAN+SAP+SAS) Impacts to City from 8.04 Deterministic Earthquake	
Damage to Essential Facilities	4 schools and 1 EOC with at least moderate damage. 0 facilities with complete damage.		59 schools, 1 EOC, 5 police stations, and 2 fire stations with at least moderate damage. 4 school facilities with complete damage.		3 schools with at least moderate damage. 0 facilities with complete damage.		4 schools with at least moderate damage. 0 facilities with complete damage.	
Damage to Utility Systems	1 wastewater facility, 1 electrical power facility, and 2 communication facility with at least moderate damage. 0 facilities with complete damage. 1,018 potable water line breaks, 511 wastewater line breaks, and 8 natural gas line breaks.		1 wastewater facility, 1 electrical power facility, and 1 communication facility with at least moderate damage. None with complete damage. 2,251 potable water line breaks, 1,131 wastewater line breaks, and 17 natural gas line breaks.		1 electrical power facility and 2 communications facilities with at least moderate damage. 563 potable water line breaks, 268 wastewater line breaks, and 4 natural gas line breaks.		1 electrical power facility, and 3 communication facility with at least moderate damage. 803 potable water line breaks, 403 wastewater line breaks, and 6 natural gas line breaks.	
Households without Power/Water Service (Based on 113,685 total households)	Power loss, Day 1: 113,685 Power loss, Day 3: 113,685 Power loss, Day 7: Power loss, Day 30: 113,685 Power loss, Day 90: 113,685	Water loss, Day 1: 110,435 Water loss, Day 3: 109,958 Water loss, Day 7: 108,722 Water loss, Day 30: 72,925 Water loss, Day 90: 0	Power loss, Day 1: 113,685 Power loss, Day 3: 113,685 Power loss, Day 7: 113,685 Power loss, Day 30: 113,685 Power loss, Day 90: 113,685	Water loss, Day 1: 113,428 Water loss, Day 3: 113,406 Water loss, Day 7: 113,356 Water loss, Day 30: 112,715 Water loss, Day 90: 0	Power loss, Day 1: 113,685 Power loss, Day 3: 113,685 Power loss, Day 7: 113,685 Power loss, Day 30: 113,685 Power loss, Day 90: 113,685	Water loss, Day 1: 98,615 Water loss, Day 3: 95,442 Water loss, Day 7: 86,276 Water loss, Day 30: 0 Water loss, Day 90: 0	Power loss, Day 1: 113,685 Power loss, Day 3: 113,685 Power loss, Day 7: 113,685 Power loss, Day 30: 113,685 Power loss, Day 90: 113,685	Water loss, Day 1: 107,645 Water loss, Day 3: 106,623 Water loss, Day 7: 103,868 Water loss, Day 30: 6,937 Water loss, Day 90: 0
Displaced Households	2,703 displaced households		11,362 displaced households		993 displaced households		1,731 displaced households	
Shelter Requirements	1,328 persons		5,637 persons		499 persons		860 persons	
Debris Generation	624,000 tons		2,390,000 tons		367,000 tons		471,000 tons	

Impacts from Earthquake (including liquefaction, landslide, subsidence, and fire following earthquake)

Earthquakes can strike without warning and cause dramatic changes to the landscape of an area that can have devastating impacts on the built environment. The greatest impact is to life safety of those in the District Service Territory. Other impacts to the District Service Territory would include damages to infrastructure such as roads, bridges, and dams; damages and loss of services to utilities and critical infrastructure, including those related to gas, power, water, wastewater and communication systems; damages to structures and other development; and possible loss of life and injuries.

Earthquakes can also cause failure of dams, levees, and reservoirs. Facilities and land downslope from dams or water reservoirs or behind levees might be subject to flooding, if the dams, reservoirs, or levees fail as a result of an earthquake. The District has locations with significant flood risk that include facilities downslope from dams or reservoirs or behind levees.

According to the EPA, earthquakes are a particularly problematic risk for water systems and wastewater treatment plants. It is the critical utility most vulnerable to this hazard and causes economic strain when disrupted.

The above ground, underground pipes, and various other lines are the main area of vulnerability, the risks for these including:

- Shaking and ground displacement
- Liquefaction
- Lateral spreading
- Settling

A large earthquake has the potential to cause large direct and indirect impacts to homes and businesses if a water or wastewater utility is damaged. According to the EPA, these vulnerabilities are exacerbated by many of these facilities being built on ground subject to liquification. These problems include:

- Disruption of drinking water and sewer services
- Loss of water system pressure from broken lines
- Ruptures in storage and process tanks
- Collapsing buildings
- Contamination of drinking water
- Sewage backups in homes and businesses
- Releases of untreated sewage

These losses may be worsened in the future due to the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

As discussed in the hazard profile section, climate change is not anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no

control over population changes, it merely reacts to them by providing additional (or reduced) services. Regarding land use, the District has no authority over how the cities it serves choose to develop land. It is unknown how changes in land use and development will affect earthquake liquefaction or earthquake-induced landslide in the District's service territory.

A large nearby earthquake can also increase the probability of secondary earthquake hazards affecting the District (and its Service Territory), including a surface fault rupture, liquefaction, landslides, and fire following earthquakes. These cascading events compound the impacts to the District (and its Service Territory during an earthquake.

Surface Fault Rupture

When a fault rupture extends to the earth's surface, the displacement can catastrophically damage structures or utilities. Fissuring, settlement, and permanent horizontal and vertical ground shifting often accompany large earthquakes. Such ground failures can significantly increase damage and may be a contributing cause of damage. Studies after the 1994 Northridge Earthquake showed that when ground failure was involved, damage to residential dwellings was three to four times greater than average shake damage. Because of their geographic extent and their tendency to be buried, networked infrastructures such as water, power, communication, and transportation lines are particularly vulnerable to ground failures.

Fault rupture itself contributes very little to damage unless the structure or system element crosses the active fault; however, liquefaction can occur further from the source of the earthquake.

Liquefaction

Ground settlement during liquefaction can cause damage when the amount of settlement varies significantly across the length of a structure. Liquefaction can occur in susceptible soils below bodies of water and can severely damage bridges, wharves, piers, and other structures at ports and harbors, as well as underwater utility lines. It can also damage USD underground lines.

Earthquake-Induced Landslides

Landslides caused by earthquakes can be widespread over the area of highest shaking intensity and also at greater distances if hillsides are in a susceptible condition. Earthquake landslides can significantly damage structures and transportation and utility lifelines.

Fire Following Earthquake

Fires after earthquakes may severely strain fire departments that must respond to multiple simultaneous ignitions. Impaired communications, water supply, transportation, and other demands such as structural collapses, hazardous materials releases, or medical emergencies affect fire department response. A few characteristics can make specific facilities more vulnerable to fire following earthquake. If a building collapses, there is a high risk for gas or electrical lines to start "seed" fires that then impact undamaged neighboring structures or start wildfires. Areas of liquefaction, fault rupture, and landslide are more vulnerable to fire. There is a greater potential for underground gas mains to break due to ground displacements, and water lines in the area might also be damaged, which could prevent the ability to fight

a fire with regular water resources. Areas that are largely built with wood frames or shingle roofs might be less prone to earthquake damage but are at a heightened risk for the spread of fires. Any of these fires could affect District facilities.

Future Development

The District takes seismic risk into account when developing new facilities, as well as when upgrading existing facilities. This includes the planned ETSU project the District is undertaking.

GIS Analysis

The District provided the ETSU future development area which was used as the basis for the inventory of future development areas for the District. Figure E-71 show the locations of the future development areas overlayed on the earthquake liquefaction zones). Table E-46 shows the future development structures and counts and which liquefaction zone they fall in.

It should be noted that no earthquake-induced landslide areas affect the future development of the District. As such, no maps or tabular analysis are shown.

Figure E-71 Union Sanitary District – Future Development in Liquefaction Susceptibility Zones

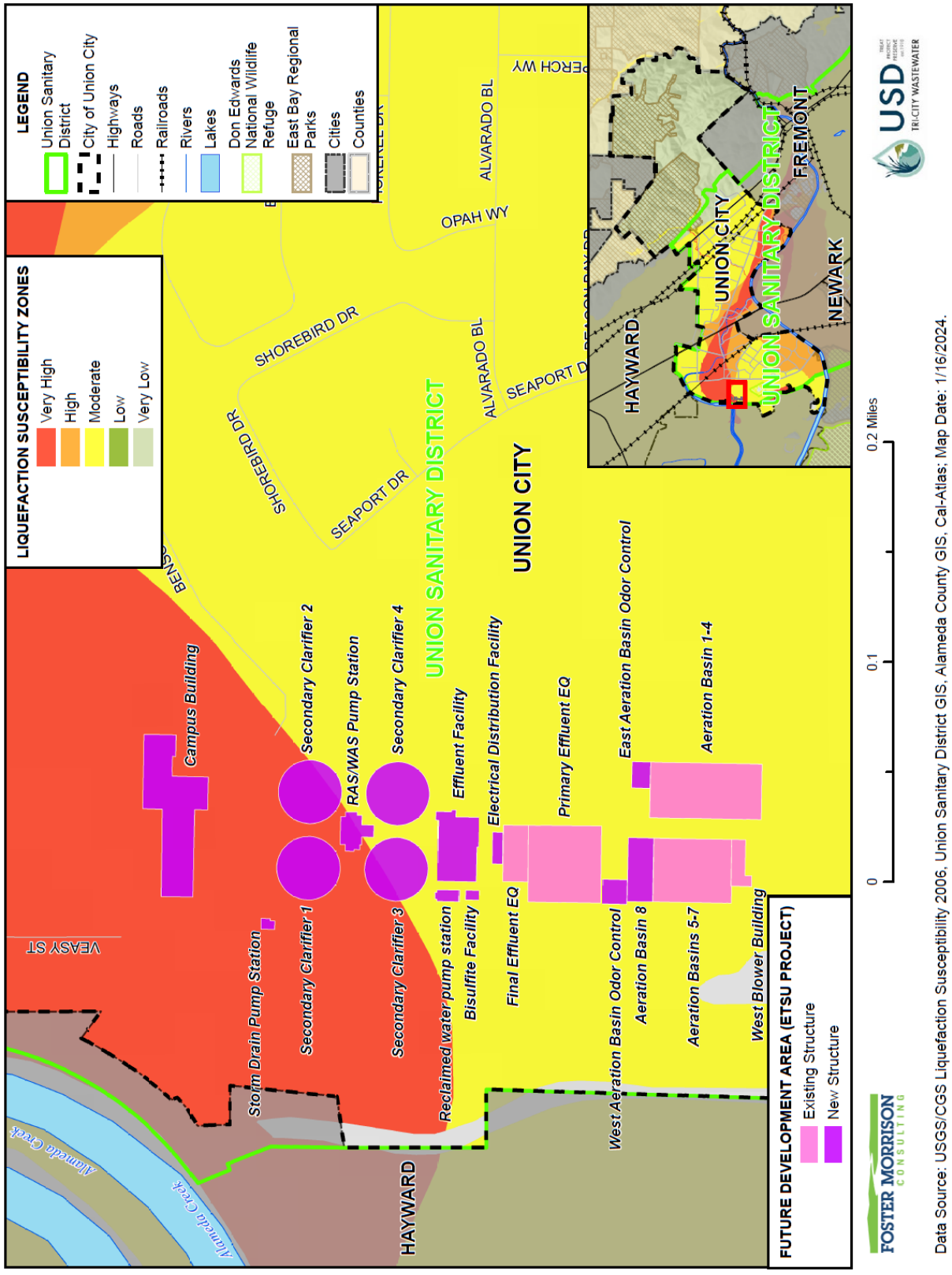


Table E-46 Union Sanitary District – Future Development Structure Names and Site Counts in Liquefaction Susceptibility Zones

Liquefaction Susceptibility Zones / Future Development Area (ETSU Project) Type	Future Development Structure Name	Site Count
Very High		
New Structure	Campus Building	1
	RAS/WAS Pump Station	1
	Secondary Clarifier 1	1
	Secondary Clarifier 2	1
	Storm Drain Pump Station	1
	Total	**5**
Very High Total		**5**
Moderate		
Existing Structure	Aeration Basin 1-4	1
	Aeration Basins 5-7	1
	Final Effluent EQ	1
	Primary Effluent EQ	1
	West Blower Building	1
	Total	**5**
New Structure	Aeration Basin 8	1
	Bisulfite Facility	1
	East Aeration Basin Odor Control	1
	Effluent Facility	1
	Electrical Distribution Facility	1
	Reclaimed water pump station	1
	Secondary Clarifier 3	1
	Secondary Clarifier 4	1
	West Aeration Basin Odor Control	1
	Total	**9**
Moderate Total		**14**
Grand Total		**19**

Source: USGS/CGS, Union Sanitary District

Flood: 1%/0.2% Annual Chance

Likelihood of Future Occurrence–Occasional/Unlikely
Vulnerability–Low

Note: Though considered a low priority hazard by the District, due to its importance in California and the Tri-City Planning Area, flooding is profiled here. It is not considered a priority hazard for mitigation planning purposes.

Hazard Profile and Problem Description

This hazard analyzes the FEMA DFIRM 1% and 0.2% annual chance floods. These tend to be the larger floods that can occur in the Tri-City Planning Area or in the District and have caused damages in the past. Flooding is 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. Normally, storm floodwaters are kept within defined limits by a variety of storm drainage and flood control measures. Occasionally, extended heavy rains result in floodwaters that exceed normal high-water boundaries and cause damage. Flooding has occurred both within the 1% and 0.2% annual chance floodplains and in other localized areas.

Location and Extent

USD has areas located in the 1% and 0.2% annual chance flood zones. This is seen in Figure E-72.

Figure E-72 Union Sanitary District – FEMA DFIRM Flood Zones

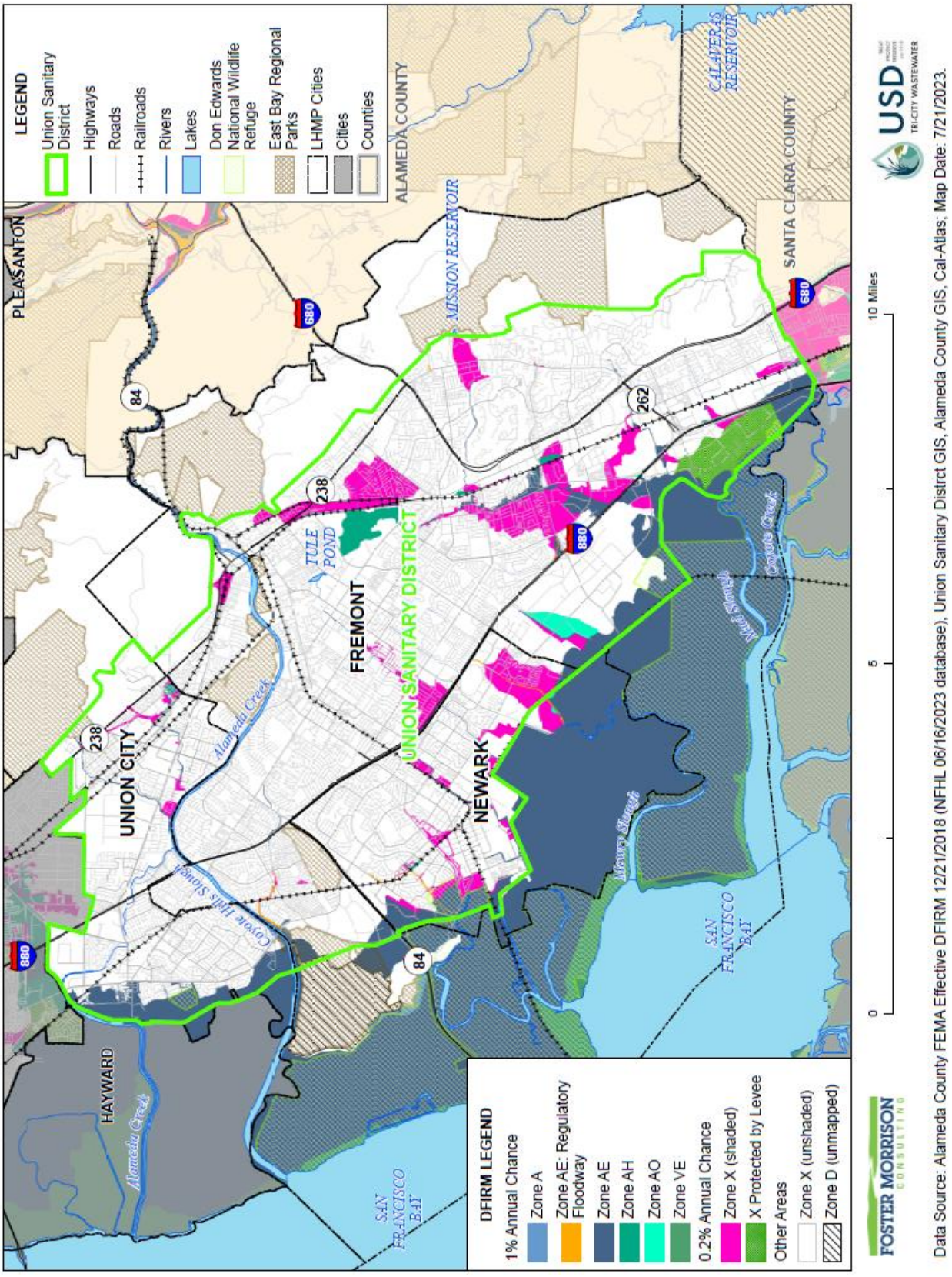


Table E-47 details the Digital Flood Insurance Rate Map (DFIRM) mapped flood zones located within the District.

Table E-47 Union Sanitary District – DFIRM Flood Hazard Zones

Flood Zone	Description	Flood Zone Present in District
A	1% annual chance flooding: No base flood elevations provided. Mandatory flood insurance purchase requirements and floodplain management standards apply.	X
AE Regulatory Floodway	1% annual chance flood: Regulatory floodway; Base flood elevations provided	X
AE	1% annual chance flooding: Base flood elevations provided. Mandatory flood insurance purchase requirements and floodplain management standards apply.	X
AH	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.	X
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. Mandatory flood insurance purchase requirements and floodplain management standards apply.	X
VE	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.	X
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. Flood insurance is not mandatory but is available.	X
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
D	Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.	X
X (unshaded)	No flood hazard	X

Source: FEMA

Additionally, flood extents can generally be measured in volume, velocity, and depths of flooding. Expected flood depths in the District vary, depending on the nature and extent of a flood event; specific depths are unknown. Flood durations in the District tend to be short to medium term, or until either the storm drainage system can catch up or flood waters move downstream. Flooding in the District tends to have a shorter speed of onset, due to the amount of water that flows through the District.

Geographical flood extents for the District from the FEMA DFIRMs are shown in Table E-48. Table E-48 represents a summary and Table E-49 represents a detailed analysis of total acres for each FEMA DFIRM flood zone. Both of these tables show the USD areas and the 1% and 0.2% annual chance flood zones.

Table E-48 Union Sanitary District – Geographical DFIRM Summary 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	3,905	5.04%	1,089	1.72%	2,815	19.88%
0.2% Annual Chance Flood Hazard	6,114	7.89%	5,257	8.30%	857	6.05%

Source: FEMA DFIRM 12/21/2018

Table E-49 Union Sanitary District– Geographical DFIRM Detailed Flood Zone Extents

Flood Zone / Property Use	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
1% Annual Chance Flood Hazard						
Zone A						
Agricultural	0	0.0%	0	0.0%	0	0.0%
Commercial	2	0.003%	0	0.0%	2	0.017%
Industrial	0	0.0%	0	0.0%	0	0.0%
Government / Institutional	362	0.467%	0	0.0%	362	2.558%
Recreational	0	0	0.0%	0.0%	0	0.0%
Residential	77	0.099%	76	0.121%	0	0.001%
Unknown	0	0.0%	0	0.0%	0	0.0%
Utilities	3	0.003%	0	0.0%	3	0.018%
Vacant	0	0.0%	0	0.0%	0	0.0%
Zone A Total	***444***	***0.572%***	***76***	***0.121%***	***367***	***2.594%***
Zone AE Floodway						
Agricultural	0	0.0%	0	0.0%	0	0.0%
Commercial	0	0.0%	0	0.0%	0	0.0%
Industrial	0	0.0%	0	0.0%	0	0.0%

Flood Zone / Property Use	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Government / Institutional	37	0.048%	0	0.0%	37	0.262%
Recreational	0	0.0%	0	0.0%	0	0.0%
Residential	1	0.001%	1	0.001%	0	0.0%
Unknown	0	0.0%	0	0.0%	0	0.0%
Utilities	8	0.010%	0	0.0%	8	0.053%
Vacant	0	0.000%	0	0.0%	0	0.000%
Zone AE Floodway Total	***45***	***0.058%***	***1***	***0.001%***	***45***	***0.315%***
Zone AE						
Agricultural	142	0.183%	0	0.0%	142	1.003%
Commercial	250	0.323%	227	0.358%	24	0.168%
Industrial	679	0.876%	493	0.778%	186	1.315%
Government / Institutional	1,476	1.904%	2	0.003%	1,473	10.406%
Recreational	3	0.004%	3	0.004%	0	0.0%
Residential	124	0.160%	107	0.169%	16	0.116%
Unknown	15	0.019%	0	0.0%	15	0.105%
Utilities	30	0.038%	0	0.0%	30	0.209%
Vacant	218	0.281%	8	0.012%	210	1.484%
Zone AE Total	***2,936***	***3.788%***	***839***	***1.325%***	***2,096***	***14.806%***
Zone AH						
Agricultural	0	0.0%	0	0.0%	0	0.0%
Commercial	88	0.113%	86	0.135%	2	0.017%
Industrial	7	0.009%	7	0.011%	0	0.0%
Government / Institutional	284	0.367%	0	0.0%	284	2.009%
Recreational	0	0.0%	0	0.0%	0	0.0%
Residential	15	0.020%	15	0.023%	1	0.005%
Unknown	1	0.002%	0	0.0%	1	0.010%
Utilities	0	0.0%	0	0.0%	0	0.0%
Vacant	1	0.001%	1	0.001%	0	0.001%
Zone AH Total	***397***	***0.512%***	***108***	***0.171%***	***289***	***2.041%***
Zone AO						
Agricultural	0	0.0%	0	0.0%	0	0.0%

Flood Zone / Property Use	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Commercial	55	0.071%	49	0.077%	6	0.042%
Industrial	13	0.017%	13	0.021%	0	0.0%
Government / Institutional	0	0.000%	0	0.0%	0	0.0%
Recreational	0	0.0%	0	0.0%	0	0.0%
Residential	3	0.004%	3	0.005%	0	0.0%
Unknown	0	0.0%	0	0.0%	0	0.0%
Utilities	3	0.003%	0	0.0%	3	0.019%
Vacant	9	0.012%	0	0.0%	9	0.065%
Zone AO Total	***83***	***0.107%***	***65***	***0.103%***	***18***	***0.126%***
1% Annual Chance Flood Hazard Total	**3,905**	**5.038%**	**1,089**	**1.720%**	**2,815**	**19.883%**
0.2% Annual Chance Flood Hazard						
Zone X (shaded)						
Agricultural	1	0.001%	0	0.0%	1	0.007%
Commercial	375	0.484%	318	0.502%	57	0.402%
Industrial	307	0.396%	306	0.484%	1	0.006%
Government / Institutional	473	0.610%	18	0.029%	455	3.211%
Recreational	5	0.007%	5	0.008%	0	0.0%
Residential	3,251	4.195%	3,153	4.977%	99	0.697%
Unknown	2	0.003%	0	0.0%	2	0.017%
Utilities	56	0.072%	0	0.0%	56	0.396%
Vacant	204	0.263%	139	0.220%	64	0.455%
Zone X (shaded) Total	***4,675***	***6.031%***	***3,940***	***6.219%***	***735***	***5.191%***
X Protected by Levee						
Agricultural	0	0.0%	0	0.0%	0	0.0%
Commercial	49	0.063%	49	0.078%	0	0.0%
Industrial	1,286	1.659%	1,268	2.002%	18	0.125%
Government / Institutional	30	0.038%	0	0.0%	30	0.210%
Recreational	0	0.0%	0	0.0%	0	0.0%
Residential	0	0.0%	0	0.0%	0	0.0%
Unknown	0	0.0%	0	0.0%	0	0.0%

Flood Zone / Property Use	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Utilities	0	0.0%	0	0.0%	0	0.0%
Vacant	75	0.096%	0	0.0%	75	0.528%
X Protected by Levee Total	***1,440***	***1.858%***	***1,318***	***2.080%***	***122***	***0.863%***
0.2% Annual Chance Flood Hazard Total	**6,114**	**7.889%**	**5,257**	**8.299%**	**857**	**6.053%**

Source: FEMA 12/21/2018 DFIRM

Past Occurrences

Disaster Declarations

A list of state and federal disaster declarations for Alameda County from flooding, including heavy rains and storms, is shown on Table E-50. These events also likely affected the District to some degree.

Table E-50 Alameda County – State and Federal Disaster Declarations from Flood 1950-2023

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	19	1950, 1955, 1957, 1958 (twice), 1962, 1963, 1970, 1982, 1983 (twice), 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	20	1955, 1958, 1962 (twice), 1970, 1982, 1983, 1986, 1995 (twice), 1997, 1998, 2005, 2006, 2017 (three), 2023 (three)

Source: Cal OES, FEMA

USD Events

The District noted no past floods since 2017 that have affected the USD.

Vulnerability to Flood: 1% 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. Predominantly, the effects of flooding are generally confined to areas near the waterways. 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 noted that flood is concerning for the District. There are increased flow capacities due to infiltration of ground water. There is also a risk of storm water erosion to USD facilities (pipeline, manholes, etc.).

Assets at Risk

Assets at risk from flood include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections.

People and Populations

District Populations

The District employs 145 employees that support 5 workgroups. The treatment plant has various construction projects currently underway and planned. These projects will have contractors and their employees onsite. Some of these people would be inside the floodplain.

Service Territory Populations

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.

To further evaluate the impact to the residential population within the District's Service Territory, utilizing the parcel/structure hazard analysis methodology described above, an estimate of District Service Territory residents who residents living in the 1% and 0.2% annual chance floodplains was conducted. The DFIRM flood zones were overlayed on the parcel layer. Those residential parcel centroids that intersect the flood zones were counted and multiplied by the 2020 Census Bureau average household factors for USD – 3.22. According to this analysis, there is a total population of 2,872 and 0 residents of the District at risk to flooding in the 1% and 0.2% annual chance floodplains, respectively. This is shown in Table E-51.

Table E-51 Union Sanitary District – Improved Residential Parcels and Population by FEMA DFIRM Flood Zone

Jurisdiction	1% Annual Chance		0.2% Annual Chance	
	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk
USD	892	2,872	0	0

Source: FEMA DFIRM 12/21/2018, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023), US Census Bureau

Structures

The analysis for structures in the District is separated out into two separate analyses:

- **USD Facility Assets** – These are the facilities, structures, and other assets which USD owns and maintains operational control.
- **Service Territory Structures** – This is comprised of the parcels and structures associated with the residents and businesses located within USD's Service Territory who use the wastewater services provided by USD.

USD Facility Assets

The District owns facilities that may be at risk to flooding. GIS was used to determine the possible impacts of DFIRM flooding on USD facilities. The methodology described in Section E.4.1 (in the Structures section) above was followed in determining USD structures at risk to flood. USD structures in the DFIRM flood zones are shown on Figure E-73 and detail in Table E-52 (for point assets) and Table E-53 (for linear assets) for 1% and 0.2% annual chance flood zones.

Figure E-73 Union Sanitary District - Assets in FEMA DFIRM Flood Zones

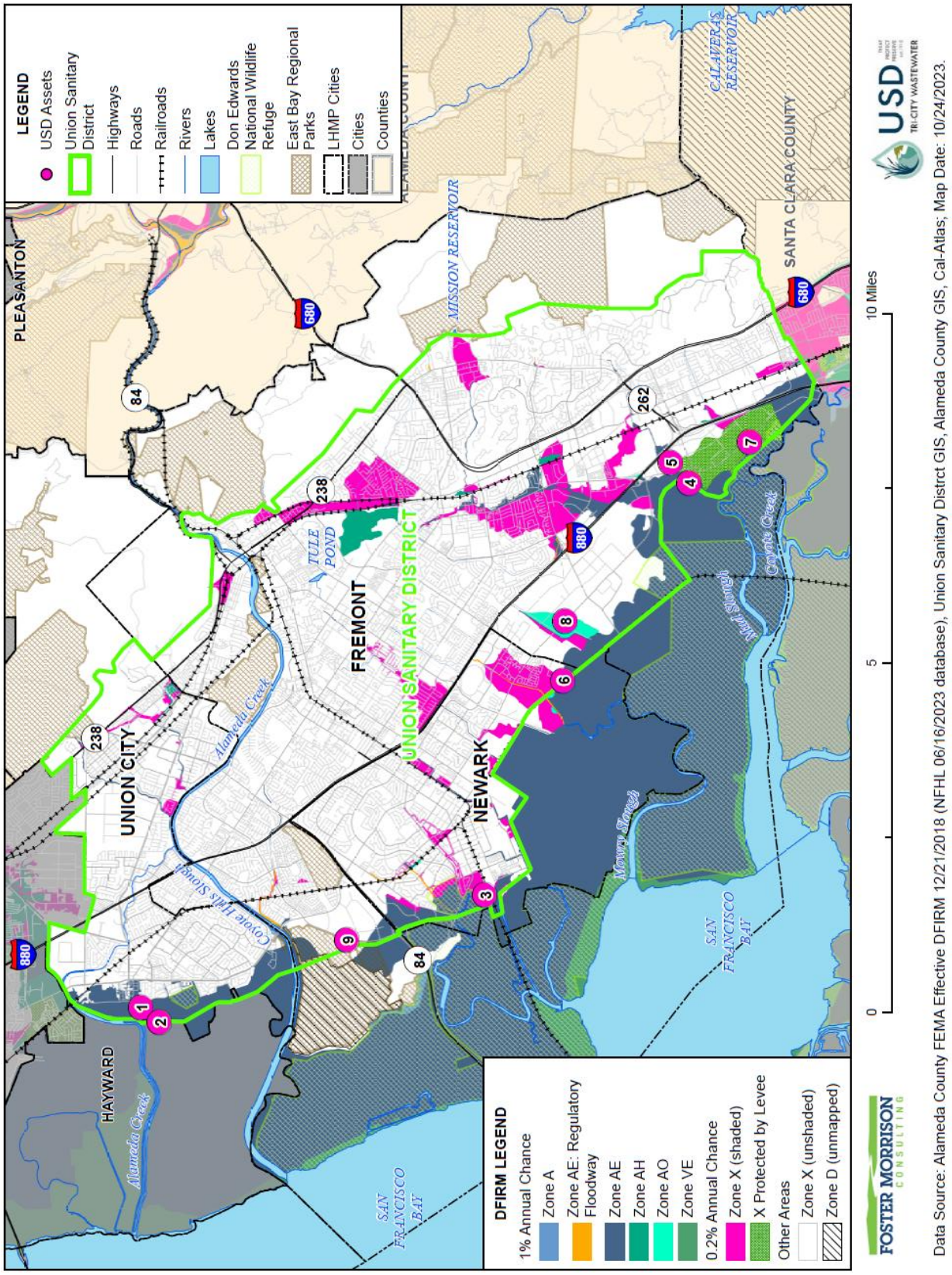


Table E-52 Union Sanitary District – Assets by Site in DFIRM Flood Zones

Flood Zone / Site Number	Site Location / Name	Asset Type	Asset Value	Property Value	Total Value
1% Annual Chance Flood Hazard					
Zone AE					
1	Alvarado Treatment Plant	Water Treatment Plant	$247,303,953	$66,060,000	$313,363,953
2	Final Effluent Pump Station	Dischargers Pump Station	$14,932,627	$0	$14,932,627
3	Newark PS	Pump Station	$18,721,354	$37,520,000	$56,241,354
4	Irvington PS	Pump Station	$10,511,794	$45,040,000	$55,551,794
5	Irvington SB	Storage Basin	$7,983,280	$0	$7,983,280
6	Cherry PS	Lift Station	$315,705	$1,580,000	$1,895,705
Zone AE Total			**$299,768,713**	**$150,200,000**	**$449,968,713**
Zone AO					
8	Boyce LS	Lift Station	$4,497,365	$340,000	$4,837,365
Zone AO Total			**$4,497,365**	**$340,000**	**$4,837,365**
1% Annual Chance Flood Hazard Total			**$304,266,078**	**$150,540,000**	**$454,806,078**
0.2% Annual Chance Flood Hazard					
X Protected by Levee					
7	Fremont LS	Lift Station	$1,086,324	$880,000	$1,966,324
0.2% Annual Chance Flood Hazard Total			**$1,086,324**	**$880,000**	**$1,966,324**

Source: FEMA 12/21/2018 DFIRM, USD

Table E-53 Union Sanitary District – Linear Assets in FEMA DFIRM Flood Zones

Flood Zone / Asset	Asset Length (in miles)	Total Asset Value
1% Annual Chance Flood Hazard		
Zone A		
Sewer Force Main (Pressurized Transport Pipeline)	0	$0
Sewer Collection System (Gravity Flow Pipeline)	0.877	$3,706,069
Zone A Total	**0.877**	**$3,706,069**
Zone AE Floodway		
Sewer Force Main (Pressurized Transport Pipeline)	4.040	$70,387,489
Sewer Collection System (Gravity Flow Pipeline)	7.020	$29,650,626
Zone AE Floodway Total	**11.059**	**$100,038,115**
Zone AE		
Sewer Force Main (Pressurized Transport Pipeline)	16.327	$284,473,003
Sewer Collection System (Gravity Flow Pipeline)	20.198	$85,316,87
Zone AE Total	**36.525**	**$369,789,875**

Flood Zone / Asset	Asset Length (in miles)	Total Asset Value
Zone AH		
Sewer Force Main (Pressurized Transport Pipeline)	0	$0
Sewer Collection System (Gravity Flow Pipeline)	1.544	$6,523,138
Zone AH Total	**1.544**	**$6,523,138**
Zone AO		
Sewer Force Main (Pressurized Transport Pipeline)	0	$0
Sewer Collection System (Gravity Flow Pipeline)	1.318	$5,565,862
Zone AO Total	**1.318**	**$5,565,862**
0.2% Annual Chance Flood Hazard		
X Protected by Levee		
Sewer Force Main (Pressurized Transport Pipeline)	1.204	$20,979,964
Sewer Collection System (Gravity Flow Pipeline)	22.437	$94,775,546
X Protected by Levee Total	**23.641**	**$115,755,511**
Zone X (shaded)		
Sewer Force Main (Pressurized Transport Pipeline)	5.163	$89,961,938
Sewer Collection System (Gravity Flow Pipeline)	22.437	$94,775,546
Zone X (shaded) Total	**27.600**	**$184,737,484**

Source: FEMA 12/21/2018 DFIRM, USD

Service Territory Structures

Certain structures in the District's Service Territory have a measure of risk from flooding. GIS was used to determine the possible impacts of flooding within the USD. The methodology described in Section 4.3.11 of the Base Plan was followed in determining structures and values at risk to the 1% (100-year) and 0.2% (500-year) annual chance flood event. Table E-54 is a summary table for the USD Service Territory. Parcel counts, land and improved values (i.e., those with a structure improvement on the parcel), estimated content replacement values, and total values in the District Service Territory are shown for the 1% and 0.2% annual chance flood zones, as well as for those properties that fall outside of the mapped FEMA DFIRM flood zones. Table E-55 breaks down Table E-54 and shows the same analysis further broken out by detailed FEMA flood zone.

Table E-54 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) at Risk in Summary Flood Zones

Flood Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard	1,992	1,070	$947,347,736	$1,738,439,645	$1,857,886,250	$4,543,673,631
0.2% Annual Chance Flood Hazard	7,254	6,494	$2,615,013,887	$4,477,575,346	$3,383,035,205	$10,475,624,438

Source: FEMA 12/21/2018 DFIRM, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)
*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone
**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

Table E-55 Union Sanitary District Service Territory – Count and Values of Parcels (and Structures) at Risk by Detailed Flood Zone and Property Use

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard						
Zone A						
Agricultural	0	0	$0	$0	$0	$0
Commercial	2	0	$0	$0	$0	$0
Government / Institutional	145	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0
Residential	40	35	$4,047,131	$9,580,753	$4,790,375	$18,418,259
Unknown	0	0	$0	$0	$0	$0
Utilities	5	0	$0	$0	$0	$0
Vacant	0	0	$0	$0	$0	$0
Zone A Total	***192***	***35***	***$4,047,131***	***$9,580,753***	***$4,790,375***	***$18,418,259***
Zone AE Floodway						
Agricultural	0	0	$0	$0	$0	$0
Commercial	0	0	$0	$0	$0	$0
Government / Institutional	20	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0
Residential	3	3	$429,806	$806,780	$403,390	$1,639,976
Unknown	0	0	$0	$0	$0	$0
Utilities	7	0	$0	$0	$0	$0
Vacant	1	0	$0	$0	$0	$0
Zone AE Floodway Total	***31***	***3***	***$429,806***	***$806,780***	***$403,390***	***$1,639,976***
Zone AE						
Agricultural	10	0	$1,648,573	$0	$0	$1,648,573
Commercial	90	76	$210,507,376	$428,941,638	$428,941,638	$1,068,390,652

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Government / Institutional	241	2	$1,580,981	$1,772,454	$1,772,454	$5,125,889
Industrial	92	77	$293,533,448	$708,715,714	$1,063,073,569	$2,065,322,731
Recreational	2	2	$7,250,750	$8,999,460	$8,999,460	$25,249,670
Residential	784	695	$198,245,434	$397,865,419	$198,932,708	$795,043,561
Unknown	5	0	$2,365,132	$0	$0	$2,365,132
Utilities	26	0	$0	$0	$0	$0
Vacant	313	11	$115,239,111	$7,046,747	$0	$122,285,858
Zone AE Total	***1,563***	***863***	***$830,370,805***	***$1,553,341,432***	***$1,701,719,829***	***$4,085,432,066***
Zone AH						
Agricultural	0	0	$0	$0	$0	$0
Commercial	38	32	$43,173,915	$46,913,938	$46,913,938	$137,001,791
Government / Institutional	17	0	$0	$0	$0	$0
Industrial	2	2	$5,782,665	$6,229,498	$9,344,247	$21,356,410
Recreational	0	0	$0	$0	$0	$0
Residential	114	110	$28,951,279	$65,932,994	$32,966,496	$127,850,769
Unknown	2	0	$0	$0	$0	$0
Utilities	0	0	$0	$0	$0	$0
Vacant	2	1	$112,995	$1,208,799	$0	$1,321,794
Zone AH Total	***175***	***145***	***$78,020,854***	***$120,285,229***	***$89,224,681***	***$287,530,764***
Zone AO						
Agricultural	0	0	$0	$0	$0	$0
Commercial	5	4	$23,414,517	$26,480,744	$26,480,744	$76,376,005
Government / Institutional	2	0	$0	$0	$0	$0
Industrial	2	2	$5,510,646	$21,294,875	$31,942,312	$58,747,833
Recreational	0	0	$0	$0	$0	$0
Residential	18	18	$3,482,855	$6,649,832	$3,324,919	$13,457,606
Unknown	0	0	$0	$0	$0	$0
Utilities	1	0	$0	$0	$0	$0
Vacant	3	0	$2,071,122	$0	$0	$2,071,122
Zone AO Total	***31***	***24***	***$34,479,140***	***$54,425,451***	***$61,747,975***	***$150,652,566***

Flood Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
1% Annual Chance Flood Hazard Total	**1,992**	**1,070**	**$947,347,736**	**$1,738,439,645**	**$1,857,886,250**	**$4,543,673,631**
0.2% Annual Chance Flood Hazard						
Zone X (shaded)						
Agricultural	2	0	$275,678	$0	$0	$275,678
Commercial	216	150	$247,687,070	$493,028,491	$493,028,491	$1,233,744,052
Government / Institutional	129	7	$4,886,203	$8,901,142	$8,901,142	$22,688,487
Industrial	93	92	$327,979,132	$366,216,100	$549,324,155	$1,243,519,387
Recreational	2	2	$7,514,580	$17,574,099	$17,574,099	$42,662,778
Residential	6,292	5,967	$1,537,459,201	$2,979,982,283	$1,489,991,154	$6,007,432,638
Unknown	2	0	$0	$0	$0	$0
Utilities	35	0	$0	$0	$0	$0
Vacant	289	97	$47,355,398	$29,159,313	$0	$76,514,711
Zone X (shaded) Total	***7,060***	***6,315***	***$2,173,157,262***	***$3,894,861,428***	***$2,558,819,041***	***$8,626,837,731***
X Protected by Levee						
Agricultural	0	0				
Commercial	6	6	$48,021,161	$99,709,413	$99,709,413	$247,439,987
Government / Institutional	5	0				
Industrial	175	173	$334,300,556	$483,004,505	$724,506,751	$1,541,811,812
Recreational	0	0				
Residential	0	0				
Unknown	0	0				
Utilities	0	0				
Vacant	8	0	$59,534,908			$59,534,908
X Protected by Levee Total	***194***	***179***	***$441,856,625***	***$582,713,918***	***$824,216,164***	***$1,848,786,707***
0.2% Annual Chance Flood Hazard Total	**7,254**	**6,494**	**$2,615,013,887**	**$4,477,575,346**	**$3,383,035,205**	**$10,475,624,438**

Source: FEMA 12/21/2018 DFIRM, Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023)

*With respect to improve parcels within the floodplain, the actual structures on the parcels may not be located within the actual floodplain, may be elevated and or otherwise outside of the identified flood zone

**This parcel count only includes those parcels in the 0.2% annual chance flood zone, exclusive of the 1% annual chance flood zone. The 0.2% annual chance flood, in actuality, also includes all parcels in the 1% annual chance flood zone.

Critical Facilities and Infrastructure, and Community Lifelines

Flooding presents a threat to critical facilities and infrastructure, and community lifelines. The following analysis discusses critical facilities and infrastructure, followed by community lifelines.

Critical Facilities and Infrastructure

As mentioned above, all USD Assets (and lines) are considered to be critical facilities. This analysis was shown on Table E-52 in the structure analysis above.

Community Lifelines

1% and 0.2% annual chance flooding presents a threat to life and property, including community lifelines in the District. Lifelines that would be vulnerable to flooding include:

- **Safety and Security** – District personnel are often called on to respond during flood emergencies. During large events, these services may become stretched.
- **Food, Hydration, Shelter** – Public health can also be at risk from flooding. Floodwater is often contaminated with sewage, which can lead to illness and affect clean drinking water.
- **Health and Medical** – Loss of life and injuries can occur during significant flood events. Flooding may complicate the ability to transport the injured possibly requiring rerouting of injured to other facilities.
- **Energy** – Floods can cause power grid issues and lead to power outages. During extreme flood events gas lines may break or otherwise be damaged from erosion and debris in floodwaters.
- **Communications** – Communication infrastructure can be inundated by a flood event causing damage and disruption in service. As well an influx of service calls to dispatch centers for reporting of flooding, power outages, or other issues can occur. District messaging systems need to be deployed during these times.
- **Transportation** – Transport networks can be affected, such as flood damage to bridges, railways and roads. This can cause lane and road closures. These closures can affect response District personnel as well as cause additional traffic issues for residents and impact evacuation routes. Life safety can also be an issue on flooded roads.
- **Hazardous Material** – Hazardous material facilities can be affected by flooding. Releases during these times can be comingles with flood waters, contaminate drinking water, as well as create additional exposures to the environment.
- **Water Systems** – Wastewater facilities are often located near areas inundated by flooding.

Given the area of flood risk shown on Figure E-72, some of these lifelines may be overwhelmed in the short term. This is especially true if a 0.2% annual chance flood event occurs.

Natural, Historic, and Cultural Resources

A major flood event could have a devastating impact on the District. 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. River banks 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 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 E-72 would be vulnerable. This is especially true if a 0.2% annual chance flood event occurs. Specific natural, historic, and cultural resources at risk can be found in the respective city annexes to this Plan Update.

Economic Assets and Community Activities of Value

As shown on Figure E-72, flooding could affect any economic asset that lies in the floodplain. This is especially true if a 0.2% annual chance flood event occurs. Specific economic assets and community activities of value at risk can be found in the respective city annexes to this Plan Update.

Impacts from Flood: 1% 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.

The EPA noted specific impacts to water and wastewater utilities from floods:

- Infrastructure damage that can interrupt service.
- Breaks in pipes that result in sewage spills and low water pressure.

- Water intakes blocked by debris.
- Combined sewer overflows.
- Quality issues with source water and treated effluents.
- Power outages and communication loss.
- Limited or no access to facilities and water testing capabilities.
- Loss of power
- Costly repairs
- Dangerous conditions for personnel

These impacts may be exacerbated by the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

As discussed in the hazard profile section, climate change is anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no control over population changes, it merely reacts to them by providing additional (or reduced) services. It is unknown how changes in land use and development will affect flood in the District's service territory.

Future Development

Future development in the USD may be built in the floodplain, as long as it conforms to the standards of the floodplain ordinance. Each city should be enforcing the floodplain ordinance on new development and substantial improvements in the District ETSU project will renew and replace aging infrastructure, improve water quality in the San Francisco Bay through enhanced wastewater treatment processes and nutrient removal, and increase the facility's resiliency to extreme wet-weather events and climate change.

GIS Analysis

The District provided the ETSU future development area which was used as the basis for the inventory of future development areas for the District. Figure E-74 show the locations of the future development areas overlayed on the DFIRM flood zones. Table E-56 shows the future development structures and counts and which flood zone they fall in.

Figure E-74 Union Sanitary District – Future Development in FEMA DFIRM Flood Zones

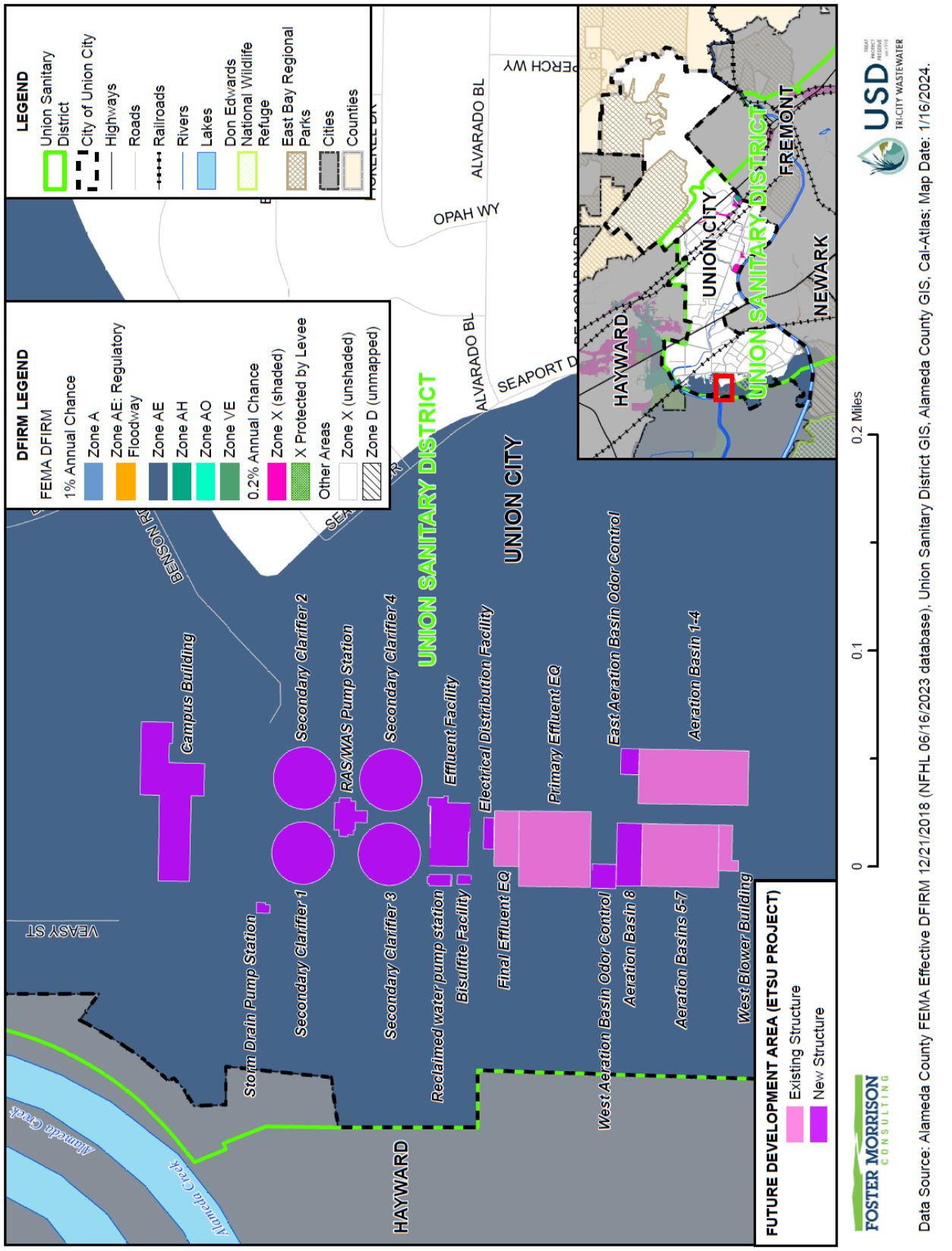


Table E-56 Union Sanitary District – Future Development Structure Names and Counts in FEMA DFIRM Flood Zones

Flood Zone / Future Development Area (ETSU Project) Type	Future Development Structure Name	Site Count
1% Annual Chance Flood Hazard		
Zone AE		
Existing Structure	Aeration Basin 1-4	1
	Aeration Basins 5-7	1
	Final Effluent EQ	1
	Primary Effluent EQ	1
	West Blower Building	1
	Total	**5**
New Structure	Aeration Basin 8	1
	Bisulfite Facility	1
	Campus Building	1
	East Aeration Basin Odor Control	1
	Effluent Facility	1
	Electrical Distribution Facility	1
	RAS/WAS Pump Station	1
	Reclaimed water pump station	1
	Secondary Clarifier 1	1
	Secondary Clarifier 2	1
	Secondary Clarifier 3	1
	Secondary Clarifier 4	1
	Storm Drain Pump Station	1
	West Aeration Basin Odor Control	1
	Total	**14**
Zone AE Total		**19**
1% Annual Chance Flood Hazard Total		**19**

Source: FEMA 12/21/2018 DFIRM, Union Sanitary District

Flood: Localized Stormwater Flooding

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Flooding occurs in areas other than the FEMA mapped 1% and 0.2% annual chance floodplains. Flooding may be from drainages not studied by FEMA, lack of or inadequate drainage infrastructure, or inadequate maintenance. Localized, stormwater flooding occurs throughout the District during the rainy season from

November through April. Prolonged heavy rainfall contributes to a large volume of runoff resulting in high peak flows of moderate duration.

Location and Extent

The District is subject to localized flooding throughout its Service Territory, including in areas of District owned properties and assets. This is discussed in Table E-57 below. There is also localized flooding potential along the urban fringe near the base of the hills and in scattered flatland areas. Some of the problem areas from heavy rains in the City were shown in the Location and Extent of the Flood: Localized Stormwater Flood discussion above. 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 USD 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 Declarations

There have been no past state or federal disaster declarations from local floods.

USD Events

The District noted that they didn't have any damage to its system although there was increased water in 2017 and 2022/2023. Localized flooding locations are outlined in the annexes for Fremont, Union City, and Newark annexes and may pose a limited impact on USD operations.

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 economic 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 USD are minor, localized flood events that are more of a nuisance than a disaster.

Many areas of the USD are at some measure of vulnerability to localized flooding. An assessment of a community's vulnerability to localized flood 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 USD's Assets at Risk to this hazard.

Local Concerns

Historically, the District has been affected by flooding of streams and creeks occurring during heavy rain and storm events. Additional development in the USD Service Territory 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.

USD wastewater systems can also be vulnerable to heavy rains and flood events. Rainfall creates a high water table, surging streams and creeks, and saturates soil. Infiltration of stormwater into water and wastewater systems may occur and presents a threat to public health and safety, when the infrastructure is no longer able to meet demands.

The USD tracks localized flooding areas. Affected localized flood areas identified by the District are summarized in Table E-57. Some of the problem areas from heavy rains in the City were shown in the Local Concerns of the Flood: Localized Stormwater Flood discussion above.

Table E-57 Union Sanitary District – List of Localized Flooding Problem Areas

Road/Area Name	Flooding	Pavement Deterioration	Washouts	High Water/ Creek Crossing	Landslides/ Mudslides	Debris	Downed Trees
Woodside Terrace (Fremont) 2023			X		X		

Source: USD

Assets at Risk

Assets at risk from localized flood include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections.

People and Populations

People and populations (including District staff and contractors) are traditionally not highly vulnerable to localized flooding, but their structures and contents can be at risk. Localized flooding may also cause transportation issues as roads and lanes are impacted or closed and affect the ability for people to travel throughout the USD Service Territory.

Structures

USD facilities in areas with localized flooding can be affected if floodwaters intrude into the structure. Structures 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.

Critical Facilities and Infrastructure, and Community Lifelines

Localized flooding, while often more of a nuisance, can cause damage to critical facilities and infrastructure during a heavy rain and storm event. Any facility that experiences localized flooding can be impacted. Utilities and other critical infrastructure can all be affected, causing interruptions in service until repairs can be made. For example, wastewater systems can be vulnerable to heavy rains and flood events. Rainfall

creates a high water table, surging streams and creeks, and saturates soil. Infiltration of stormwater into water and wastewater systems may occur and presents a threat to public health and safety, when the infrastructure is no longer able to meet operational needs and local demands.

Due to the relatively minor nature of localized flooding, community lifelines are unlikely to be overwhelmed. There may be minor vulnerabilities to the following:

- **Safety and Security** – Law Enforcement/Security, Fire Service, and Community Safety officials may be needed to close roads and redirect traffic during localized flood events. These agencies may also experience flooded roads when responding to emergencies.
- **Communications** – Unless directly affected by flooding, communication systems are not likely to be impacted. Warnings and Messaging may be required to reroute traffic away from localized flooding areas.
- **Transportation** – Highways, roads, and bridges may be temporarily blocked until localized floodwaters recede.
- **Water Systems** – Water and wastewater systems can be infiltrated during localized flooding events. Stormwater drainage systems are often undersized and inadequate to convey the volume of flood waters.

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. Wetlands 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. Specific natural, historic, and cultural resources at risk can be found in the respective city annexes to this Plan Update

Economic Assets and Community Activities of Value

Localized flooding occurs on an annual basis throughout the District during storm events. Most of these events have limited impacts and include those associated with localized flooding due to undersized drainage systems, affecting nearby roads, structures, and other nearby assets. Unless directly affected by localized flooding, these events are unlikely to affect the City's key economic assets.

Community activities of value may have minor vulnerabilities if a localized flood event were to occur during the activity. This may cause the activity to be relocated, cancelled, or rescheduled. Specific economic assets and community activities of value at risk can be found in the respective city annexes to this Plan Update.

Impacts from Localized Flood

Primary concerns associated with stormwater flooding include impacts to infrastructure that provides a means of ingress and egress throughout the community. Ground saturation can result in instability, collapse, or other damage to trees, structures, roadways and other critical infrastructure. Objects can also be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt services. Standing water can cause damage to crops, roads, and foundations. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

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. Localized flooding impacts may be exacerbated in the future due to the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

These impacts may be exacerbated by the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

As discussed in the hazard profile section, climate change is anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no control over population changes, it merely reacts to them by providing additional (or reduced) services. Regarding land use, the District has no authority over how the cities it serves choose to develop land.

Future Development

The District noted that post-construction runoff impact occurs by changing the natural hydrology of a land area through the creation of new impervious surfaces during development. Increased impervious surfaces interrupts the natural cycle of gradual percolation of water through vegetation and soil by altering the timing and quantity of peak flows. Instead, water is collected from surfaces such as asphalt and concrete and routed to drainage systems where large volumes of runoff quickly flow to the nearest receiving waterway. The effects of this process include stream bank scouring, bank erosion and downstream flooding, which often lead to a loss of aquatic life and damage to property. The risk of stormwater/localized flooding to future development can be minimized by accurate recordkeeping of repetitive localized storm activity. Mitigating the root causes of the localized stormwater or choosing not to develop in areas that often are subject to localized flooding will reduce future risks of losses due to stormwater/localized flooding. Future development in the District may add to the drainage issues already faced by the District, unless adequate drainage facilities are ensured at new development locations.

Severe Weather: Heavy Rains and Storms

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Storms in the District occur annually and are generally characterized by heavy rain often accompanied by strong winds and sometimes lightning and hail. Approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. A thunderstorm is classified as severe when it contains one or more of the following phenomena: hail that is three-quarters of an inch or greater, winds in excess of 50 knots (57.5 mph), or a tornado. Heavy precipitation in the District falls mainly in the fall, winter, and spring months. Wind often accompanies these storms; hail and lightning are rare in the District.

Location and Extent

Heavy rain events occur on a regional basis. Rains and storms can occur in any location of the District. All portions of the District are at risk to heavy rains. Most of the severe rains occur during the fall, winter, and spring months. There is no scale by which heavy rains and severe storms are measured. Magnitude of storms is measured often in rainfall and damages. The speed of onset of heavy rains can be short, but accurate weather prediction mechanisms often let the public know of upcoming events. Hail and lightning are rare in the District and the Tri-City Planning Area. Duration of severe storms in California, Alameda County, and the District can range from minutes to hours to days. Information on precipitation extremes can be found in Section 4.3.4 of the Base Plan.

Past Occurrences

Disaster Declarations

According to historical hazard data, severe weather, including heavy rains and storms, is an annual occurrence in the District. This is the cause of many of the federal disaster declarations related to flooding. Disaster declarations from flooding are shown on Table E-58.

Table E-58 Alameda County Disaster Declarations from Flood and Storms 1950-2023

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Flood (including heavy rains and storms)	19	1950, 1955, 1957, 1958 (twice), 1962, 1963, 1970, 1982, 1983 (twice), 1986, 1995 (twice), 1997, 1998, 2008, 2017 (twice)	20	1955, 1958, 1962 (twice), 1970, 1982, 1983, 1986, 1995 (twice), 1997, 1998, 2005, 2006, 2017 (three), 2023 (three)

Source: Cal OES, FEMA

USD Events

The District noted that heavy rains fell in the winter of 2017 and 2022/2023 as well as in 2023/2024. 2017 and 2023 storm events did not cause damage but the District incurred overtime costs in the field and in the

plant to ensure collection system and treatment processes were not impacted. More information can be found in the Past Occurrences section of the Flood: 1%/0.2% Annual Chance above.

Vulnerability to Heavy Rain and Storms

Heavy rain and severe storms are the most frequent type of severe weather occurrences in the District. These events can cause 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 noted that heavy rains can cause both localized flooding and flooding in the floodplains. Atmospheric river storms are of great concern as they can dump large amounts of water in single storms, or in back-to-back storms as seen in the winter of 2022/2023, as well as in the winter of 2023/2024.

Assets at Risk

Assets at risk from heavy rain and storms include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections.

People and Populations

District Populations

District staff would be at limited risk to heavy rains and storms. However, those who are working outside may be at risk to lightning.

Service Territory Populations

Populations in the USD Service Territory have some measure of risk to heavy rains and storms. Populations at risk to heavy rains and storms include those who live in floodplains (discussed in further detail in the Flood: 1%/0.2% Annual Chance section above), those who live in and near localized flooding areas floodplains (discussed in further detail in the Flood: Localized Stormwater Flooding section above), and those who are unsheltered.

Structures

Structures in the District have some risk to heavy rains and storms; although it is the resulting flooding that causes some of the more significant issues. Structures built to modern building codes are built to withstand

heavy rains and storms (including lightning). During a heavy storm, localized flooding may cause water intrusion into buildings from the outside. Older homes, buildings, and critical facilities may be at increased risk to heavy rains and storms. While it is rare for USD to lose power as a result of heavy rains and storms events due to their backup power systems in place, the risk does still remain.

Critical Facilities and Infrastructure, and Community Lifelines

Most critical facilities are built to modern design standards that take heavy rains and storms into account when siting and building these structures. However, during a heavy storm, localized flooding may cause water intrusion into buildings from the outside. Infiltration of water into the systems infrastructure may also occur. During a heavy storm, trees may be downed that can cause damage to critical facilities and infrastructure. Power outages from these events can also affect critical facilities.

Community lifelines likely to have some vulnerability to heavy rains and storms include:

- **Safety and Security** – District personnel may be called on to perform riskier duties during times of heavy rains and flooding.
- **Food, Hydration, Shelter** – Public health can also be at risk from flooding. Floodwater is often contaminated with sewage, which can lead to illness and affect clean drinking water.
- **Health and Medical** – Patient movement from accident scenes by EMS may have to be rerouted. Public health can be at risk from flooding caused by heavy rains.
- **Energy** – Downed trees can fall on electric lines in the District, causing power outages. Lightning strikes can cause transformers and other infrastructure to be damaged.
- **Communications** – An influx of service calls to dispatch centers for reporting of flooding, power outages, downed trees, or other issues can occur. Messaging systems need to be deployed during these times to let the public know about road closures, washouts, debris on roads, or lane closures.
- **Transportation** – Highways and local roads may see extensive flooding. This can cause lane closures or road closures. These closures can affect District response personnel as they travel to District sites.
- **Hazardous Material** – Hazardous material facilities can be affected by flooding. Spills during these times can release contaminants to the environment, affecting the drinking water and natural systems.
- **Water Systems** – Water systems in the District, especially drainage systems, can be temporarily overwhelmed during periods of heavy rains and storm.

Short-term, heavy storms can cause both widespread flooding as well as extensive localized drainage issues throughout the District. As storms continue to increase in intensity, the limited drainage infrastructure has become an increasingly important issue. Inadequate drainage can contribute to flooding, erosion, and in a few areas, landslides in the District. While components of these lifelines may be damaged or otherwise impacted, it is unlikely that this type of event would overwhelm and take out any of these lifelines in the District as a whole.

Natural, Historic, and Cultural Resources

Large 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 storm and flood events. Specific natural, historic, and cultural resources at risk can be found in the respective city annexes to this Plan Update.

Economic Assets and Community Activities of Value

Heavy rain and storm events can cause direct damage to economic assets such as businesses and commercial centers. During extreme events, the economy may slow as people stay home or inside. Business revenue may be reduced during extended storm events. Community activities of value may see a reduction in attendance, impacting revenues associated with these events, especially those that occur outdoors. Events may be cancelled or rescheduled. Specific economic assets and community activities of value at risk can be found in the respective city annexes to this Plan Update.

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. Landslides 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 and erosion that would likely have the greatest impact.

Floodwaters also saturate the ground, which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. Infiltration and lack of treatment can lead to overloaded sewer lines that can back up into low-lying areas and homes. Even when it is diluted by flood waters, raw sewage can be a breeding ground for bacteria such as e. coli and other disease-causing agents.

The EPA noted specific impacts to water and wastewater utilities from heavy rains and storms (and resulting flooding):

- Infrastructure damage that can interrupt service.
- Breaks in pipes that result in sewage spills and low water pressure.
- Water intakes blocked by debris.
- Combined sewer overflows.
- Quality issues with source water and treated effluents.
- Power outages and communication loss.
- Limited or no access to facilities and water testing capabilities.
- Loss of power
- Costly repairs
- Dangerous conditions for personnel

These impacts may be exacerbated by the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

As discussed in the hazard profile section, climate change is anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no control over population changes, it merely reacts to them by providing additional (or reduced) services. Regarding land use, the District has no authority over how the cities it serves choose to develop land. Changes in land use and development may also amplify the impacts of heavy rains and storms, as additional impervious surfaces can cause additional runoff and localized flooding.

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 should be built to withstand hail damage, lightning, and thunderstorm winds. With adherence to development standards, future losses to new development should be minimal. ETSU project will renew and replace aging infrastructure, improve water quality in the San Francisco Bay through enhanced wastewater treatment processes and nutrient removal, and increase the facility's resiliency to extreme wet-weather events and climate change.

Subsidence

Likelihood of Future Occurrence–Likely
Vulnerability–Medium

Hazard Profile and Problem Description

Land subsidence, as defined by the CGS, is the sinking of the land over man-made or natural underground voids. Fluctuations in the level of underground water caused by pumping or by injecting fluids into the earth can initiate sinking to fill the empty space previously occupied by water or soluble minerals. This can also cause sinkholes to occur. This hazard profile covers non-earthquake subsidence. Earthquake based subsidence is discussed in the earthquake section above.

The 2023 State Hazard Mitigation Plan noted that subsidence happens either due to natural processes (organic soil decomposition) or as a result of human activities (groundwater pumping). Groundwater pumping is more likely to affect the City. Fine-grained sediments (clays and silts) in an aquifer system are the main causes of land subsidence due to groundwater pumping. Such sediments tend to be deposited in random orientations with a lot of room between them to store water. However, when groundwater levels fall, the sediments are rearranged into stacks that occupy less space and have less space between them to store water.

Location and Extent

Location maps, by possible cause, were shown in Section 4.3.15 of the Base Plan. They show limited areas of the District at risk. There is no scientific scale for measuring subsidence. It is traditionally measured in historical changes in land elevations and groundwater tables. The speed of onset may be gradual or sudden.

Past Occurrences

Disaster Declarations

There have been no past federal or state disaster declarations due to subsidence in Alameda County.

USD Events

The District noted no past occurrences as well.

Vulnerability from Subsidence

Subsidence can result in serious structural damage to buildings, roads, irrigation ditches, underground utilities, and pipelines. It can disrupt and alter the flow of surface or underground water. Weight, including surface developments such as roads, reservoirs, and buildings and manmade vibrations from such activities as blasting or heavy truck or train traffic can accelerate the natural processes of subsidence.

The consequences of improper use of land subject to ground subsidence can be excessive economic losses, including the high costs of repair and maintenance for buildings, irrigation works, highways, utilities, and other structures.

California's land subsidence is often tied to prolonged droughts and simultaneous record-breaking heat. When the State endures prolonged periods of drought, surface water stores are depleted, and the reliance on groundwater for water supply is increased. A discussion of local concerns and assets at risk follows.

Local Concerns

The District is concerned with subsidence behind existing levees. As sea levels rise, additional fill would be needed to increase the levee height. According to the USD Preliminary Study of the Effect of Sea Level Rise on District Infrastructure (June 2013), the required increase in levee crest elevations to maintain existing protection would have to match anticipated sea level rise, increased wave run-up, and subsidence resulting from the added fill on poorly compacted Bay Muds. The levees would have to be continually maintained and improved by both raising and strengthening the structures. These costs are in addition to the loss of mudflat and salt marsh, which have both ecological and flood protection functions, as they are "squeezed" against the levees. Moreover, improving coastal levees does not address rising groundwater, saltwater intrusion, and drainage issues behind the levees.

The same report noted that National Research Council values include subsidence of 1.5 mm yr-1 for all of California south of Cape Mendocino due to deep tectonic movements. This is a rough estimate that doesn't

take into account localized variations in vertical land motion due to shallow subsidence and local tectonic movement.

Additionally, the potential for subsidence arises from various factors, with a primary concern being the withdrawal of groundwater in the region. As groundwater is depleted, the soil may undergo compaction, leading to the sinking of the ground surface. This subsidence poses a substantial risk to the forcemain pipelines. Sea level rise over time will further compound the subsidence issues. These pipelines, crucial for the transportation of essential resources, are at risk of damage during significant seismic activities (during and after), jeopardizing the ability of USD to maintain regular operations.

Subsidence could affect the forcemain pipes in the District which fall along the low-lying coastal areas of the District. If one of the forcemains was affected, it would create impacts for USD (who has a fiscal outlay to fix and repair piping) as well as to customers who would see additional costs transferred to them in order to pay for repairs.

Assets at Risk

Assets at risk from subsidence include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections.

People and Populations

District Populations

Since subsidence generally happens over a long period of time, there is only a minimal risk to people (including District staff and contractors).

Service Territory Populations

Since subsidence generally happens over a long period of time, there is only a minimal risk to people populations.

Structures

All structures in the District bear some measure of risk to subsidence. Subsidence could cause damages as building footings become unstable. However, as noted above, area groundwater levels have been lowered due to pumping, and no related subsidence has resulted. According to the Alameda County Water District, a groundwater recharge program has been successful, and groundwater levels are now stable. A sinkhole (though rare) could affect a structure.

Critical Facilities and Infrastructure, and Community Lifelines

All critical facilities in the District bear some measure of risk to subsidence. However, as noted above, area groundwater levels have been lowered due to pumping, no related subsidence has resulted.

Natural, Historic, and Cultural Resources

All natural, historic, and cultural resources in the District bear some measure of risk to subsidence. However, as noted above, very little subsidence has occurred in the past. The areas the District is concerned with regarding subsidence (Bay Mud near the levees) has no historic or cultural resources. There are natural resources in these areas.

Economic Assets and Community Activities of Value

As noted above, very little subsidence has occurred in the past. The areas the District is concerned with subsidence occurring (Bay Mud near the levees) have no economic assets or community activities of value.

Impacts from Subsidence

Effects of land subsidence in California include increased flood risk in low-lying areas, damage to buildings and infrastructure, loss of groundwater aquifers, and damage to aquatic ecosystems. As the land sinks, it can experience increased flooding and adverse impacts on sewer lines, stormwater drainage systems, and other impacts to critical facilities and infrastructure. As subsidence progresses, areas protected by levees can be impacted. Compaction of the aquifer system due to subsidence may permanently decrease its capacity to store water. The forcemains in the District are at risk from subsidence.

These impacts can be exacerbated by the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development. Impacts in the District are expected to be minimal, as limited areas of subsidence exist.

As discussed in the hazard profile section, climate change is anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no control over population changes, it merely reacts to them by providing additional (or reduced) services. Regarding land use, the District has no authority over how the cities it serves choose to develop land. It is unknown how changes in land use and development will affect subsidence in the District's service territory.

Future Development

The vulnerability of future development from subsidence can be minimized by understanding areas of the District prone to subsidence and addressing subsidence issues during the siting, design and construction process for new facilities as well as considering mitigation measures for existing areas of concern

Wildfire

Likelihood of Future Occurrence–Highly Likely
Vulnerability–Low

Note: Though considered a low priority hazard by the District, due to its importance in California and the Tri-City Planning Area, wildfire is profiled here. It is not considered a priority hazard for USD for mitigation planning purposes.

Hazard Profile and Problem Description

Wildland fire and the risk of a conflagration is an ongoing concern for the Tri-City Planning Area, but of limited concern to USD. Throughout California, communities are increasingly concerned about wildfire safety as increased development in the foothills and mountain areas and subsequent fire control practices have affected the natural cycle of the ecosystem. Wildland fires affect grass, forest, and brushlands, as well as any structures located within them. Where there is human access to wildland areas the risk of fire increases due to a greater chance for human carelessness and historical fire management practices. Historically, the fire season extends from early spring through late fall of each year during the hotter, dryer months; however, in recent years, the risk of wildfire has become a year around concern. Fire conditions arise from a combination of high temperatures, low moisture content in the air and fuel, accumulation of vegetation, and high winds. These high winds can result in red flag days and can result in PSPS events in the District. While wildfire risk has predominantly been associated with more remote forested areas and wildland urban interface (WUI) areas, significant wildfires can also occur in more populated, urban areas.

Wildfire Smoke and Air Quality

Smoke from wildfires is made up of gas and particulate matter, which can be easily observed in the air. Air quality standards have been established to protect human health with the pollutant referred to as PM2.5 which consists of particles 2.5 microns or less in diameter. These smaller sizes of particles are responsible for adverse health effects because of their ability to reach the lower regions of the respiratory tract.

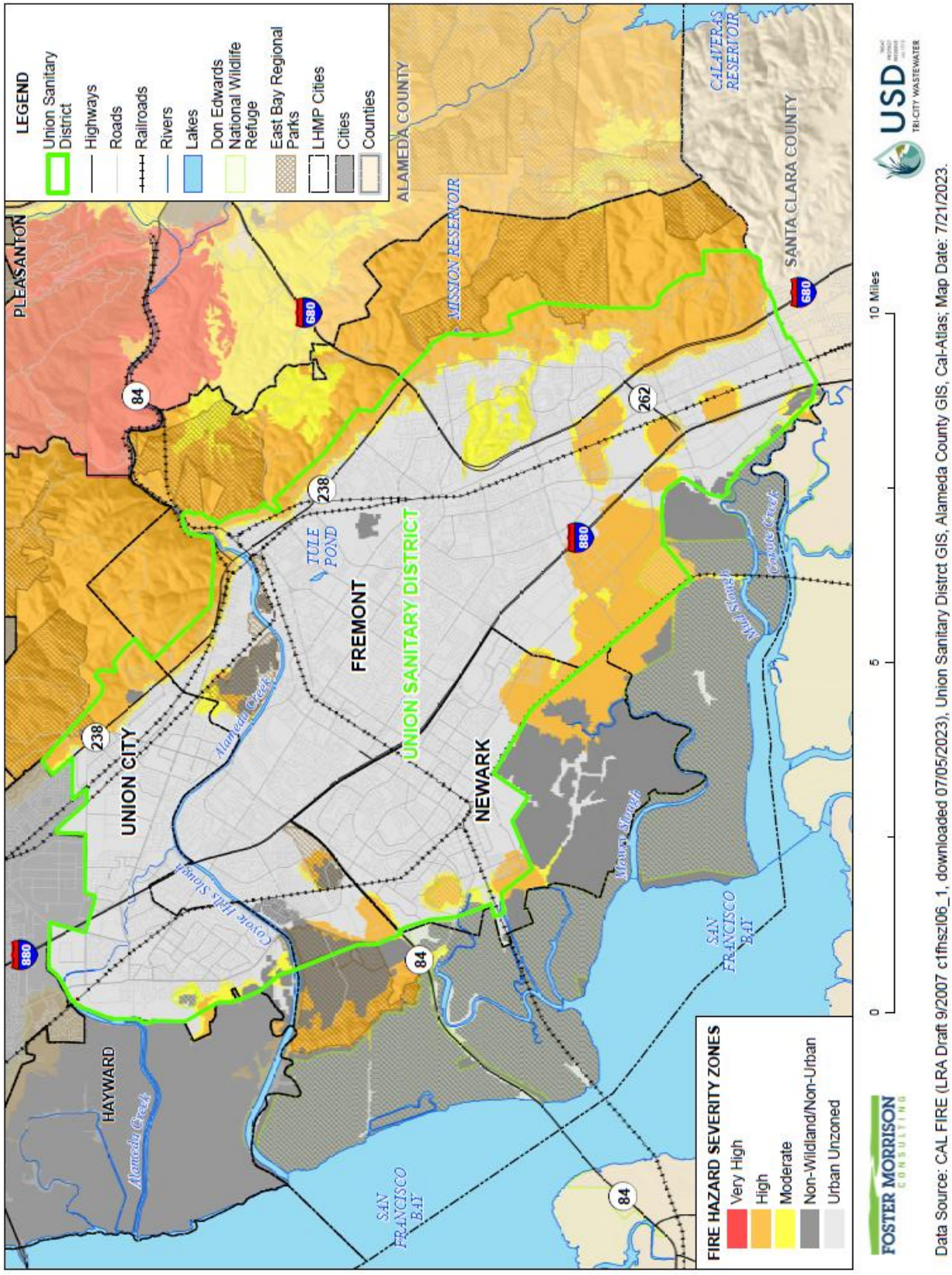
Wildfire smoke can have negative effects to those who live or work in or near a fire burn area. Smoke and air pollution from wildfires can be a severe health hazard. Significant wildfires occurring in nearby northern California communities since the 2017 LHMP Update have created significant air pollution affecting area residents. Planning Area residents have been affected by wildfire smoke and poor air quality, from fires both within the East Bay area and from those much further away. During 2018 during the Camp Fire in Butte County, the District experienced 13 days of the worst air quality previously experienced in the region. It was reported that during this period, residents could not see to drive or bike or hike as one could not see the trails, or trees, or cars, or other people. This in part contributed to rare, offshore winds bringing smoke into the area where it settled.

The District noted that it has standardized monitoring and communication with employees. The District retains a supply N95 masks in response to poor air quality.

Location and Extent

Wildfire can affect all areas of the District. CAL FIRE has estimated that the risk varies across the District and has created maps showing risk variance. Following the methodology described in Section 4.3.19 of the Base Plan, wildfire maps for the USD were created. Figure E-75 shows the CAL FIRE Fire Hazard Severity Zone (FHSZ) in the District. As shown on the maps, FHSZs within the District range from Urban Unzoned to High.

Figure E-75 Union Sanitary District – CAL FIRE Fire Hazard Severity Zones



Wildfires tend to be measured in structure damages, injuries, and loss of life as well as on acres burned. Fires can have a quick speed of onset, especially during periods of drought or during hot dry summer months. Fires can burn for a short period of time or may have durations lasting for a week or more. Geographical FHSZ extent from CAL FIRE is shown in Table E-59.

Table E-59 Union Sanitary District – CAL FIRE Fire Hazard Severity Zone Geographical Extents

Fire Hazard Severity Zone	Total Acres	% of Total Acres	Improved Acres	% of Total Improved Acres	Unimproved Acres	% of Total Unimproved Acres
Very High	0	0.0%	0	0.0%	0	0.0%
High	8,750.39	11.3%	5,248.70	8.3%	3,501.69	24.7%
Moderate	3,007.67	3.9%	2,045.80	3.2%	961.86	6.8%
Non-Wildland/Non-Urban	1,121.91	1.4%	98.49	0.2%	1,023.42	7.2%
Urban Unzoned	64,620.36	83.4%	55,949.15	88.3%	8,671.21	61.2%
Union Sanitary District Total	**77,500.32**	**100.0%**	**63,342.14**	**100.0%**	**14,158.18**	**100.0%**

Source: CAL FIRE, Cal Atlas

Past Occurrences

Disaster Declarations

There has been one state and two federal disaster declarations due to fire, as shown in Table E-60. These were from an unnamed California Forest and Brush Fire in 1970, and the Tunnel Fire in 1991.

Table E-60 Alameda County – State and Federal Wildfire Disaster Declarations 1950-2020

Disaster Type	State Declarations		Federal Declarations	
	Count	Years	Count	Years
Wildfire	1	1970	2	1970, 1991

Source: Cal OES, FEMA

USD Events

USD noted no other past wildfires that directly affected the District. USD noted that it had Air Quality occurrences resulting from wildfire events from both within and outside the Tri-City Planning Area. These issues were managed by the safety program with recommendations for use of N95 masks. These smoke and air quality events did not impact USD's workforce count or cause delays.

Vulnerability to Wildfire

There is a risk of wildfire in the USD hill area due to the interface of residential and open space land uses. The combination of rugged terrain, flammable vegetation, high winds, and limited access creates hazards that can result in loss of life and property. These factors, combined with natural weather conditions common to the area, including periods of drought, high temperatures, low relative humidity, and periodic winds, can result in frequent and sometimes catastrophic fires. Any fire, once ignited, has the potential to quickly become a large, out-of-control fire.

Local Concerns

USD is not immune to numerous types of grass and brush fires and any one of them may accelerate into an urban interface wildfire. Such a situation could lead to evacuation of large portions of the population and the potential for significant loss of property, structures, critical infrastructure, and rangeland. The natural fuels available in or near the District vary greatly in the rate and intensity of burning. Fires in heavy brush and stands of trees burn with great intensity but more slowly than in dry grass and leaves. Dense fuels will propagate fire better than sparse fuels. These fuel types are more available around the eastern and northwestern areas of the District.

Assets at Risk

Assets at risk from wildfire include people and populations; structures; critical facilities and infrastructure, and community lifelines; natural, historic, and cultural resources; and economic assets and community activities of value. These are discussed in the following sections.

People and Populations

District Populations

The District employs 145 employees that support 5 workgroups. The District has one property in the CAL FIRE High Fire Hazard Severity Zone. These employees would be a tome measure of risk. Depending on the location and nature of a wildfire, District employees and contractors may be at risk to wildfire event. All of them are at risk to wildfire related air quality issues.

USD Service Territory Populations

All populations are at some vulnerability to wildfire. Certain vulnerable populations are at the greatest risk to the effects of wildfire as well as smoke and air quality issues that wildfires bring. Vulnerable populations include:

- Unhoused
- Infants and children under age five and their caregivers
- Elderly (65 and older)
- Individuals with disabilities
- Individuals' dependent on medical equipment
- Individuals who exercise or recreate outdoors

- Individuals who work outdoors
- Individuals with impaired mobility

To further evaluate the impact to the residential population within the District Service Territory, the FHSZ dataset was overlayed on the parcel layer. The FHSZ dataset was overlayed on the Tri-City parcel layer. Those residential parcel centroids that intersect the FHSZs were counted and multiplied by the 2020 Census Bureau average household factors for the USD – 3.22. According to this analysis, there is a total population of 20,166 residents of USD at risk to moderate or higher FHSZs. This is shown in Table E-61.

Table E-61 Union Sanitary District Service Territory – Improved Residential Parcels and Population by Fire Hazard Severity Zone

Jurisdiction	Very High		High		Moderate	
	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk	Improved Residential Parcels	Population at Risk
USD	0	0	8,062	25,960	3,759	12,104

Source: CAL FIRE, US Census Bureau Average Household Sizes

Structures

The analysis for structures in the District is separated out into two separate analyses:

- **USD Facility Assets** – These are the facilities, structures, and other assets which USD owns and maintains operational control.
- **Service Territory Structures** – This is comprised of the parcels and structures associated with the residents and businesses located within USD's Service Territory who use the wastewater services provided by USD.

USD Facility Assets

The District owns facilities that may be at risk to wildfire. GIS was used to determine the possible impacts of CAL FIRE Fire Hazard Severity Zones on USD facilities. The methodology described in Section E.4.1 (in the Structures section) above was followed in determining USD structures at risk to wildfire. USD structures in the CAL FIRE Fire Hazard Severity Zones are shown on Figure E-76 and detailed in Table E-62 (for point assets) and Table E-63 (for linear assets) for the moderate or higher FHSZ. USD has only 1 site located within a moderate of higher FHSZ.

Figure E-76 Union Sanitary District – Assets in CAL FIRE Fire Hazard Severity Zones

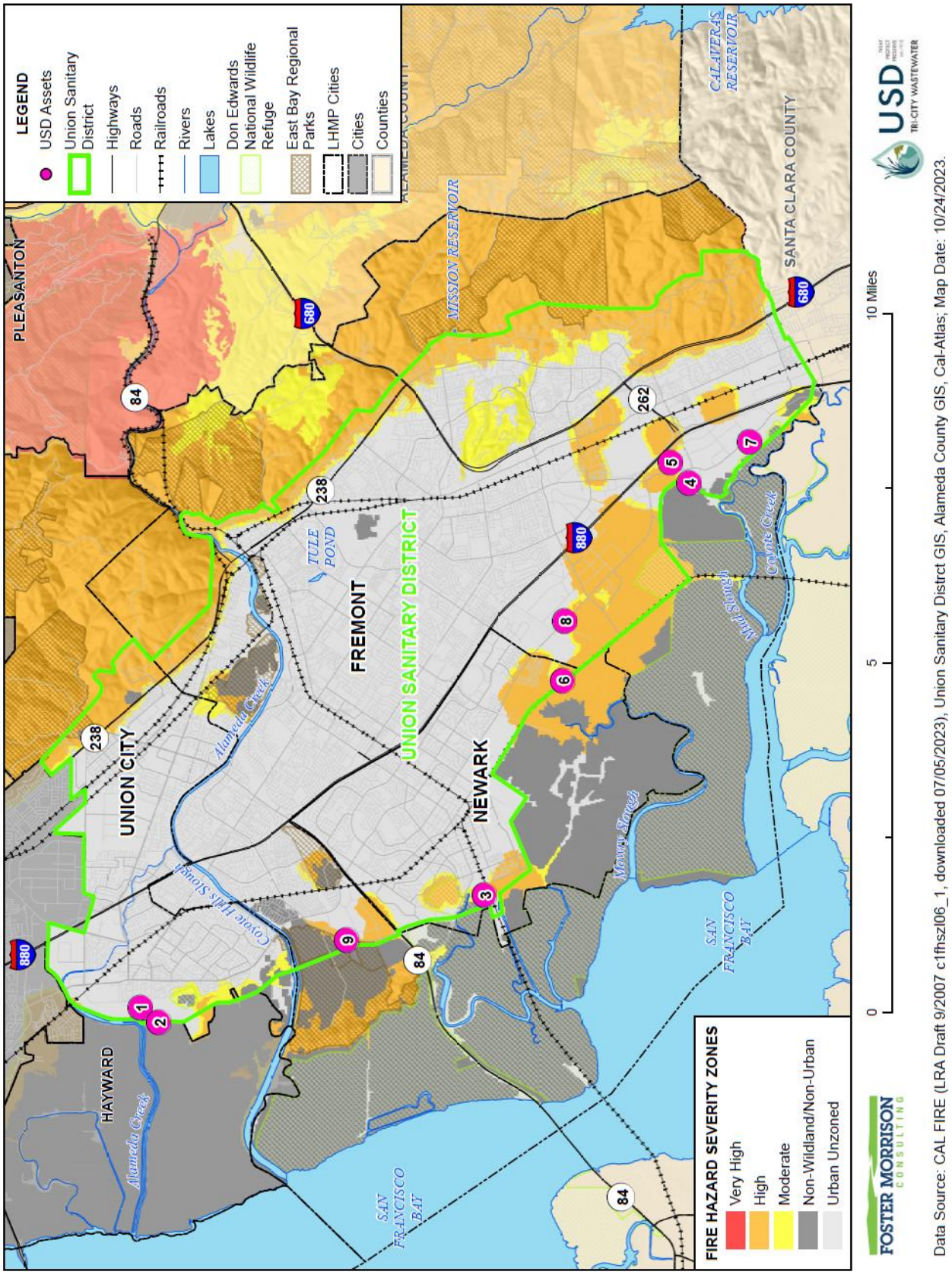


Table E-62 Union Sanitary District – Assets by Site in CAL FIRE Fire Hazard Severity Zones

Fire Hazard Severity Zone / Site Number	Site Location / Name	Asset Type	Asset Value	Property Value	Total Value
High					
6	Cherry PS	Lift Station	$315,705	$1,580,000	$1,895,705

Source: CAL FIRE, USD

Table E-63 Union Sanitary District – Linear Assets in CAL FIRE Fire Hazard Severity Zones

Fire Hazard Severity Zone / Asset	Asset Length (in miles)	Total Asset Value
High		
Sewer Force Main (Pressurized Transport Pipeline)	13.49	$235,096,771
Sewer Collection System (Gravity Flow Pipeline)	83.22	$351,505,536
High Total	**96.71**	**$586,602,308**
Moderate		
Sewer Force Main (Pressurized Transport Pipeline)	2.90	$50,603,276
Sewer Collection System (Gravity Flow Pipeline)	38.61	$163,100,797
Moderate Total	**41.52**	**$213,704,074**
Non-Wildland/Non-Urban		
Sewer Force Main (Pressurized Transport Pipeline)	3.27	$56,906,714
Sewer Collection System (Gravity Flow Pipeline)	4.57	$19,290,891
Non-Wildland/Non-Urban Total	**7.83**	**$76,197,605**
Urban Unzoned		
Sewer Force Main (Pressurized Transport Pipeline)	7.31	$127,433,830
Sewer Collection System (Gravity Flow Pipeline)	687.57	$2,904,285,396
Urban Unzoned Total	**694.88**	**$3,031,719,225**

Source: CAL FIRE, USD

USD Service Territory

All structures in the District have some risk to wildfire. GIS was used to determine the possible impacts of wildfire within the USD Service Territory. The methodology described in Section 4.3.17 of the Base Plan was followed in determining structures and values at risk in fire hazard severity zones. Summary analysis results for the USD Service Territory are shown in Table E-64, which summarizes total parcel counts, improved parcel counts and their structure values by moderate or higher fire hazard severity zone. Table

E-65 breaks out the Table E-64 by adding the property use details by moderate or higher fire hazard severity zone for the District.

Table E-64 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) by CAL FIRE Fire Hazard Severity Zone

Fire Hazard Severity Zone	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Very High	0	0	$0	$0	$0	$0
High	9,505	7,688	$4,291,952,275	$8,227,226,132	$5,709,072,011	$18,228,250,418
Moderate	4,489	3,859	$1,452,964,881	$2,943,837,767	$1,667,189,572	$6,063,992,220

Source: Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023), CAL FIRE

Table E-65 Union Sanitary District Service Territory – Count and Value of Parcels (and Structures) by CAL FIRE Fire Hazard Severity Zone and Property Use

Fire Hazard Severity Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Very High						
Agricultural	0	0	$0	$0	$0	$0
Commercial	0	0	$0	$0	$0	$0
Government / Institutional	0	0	$0	$0	$0	$0
Industrial	0	0	$0	$0	$0	$0
Recreational	0	0	$0	$0	$0	$0
Residential	0	0	$0	$0	$0	$0
Unknown	0	0	$0	$0	$0	$0
Utilities	0	0	$0	$0	$0	$0
Vacant	0	0	$0	$0	$0	$0
Very High Total	**0**	**0**	**$0**	**$0**	**$0**	**$0**
High						
Agricultural	25	6	$13,864,568	$4,098,937	$4,098,937	$22,062,442
Commercial	216	156	$734,048,854	$1,529,478,254	$1,529,478,254	$3,793,005,362
Government / Institutional	319	15	$26,826,188	$65,948,744	$65,948,744	$158,723,676
Industrial	137	127	$530,490,267	$821,484,504	$1,232,226,745	$2,584,201,516
Recreational	1	1	$6,200,000	$1,100,000	$1,100,000	$8,400,000
Residential	8,062	7,314	$2,640,268,412	$5,752,438,748	$2,876,219,331	$11,268,926,491
Unknown	24	2	$47,909,774	$63,581	$0	$47,973,355
Utilities	45	0	$0	$0	$0	$0

Fire Hazard Severity Zone / Property Use	Total Parcel Count	Improved Parcel Count	Total Land Value	Improved Structure Value	Estimated Contents Value	Total Value
Vacant	676	67	$292,344,212	$52,613,364	$0	$344,957,576
High Total	**9,505**	**7,688**	**$4,291,952,275**	**$8,227,226,132**	**$5,709,072,011**	**$18,228,250,418**
Moderate						
Agricultural	5	0	$516,054	$0	$0	$516,054
Commercial	79	54	$90,532,896	$105,700,889	$105,700,889	$301,934,674
Government / Institutional	190	4	$2,591,843	$19,495,058	$19,495,058	$41,581,959
Industrial	39	36	$147,311,952	$223,155,171	$334,732,754	$705,199,877
Recreational	1	1	$40,822	$91,604	$91,604	$224,030
Residential	3,948	3,759	$1,124,953,227	$2,414,338,571	$1,207,169,267	$4,746,461,065
Unknown	10	1	$5,936,236	$179,857	$0	$6,116,093
Utilities	18	0	$0	$0	$0	$0
Vacant	199	4	$81,081,851	$180,876,617	$0	$261,958,468
Moderate Total	**4,489**	**3,859**	**$1,452,964,881**	**$2,943,837,767**	**$1,667,189,572**	**$6,063,992,220**

Source: Alameda County Parcel/Assessor Data (Source: City of Fremont, May 2023), CAL FIRE

Critical Facilities and Infrastructure, and Community Lifelines

Wildfire presents a threat to critical facilities and infrastructure, and community lifelines. The following analysis discusses critical facilities and infrastructure, followed by community lifelines.

Critical Facilities and Infrastructure

As mentioned above, all USD Assets (including lines) are considered to be critical facilities, some of which fall within Cal Fire's FHSZs. This analysis was shown on Table E-62 in the structure analysis above.

Community Lifelines

Wildfire flooding presents a threat to life and property, including lifelines in the District. Community lifelines that would be at risk to wildfire include:

- **Safety and Security** –District personnel may need to respond if a wildfire occurred in or near District facilities.
- **Food, Hydration, Shelter** – Shelters may need to be opened to handle those displaced by a wildfire. Food and water would need to be provided.
- **Health and Medical** – There may be injuries and deaths from wildfire. District personnel can be at risk from air quality issues from smoke.
- **Energy** – wildfires could impact large areas of above ground electric infrastructure, causing widespread power outages, which could affect District operations.
- **Communications** – District messaging systems need to be deployed during these times to let the public know about road closures or evacuation routes.

- **Transportation** – highways and local roads may see closures. These closures can affect District personnel as well as cause additional traffic issues for residents.
- **Hazardous Material** – hazardous material facilities can be affected by wildfire. A spill during these times can cause additional risk to responders, as well as additional exposure to the environment.
- **Water Systems** – Water systems may be taxed during wildfires. Water quality can be significantly affected.

Depending on the location and nature of an event, a large wildfire event could temporarily overwhelm certain lifelines in the District.

Natural, Historic, and Cultural Resources

Natural, historic, and cultural resources located within areas at risk to wildfire would be vulnerable. Should a wildfire occur in the District, the impacts to natural, historic and cultural resources could be extensive and include air pollution, contamination from water runoff containing toxic products, and other environmental discharges or releases from burned materials affecting soils, habitat areas, wildlife, and aquatic resources. Historic and cultural resources can be affected and are often more vulnerable due to their older age, construction type, and lack of fire prevention infrastructure such as sprinklers. Specific natural, historic, and cultural facilities at risk can be found in the respective city annexes to this Plan Update.

Economic Assets and Community Activities of Value

Wildfires in the District can cause direct damage to economic assets such as businesses and commercial centers located in affected areas. During extreme events, the economy may slow while recovery efforts are prioritized. Business revenue may be reduced during extended events. Community activities and events in areas affected by wildfire (and smoke and air quality issues) may be cancelled or rescheduled. More information on these economic assets and community activities of value can be found in the respective city annexes to this Plan Update.

Impacts from Wildfire

Potential impacts from wildfire include loss of life and injuries and damage to structures and other improvements, critical facilities and infrastructure, and natural and cultural resources. Wildfires can cause short-term and long-term disruption to the District. The impacts of a fire are felt long after the fire is extinguished. In addition to the loss of property in fires, the loss in vegetation and changes in surface soils alters the environment. Fires can have devastating effects on watersheds through loss of vegetation and soil erosion, which may impact the District by changing runoff patterns, increasing sedimentation, reducing natural and reservoir water storage capacity, and degrading water quality. Fires can also affect air quality in the District; smoke and air pollution from wildfires can be a severe health hazard.

Although the physical damages and casualties arising from wildland-urban interface fires may be severe, it is important to recognize that they also cause significant economic impacts by resulting in a loss of function of District buildings and infrastructure. Economic impacts of loss of transportation and utility services may include traffic delays/detours from road and bridge closures and loss of electric power, potable water, and wastewater services. Fires can also cause major damage to power plants and power lines needed to distribute electricity to operate facilities. Recently, the threat of wildfire, combined with the potential for

high winds, heat, and low humidity, has caused PG&E to initiate a PSPS which can also significantly impact a community through loss of services, business closures, and other impacts associated with loss of power for an extended period. In addition, catastrophic wildfire can create favorable conditions for other hazards such as flooding, landslides, and erosion during the rainy season.

Smoke impacts may come from wildfires outside the District. The 2023 State Hazard Mitigation Plan noted that the danger of wildfire smoke comes primarily from particulate matter 2.5 (PM2.5), consisting of fine particles that are 2.5 micrometers (about a ten-thousandth of an inch) or less in diameter. On a given day, California wildfires can produce 10 times more PM2.5 air pollution than is produced by all other pollution sources combined. The small particles in PM2.5 pollution are capable of reaching deep into the lungs, causing a host of complications, including significantly increased risks of heart disease, respiratory disease, asthma, and premature mortality. Smoke from wildfires that burn homes and other structures can additionally contain toxic materials such as asbestos and heavy metals. Studies indicate that wildfire smoke is up to 10 times more harmful than other forms of PM2.5 pollution.

All of these impacts may be exacerbated by the effects of climate change, changes in population patterns (migration, density, or the makeup of socially vulnerable populations), and changes in land use and development.

As discussed in the hazard profile section, climate change is anticipated to exacerbate this hazard over time. While population projections for the cities served by the District (shown in their respective annexes) show average annual growth rates between 0.19 % to 0.74% over the next 25 years. These anticipated changes in population are relatively small, which limits additional impacts. The District noted it has no control over population changes, it merely reacts to them by providing additional (or reduced) services. Regarding land use, the District has no authority over how the cities it serves choose to develop land. It is unknown how changes in land use and development will affect wildfire in the District's service territory.

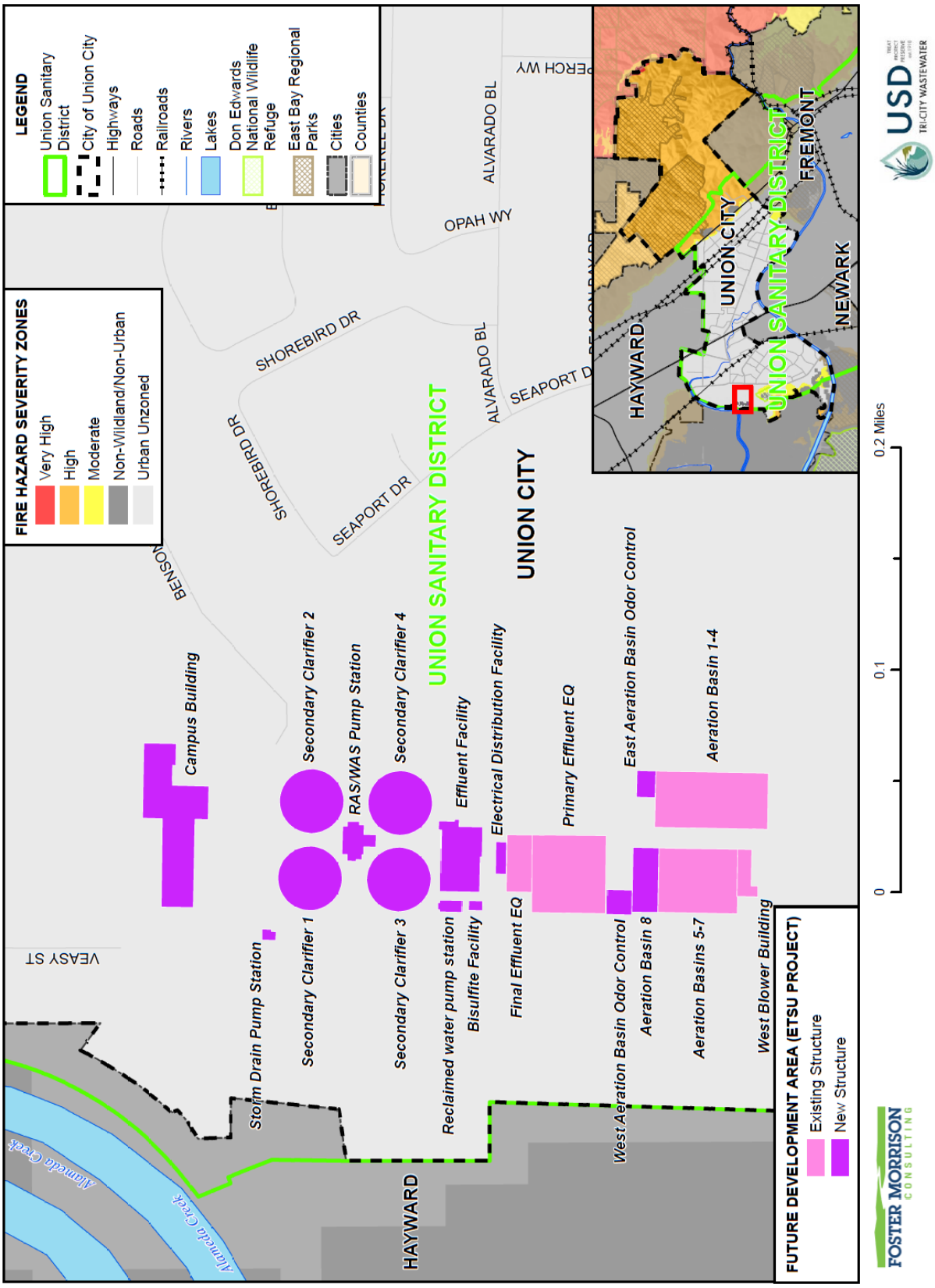
Future Development

Additional growth and development within moderate or higher fire hazard severity zones in the District would place additional values at risk to wildfire. ETSU project will renew and replace aging infrastructure, improve water quality in the San Francisco Bay through enhanced wastewater treatment processes and nutrient removal, and increase the facility's resiliency.

GIS Analysis

The District provided the ETSU future development area which was used as the basis for the inventory of future development areas for the District. Figure E-77 show the locations of the future development areas overlayed on the CAL FIRE FHSZs. All future development falls in the Urban Unzoned FHSZ, as such no tabular analysis is presented.

Figure E-77 Union Sanitary District – Future Development in CAL FIRE FHSZs



E.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.

E.5.1. Regulatory Mitigation Capabilities

Table E-66 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 USD.

Table E-66 Union Sanitary District – 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	Y	The CIP is a primary mechanism for implementing projects in the District.
Climate Change Adaptation Plan	N	N/A
Community Wildfire Protection Plan	N	N/A
Comprehensive/Master Plan	Y	The Master Plan continues to provide direction on future growth and operational goals of the District.
Continuity of Operations Plan	Y	The District's COOP plan outlines processes for continued operations of USD facilities and services.
Economic Development Plan	N	N/A
Land Use Plan	N	N/A
Local Emergency Operations Plan	Y	The EOP is updated as needed and provides direction on disaster response for the District.
Stormwater Management Plan	N	N/A
Transportation Plan	N	N/A
Other (describe)	Y	See below plans.
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	N/A
Building code	N	N/A
Flood insurance rate maps	N	N/A
Floodplain ordinance	N	N/A
Natural hazard-specific ordinance (stormwater, steep slope, wildfire)	N	N/A

Subdivision ordinance	N	N/A
Zoning ordinance	N	N/A
Other		
How can these capabilities be expanded and improved to reduce risk?		
The District has limited authority to expand these regulatory capabilities. However, it partners with jurisdictions that do. The District will seek ongoing partnership and collaboration with the cities we serve.		

Source: USD

2023 Sewer System Management Plan

The Goals of the Union Sanitary District for the Maintenance and Management of its Collection System are to:

- Provide a safe work environment for our employees
- Minimize preventable Spills
- Understand the condition of and maintain our infrastructure to maximize the life of the collection system
- Operate & maintain our system to minimize impacts on our customers
- Prepare for emergencies
- Be a part of the community & be a responsive public agency
- Involve our employees in the strategic planning process for Collection System
- Effectively plan system expansion to meet the capacity needs of the three cities we serve (Fremont, Newark, Union City)
- Set high, achievable standards for the construction of new infrastructure.

Capacity and Conditions Assessments Summaries

The District owns and operates the InfoWorks™ ICH Hydraulic Model to assess current and future capacity requirements in the District's collection system. The District completed the Sewer Capacity and Condition Assessment Studies for the Irvington Basin in 1995, 2004, 2015, and 2022; for the Alvarado Basin in 2007, 2008 and 2017; and for the Newark Basin in 2000, 2012 and 2019.

When working on the Sewer Capacity and Condition Assessments, flow monitoring is conducted at about a dozen locations in each basin of the collection system. The flow data is then used to calibrate the flow model to ensure accuracy of the program. Along with land use information and rain fall data, the Flow Model is then run to assess the capacity requirements in the District's collection system. USD uses the Design Storm criterion of 'a storm with a 10-year recurrence interval.' The capacity deficiencies identified by the flow model are then grouped, prioritized, and, if needed, included in the District's 20-year Capital Improvement Plan (CIP) budget. This is an ongoing effort.

The District has put together a multitude of previous capacity and conditions assessments. This includes:

- 1989 Sewer Master Plan
- 1989 Transport System Master Plan
- 1994 District-Wide Master Plan
- 1995 Irvington Basin Master Plan

- 1997 Alvarado Basin Master Plan
- 1999 Wastewater Equalization Storage Facilities Pre - Design
- 1999 Irvington Raw Wastewater Equalization Storage Facilities Project - Pump Station Feasibility Study
- 2000 Newark Basin Master Plan
- 2001 Irvington Equalization Storage Facilities Project - Bypass Pumping Design
- 2004 Irvington Basin Master Plan Update
- 2004 Force Main Facility Plan - External Inspection
- 2004 Force Main Facility Plan - Internal Inspection
- 2006 Force Main Facility Emergency Response Plan
- 2008 Sanitary Sewer Hydrogen Sulfide Induced Corrosion Study
- 2008 Force Main Assessment Summary
- 2008 Long-Term Gravity Sewer Renewal/Replacement Projection Summary
- 2008 Alvarado Basin Sewer Master Plan Update
- 2012 Newark Basin Master Plan Update
- 2015 Irvington Sewer Master Plan Update
- 2017 Alvarado Basin Master Plan Update
- 2019 Newark Basin Master Plan Update
- 2022 Irvington Basin Master Plan Update

Sanitary Sewer Master Plan (2021 Audit)

USD has had a Sanitary Sewer Management Plan in place addressing all the required elements for many years now. QA/QC reports and data trends are reviewed to determine the effectiveness of USD's Sanitary Sewer Master Plan (SSMP) as a tool to successfully manage the Collection System. Since the last audit, USD has re-certified its SSMP. Specifics of the changes are detailed in the Log Summary of this audit. USD has had 3 SSO's over the 2 calendar years of 2019 and 2020. USD also recovered 100% of the total 1,700 gallons spilled. A written report has been prepared and is available for review upon request at the District Office. Twice a year, USD reviews and updates its Log Summary, once at the beginning of the Fiscal Year and once at the beginning of the Calendar Year.

Sea Level Rise Report (June 2013)

The Union Sanitary District (USD) is an independent special district which provides wastewater collection, treatment, and disposal services to the residents and businesses of the cities of Fremont, Newark, and Union City in Southern Alameda County, California. The District is taking a proactive approach to determine potential impacts of sea level rise on District infrastructure and operations, assess its vulnerability, and begin to develop adaptation strategies and actions to limit its vulnerability and risk in response to future sea level rise.

Over the next fifty years there is the potential for accelerated sea level rise to impact and damage critical USD wastewater operations and infrastructure located along the eastern San Francisco Bay shoreline. Exposure includes direct impacts from rising sea levels including increased wave action and flooding and indirect impacts including rising groundwater levels and corrosivity.

The purpose of the USD Preliminary Study of the Effects of Sea Level Rise on District Infrastructure is to:

- Present a preliminary assessment of vulnerabilities and potential impacts to District infrastructure, and

- Provide strategies on how the District can become more resilient to sea level rise, and limit exposure and impacts to its infrastructure, and the dependent economic, industrial, commercial, and societal functions dependent on the District.

The project study area is focused on District infrastructure located within and near the shoreline, extending from the Fremont Boulevard Lift Station at the southern end of the service area to the Alvarado Wastewater Treatment Plant (WWTP) at the northern end, and incorporates the USD's wastewater pump stations, lift stations, twin forcemains, and WWTP infrastructure.

USD Seismic Preliminary Report (April 2016)

This report summarizes the findings from an initial seismic assessment of the Union Sanitary District's major pipelines and a representative sampling of its structures. This report discusses the vulnerability that the Union Sanitary District's major pipelines and structures have with respect to a significant seismic event, and then discusses how these seismic vulnerabilities can be mitigated. Based on the conclusions of this study, we believe that some of the structures and pipeline sections critical to delivering service to system are seismically vulnerable and therefore damage could be expected following a large seismic event. Union Sanitary District management has determined that protecting loss of life during the seismic event and restoring a minimal level of service shortly following a seismic event should be the primary targets of seismic mitigation efforts. Consequently, this report rates structures and pipeline sections based on seismic vulnerability and relative importance to inform a targeted mitigation effort. The most critical structures to retrofit are important structures with significant occupancy and seismically venerable structures with pre-cast concrete roofs. The main force main pipelines are expected to perform relatively well in a seismic event except at the Alameda Creek crossing. Based on this limited preliminary study, it is estimated that a rough order of magnitude construction cost to seismically upgrade the most vulnerable structures and pipelines will be on the order of $40,000,000.

E.5.2. Administrative/Technical Mitigation Capabilities

Table E-67 identifies the District department(s) responsible for activities related to mitigation and loss prevention in USD.

Table E-67 Union Sanitary District – 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	Y	Engineering department (CIP/ETSU)
Community Planner	N	Planning completed at different levels, Includes Technical Services Manager, ETSU Program Manager, General Manager

Emergency Manager	N	
Floodplain Administrator	N	
GIS Coordinator	Y	Position within the engineering team
Planning Commission	N	Planning is conducted within the CIP/ETSU teams
Other	N/A	
Technical	**Y/N**	**Has capability been used to assess/mitigate risk in the past?**
Grant writing	N	
Hazard data and information	Y	Reference of studies and plans
GIS analysis	Y	Position within our CIP team
Mutual aid agreements	Y	CalWARN
Other	N/A	
How can these capabilities be expanded and improved to reduce risk?		
Consider development of internal staff to complete tasks aligned with current limited capabilities. Additional staff will be added when and where applicable. Any new staff will be trained on emergency procedures, including mitigation and preparedness, as well as response and recovery.		

Source: USD

E.5.3. Fiscal Mitigation Capabilities

Table E-68 identifies financial tools or resources that the District could potentially use to help fund mitigation activities.

Table E-68 Union Sanitary District – 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	Y	
Community Development Block Grant	N	
Federal funding programs (non-FEMA)	Y	Energy, WIFIA, Bonds
Fees for water, sewer, gas, or electric services	Y	Sewer capacity fees
Impact fees for new development	Y	Developer fees
State funding programs	Y	State Revolving Fund
Stormwater utility fee	N	N/A
Other		
How can these capabilities be expanded and improved to reduce risk?		
The District prioritizes the exploration of alternative/additional funding sources in effort to minimize excessive rate increase of customer rates.		

Source: USD

E.5.4. Mitigation Education, Outreach, and Partnerships

Table E-69 identifies education and outreach programs and methods already in place that could be/or are used to implement mitigation activities and communicate hazard-related information.

Table E-69 Union Sanitary District – Mitigation Education, Outreach, and Partnerships

Program/Organization	In Place Y/N	How widespread are each of these in your community?
Community newsletters	Y	Annual newsletter, mailed and on website Union Sanitary - Union Sanitary District Newsletters - Union Sanitary District
Hazard awareness campaigns (such as Firewise, Storm Ready, Severe Weather Awareness Week, school programs, public events)	Y	District has a school outreach program and participates in local events
Local news	N	
Organizations that interact with underserved and vulnerable communities	N	
Social media	Y	Regularly posted campaigns on social media
Other		
How can these capabilities be expanded and improved to reduce risk?		
Perform ongoing evaluation of outreach events/efforts and make appropriate adjustments to further education our customers.		

Source: USD

E.5.5. Other Mitigation Efforts

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

Multi-Hazard

Emergency Response Procedures (June 2022)

The District is committed to providing a standardized and planned response to emergency situations which may arise within the District and to provide an effective response to multi-agency emergencies by utilizing the Standardized Emergency Management System. The Emergency Response Procedure (ERP) has been developed to enable staff to effectively and efficiently respond to large scale emergencies in order to prevent health hazards, protect public and private properties, and prevent damage to District facilities.

Enhanced Treatment and Site Upgrade Program (2019)

The goal of this ETSU Program is to provide USD with a technically and fiscally sound, practical plan for the District's WWTP) located in Union City, CA for the next 20 to 40 years. The ETSU Program is intended to be a roadmap, outlining key decisions to be considered in the future. The roadmap will allow USD to implement critical near-term projects over the next 5 to 10 years while maintaining compatibility and

flexibility with the long-term vision for the WWTP, thereby avoiding stranded assets and undesirable space planning ramifications. This ETSU Program is not intended to approve any individual phase or project, but to identify the proposed plan and projects USD intends to pursue, subject to further review during a formal decision-making process.

CCTV Inspections

USD periodically inspects its piping system using closed circuit tv inspection videos. Force mains were inspected in 2017 and 2018.

Climate Change

Electrification of our plant/site- moving to 0 emission vehicles

Changes in wastewater characteristics- less water, equals changes in processes/ new infrastructure for solids loading capacity.

Drought and Water Shortage

The District uses potable water for landscaping on the treatment plant.

The District did a Solids Capacity Loading Study. It found that low flow/high efficiency fixtures promoted in California to respond to drought and reduce water usage has worked. It resulted in reduced liquid flow to plant requiring change in chemical and processes at the plant to adjust to new ww characteristics.

Heavy Rains and Storms

Wet Weather And Emergency Outfall Operation Procedures (March 2023)

This SOP contains the instructions and steps that Operators follow to handle peak wet weather flows during heavy seasonal rainfalls. All work shall be performed safely in compliance with applicable standards and in a manner that minimizes adverse impacts.

E.6 Mitigation Strategy

E.6.1. Mitigation Goals and Objectives

The USD adopts the hazard mitigation goals and objectives developed by the Planning Committee and described in Chapter 5 Mitigation Strategy.

E.6.2. Mitigation Actions

The planning team for the USD identified and prioritized the following mitigation actions based on the risk assessment. Background information and information on how each action will be implemented and administered, such as ideas for implementation, responsible office, potential funding, estimated cost, and

timeline are also included. The following hazards were considered a priority for purposes of mitigation action planning:

- Climate Change
- Coastal Flood and Sea Level Rise
- Drought & Water Shortage
- Earthquake
- Localized Stormwater Flooding
- Severe Weather: Heavy Rains and Storms
- Subsidence

Actions for the District in this Plan are summarized on Table E-70. Details of each action follow the table.

Table E-70 Union Sanitary District Mitigation Actions

Action Title	New Action/ Previous Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
USD Actions					
Multi-Hazard Actions					
Action 1. Public Education Outreach	2017 Action	X	X		Property Protection Emergency Services
Action 2. Enhanced Treatment and Site Upgrade (ETSU)- Phase 1A Campus Building and Aeration Basin Modifications; Phase 1B Secondary Clarifiers & Effluent Facilities; Phase 1C Plant Equalization Storage	2017 Action	X	X		Property Protection Structural Projects
Climate Change Actions					
Action 3. Irvington Pump Station Solar & Battery Project	New Action	X	X		Property Protection Emergency Services
Action 4. Battery Storage & 3rd Cogen	New Action	X	X		Public Information
Sea Level Rise, Earthquake Heavy Rains and Storms, and Flood Actions					
Action 5. Field Ops Building Seismic Upgrade	2017 Action	X	X		Property Protection Structural Projects
Drought/Water Shortage Actions					
Action 6. Digester #8	New Action	X	X		Property Protection Structural Projects
Earthquake Actions					
Action 7. Seismic Retrofit of Concrete Structures	2017 Action	X	X		Property Protection Structural Projects
Action 8. Newark Pump Station Emergency Outfall	2017 Action	X	X		Property Protection Structural Projects Natural Resource Protection

Action Title	New Action/ Previous Action	Address Current Development	Address Future Development	Continued NFIP Compliance	Mitigation Type
Action 9. Seismic upgrade of Primary Clarifier 1-4	2017 Action	X	X		Property Protection Structural Projects
Sea Level Rise, Subsidence Actions					
Action 10. Forcemain Alameda Creek Crossing Ground Stabilization	2017 Action	X	X		Property Protection Structural Projects Natural Resource Protection

Multi-Hazard Actions

Action 1. Public Education Outreach

Hazards Addressed: Multi-hazard (Climate Change, Coastal Flood and Sea Level Rise, Drought & Water Shortage, Earthquake, Localized Stormwater Flooding, Severe Weather: Heavy Rains and Storms, and Subsidence)

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

Issue/Background: Climate change and other hazards exacerbate the challenges our wastewater treatment plant faces, as extreme weather events and shifting precipitation patterns can strain the infrastructure. Additionally, improper waste disposal practices contribute to climate change through increased energy use and emissions associated with the treatment and processing of contaminated wastewater. By addressing these issues and providing proper wastewater management, we not only enhance our community's resilience to climate-related hazards but also reduce the environmental impact.

Project Description: Lauch a public education campaign to raise awareness and encourage responsible practices among residents and businesses. The campaign will focus on discouraging actions such as flushing wipes, medications, and grease down drains, which can strain our wastewater infrastructure and lead to environmental and public safety hazards. Distribution/materials will vary.

Other Alternatives: None Listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Strategic Plan

Responsible Office/Partners: District Management

Cost Estimate: $1,200 to $5,000 estimated

Benefits (Losses Avoided): Reduced risk to those who work and live in USD Service Territory.

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: Ongoing

Project Priority (H, M, L): L

Action 2. Enhanced Treatment and Site Upgrade (ETSU)- Phase 1A Campus Building and Aeration Basin Modifications; Phase 1B Secondary Clarifiers & Effluent Facilities; Phase 1C Plant Equalization Storage

Hazards Addressed: Climate Change, Coastal Flooding/Sea Level Rise, Drought and Water Shortage, Earthquake, Flood, and Severe Weather: Heavy Rains and Storms

Goals Addressed: 1, 2, 4, 7

Issue/Background: The following projects are aimed at addressing life safety concerns and restoring essential services in the event of an earthquake. Additionally, the building's vulnerability to seismic events is compounded by its susceptibility to damage from sea level rise, highlighting the need for comprehensive resilience measures to protect against multiple environmental threats.

Admin Seismic Upgrade – This building was identified to be critical to life safety and restoring basic service. The building has seismic deficiencies and is vulnerable to damage from a seismic event.

Control Building Seismic Upgrade - This building was identified to be critical to life safety and restoring basic service. The building has seismic deficiencies and is vulnerable to damage from a seismic event.

Build a new facilities maintenance shop – facility will meet seismic standards and built on a raised foundation to accommodate hazards of sea level rise, flooding, and heavy rain and storms

Rebuild East Aeration Tank Roof – The tank concrete roof has been identified as seismically unstable and has a weakened load capacity. Loss of this structure reduces our treatment capacity by 20%.

Equalization Storage Basin at Alvarado. Basin will temporarily hold wastewater if discharge through the East Bay Dischargers Authority (EBDA) system is interrupted. This prevents discharge of treated waste into Alameda Creek.

Project Description: The District's Enhanced Treatment and Site Upgrade (ETSU) Program Phase 1 projects began construction in late 2021, launching a program that will support the next 40 years of reliable and cost-effective service to the Tri-Cities. The projects will renew and replace aging infrastructure, improve water quality in the San Francisco Bay through enhanced wastewater treatment processes and nutrient removal, and increase the facility's resiliency to extreme wet-weather events, such as heavy rain and storms, atmospheric rivers, and associated flooding, and climate change.

See: Enhanced Treatment & Site Upgrade - Union Sanitary District

Other Alternatives: None Listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Enhanced Treatment and Site Upgrade (ETSU) Project

Responsible Office/Partners: Enhanced Treatment and Site Upgrade (ETSU)

Cost Estimate: $482 Million Program Budget (Detailed project details available as requested)

Benefits (Losses Avoided): Limit life safety concerns and maintain essential services in the event of an earthquake. Protection against multiple environmental threats and impacts to natural systems.

Potential Funding: Sewer Service Charges, Developer Fees (Anticipated Financing Methods: Bond, WIFIA, SRF)

Timeline: Phase 1A Campus Building and Aeration Basin Modifications Estimated Completion: 2025

Phase 1B Secondary Clarifiers & Effluent Facilities Estimated Completion: 3 to 5 years

Phase 1C Plant Equalization Storage Estimated Completion: 5 to 7 years

Project Priority (H, M, L): H

Climate Change Actions

Action 3. Irvington Pump Station Solar & Battery Project

Hazards Addressed: Climate Change

Goals Addressed: 1, 2, 4, 5

Issue/Background: With the increasing frequency and intensity of extreme weather events, it's crucial to enhance the resilience of critical infrastructure. Upgrading the solar and battery facility at the Irvington Pump Station aligns with the state's commitment to reducing greenhouse gas emissions and promoting renewable energy. By doing so, The District is addressing the immediate need for an aging facility but also contributing to California's broader efforts in combating climate change and fostering a more sustainable future.

Project Description: Project includes installing a new solar and battery facility at the District's Irvington Pump Station. The existing solar facility at this station is nearing the end of its useful life.

Other Alternatives: None Listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Capital Improvement Program (CIP)

Responsible Office/Partners: Capital Improvement Program (CIP) Team

Cost Estimate: $3.5M to $6.4M

Benefits (Losses Avoided): An operational solar facility will ensure continued operations of the pump station. Limit impacts to property and natural resources.

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: 2 to 5 years

Project Priority (H, M, L): M

Action 4. Battery Storage & 3rd Cogen

Hazards Addressed: Climate Change

Goals Addressed: 1, 2, 4, 5

Issue/Background: With the increasing frequency and intensity of extreme weather events, it's crucial to enhance the resilience of critical infrastructure. In response to the urgent demand the District is planning installation of a new 1.6 MW cogeneration engine and peak shaving battery storage. This initiative is not merely a routine upgrade; it is a strategic response to the environmental imperatives that California faces.

Project Description: Project includes installing a new 1.6 MW cogeneration engine and peak shaving battery storage at the District's Alvarado Wastewater Treatment Plant.

Other Alternatives: None Listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Capital Improvement Program (CIP)

Responsible Office/Partners: Capital Improvement Program (CIP) Team

Cost Estimate: $23.8 M

Benefits (Losses Avoided): Keep systems up and functional. Limit impacts to property and natural resources.

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: 2 to 5 years

Project Priority (H, M, L): M

Sea Level Rise, Earthquake, Heavy Rains and Storms, and Flood Actions

Action 5. Field Ops Building Seismic Upgrade

Hazards Addressed: Sea Level Rise, Earthquake, Heavy Rain and Storms, Flood

Goals Addressed: 1, 2, 4, 7

Issue/Background: The Field Ops Building Seismic Upgrade project is aimed at addressing life safety concerns and restoring essential services in the event of an earthquake. Additionally, the building's vulnerability to seismic events is compounded by its susceptibility to damage from sea level rise, heavy rain and storms, and related flooding, highlighting the need for comprehensive resilience measures to protect against multiple environmental threats.

Project Description: This project will include seismic retrofits, leak repairs, and internal floor plan updating to the Field Operations Building.

Other Alternatives: None listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Capital Improvement Program (CIP)

USD Enhanced Treatment and Site Upgrade (ETSU) Project

Responsible Office/Partners: Capital Improvement Program (CIP) Team

Cost Estimate: $5.7M

Benefits (Losses Avoided): Limit life safety concerns and maintain essential services during a hazard event. Protection against multiple environmental threats and impacts to natural systems

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: 2 to 5 years

Project Priority (H, M, L): H

Drought/Water Shortage Actions

Action 6. Digester #8

Hazards Addressed: Drought/Water Shortage

Goals Addressed: 1, 2, 4

Issue/Background: In significantly dry seasons and increased drought events, incoming wastewater flow is reduced, making it essential to construct a new digester at our wastewater treatment plant to optimize the treatment process and ensure efficient resource recovery from the reduced input, while also maintaining regulatory compliance. This new digester will enable us to adapt to changing environmental conditions and enhance the plant's resilience in the face of ongoing water scarcity challenges.

Project Description: Project includes constructing a new 2.4-million-gallon digester and heating and mixing building at the District's Alvarado Wastewater Treatment Plant.

Other Alternatives: None listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Capital Improvement Program (CIP)

Responsible Office/Partners: Capital Improvement Program (CIP) Team

Cost Estimate: $59.4 M

Benefits (Losses Avoided): Limit public safety concerns and maintain essential services in disasters. Protection against multiple environmental threats and impacts to natural systems. Limit impacts associated with drought and water shortage issues.

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: 5+ years

Project Priority (H, M, L): M

Earthquake Actions

Action 7. Seismic Retrofit of Concrete Structures

Hazards Addressed: Earthquake

Goals Addressed: 1, 2, 4, 7

Issue/Background: This is an ongoing project to improve concrete structures as we have other repairs or improvements of the structure. Planned actions and estimates are from our documented seismic assessments

Project Description: These are for the seismic retrofit of concrete structures at the plant.

Other Alternatives: None listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Capital Improvement Program (CIP)

Responsible Office/Partners: Capital Improvement Program (CIP) Team

Cost Estimate: $600,000

Benefits (Losses Avoided): Limit public and safety concerns and maintain essential services in disasters. Protection against environmental threats and impacts to natural systems.

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: 3 to 5 years

Project Priority (H, M, L): M

Action 8. Newark Pump Station Emergency Outfall

Hazards Addressed: Earthquake

Goals Addressed: 1, 2, 4, 7

Issue/Background: Newark Pump Station Emergency Outfall – Establish an outfall from the Newark pump station to the SF bay. This will allow discharge of wastewater if the force main to the treatment plant is damaged or the treatment plant is damaged and prevent wastewater backup into communities and wetland areas causing a public health concern.

Project Description: Complete a study that will determine various recommendations for cost effective development of emergency outfall at Newark pump station.

Other Alternatives: To be determined from study

Existing Planning Mechanism(s) through which Action will be implemented: USD Capital Improvement Program (CIP)

Responsible Office/Partners: Capital Improvement Program (CIP) Team

Cost Estimate: $300,000

Benefits (Losses Avoided): Limit public and safety concerns and maintain essential services in disasters. Protection against environmental threats and impacts to natural systems.

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: 5 years

Project Priority (H, M, L): L

Action 9. Seismic upgrade of Primary Clarifier 1-4

Hazards Addressed: Earthquake

Goals Addressed: 1, 2, 4

Issue/Background: The roof structure over the clarifiers has been identified as seismically unstable. Loss of this structure would reduce our treatment capacity by approximately 85 percent.

Project Description: This project will upgrade the Primary Clarifiers 1 through 4 Building's structure to address seismic deficiencies identified in the 2016 Seismic Study

Other Alternatives: None listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Capital Improvement Program (CIP)

Responsible Office/Partners: Capital Improvement Program (CIP) Team

Cost Estimate: $6.7M

Benefits (Losses Avoided): Limit public and safety concerns and maintain essential services in disasters. Protection against multiple environmental threats and impacts to natural systems.

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: 2 to 5 years

Project Priority (H, M, L): M

Sea Level Rise, Subsidence Actions

Action 10. Forcemain Alameda Creek Crossing Ground Stabilization

Hazards Addressed: Sea Level Rise, Subsidence

Goals Addressed: 1, 2, 4

Issue/Background: The Alameda Creek crossing is a vital juncture in the infrastructure network managed by USD. However, the specter of seismic events in the region raises concerns about the integrity of the forcemain pipelines. Additionally, the potential for subsidence arises from various factors, with a primary concern being the withdrawal of groundwater in the region. As groundwater is depleted, the soil may undergo compaction, leading to the sinking of the ground surface. This subsidence poses a substantial risk to the forcemain pipelines. Sea level rise over time will further compound the subsidence issues. These pipelines, crucial for the transportation of essential resources, are at risk of damage during significant seismic activities (during and after), jeopardizing the ability of USD to maintain regular operations.

Project Description: This project will include improvements to protect the forcemain pipelines at the Alameda Creek crossing from damage during significant seismic events in the region. The improvements will allow USD to maintain operation of the pipelines.

Other Alternatives: None listed

Existing Planning Mechanism(s) through which Action will be implemented: USD Capital Improvement Program (CIP)

Responsible Office/Partners: Capital Improvement Program (CIP) Team

Cost Estimate: $100,000

Benefits (Losses Avoided): Limit public and safety concerns and maintain essential services in disasters. Protection against environmental threats and impacts to natural systems.

Potential Funding: Sewer Service Charges, Developer Fees

Timeline: 2 to 5 years

Project Priority (H, M, L): M